E-Programme &
E-Abstract

CMU Annual Research Summit 2025

18-19 AUGUST 2025

CHIANG MAI MARRIOTT HOTEL

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CMU Annual Research Summit 2025

จัดพิมพ์โดย : สำนักงานบริหารงานวิจัย สำนักงานมหาวิทยาลัย มหาวิทยาลัยเชียงใหม่

เดือนปีที่จัดพิมพ์ : สิงหาคม 2568

ออกแบบและจัดรูปเล่ม : สำนักงานบริหารงานวิจัย สำนักงานมหาวิทยาลัย มหาวิทยาลัยเชียงใหม่

@2025 CMU Annual Research Summit



สารจากอธิการบดีมหาวิทยาลัยเชียงใหม่

ในโอกาสการจัดประชุมวิชาการ CMU Annual Research Summit ประจำปี 2568

ในนามของมหาวิทยาลัยเชียงใหม่ ข้าพเจ้ารู้สึกเป็นเกียรติอย่างยิ่งที่ได้ต้อนรับวิทยากรผู้ทรงคุณวุฒิ คณาจารย์ นักวิจัย ตลอดจนผู้เข้าร่วมประชุมทุกท่าน สู่เวทีการแลกเปลี่ยนองค์ความรู้และความร่วมมือทางวิชาการในงานประชุมวิชาการ CMU Annual Research Summit ประจำปี 2568

พันธกิจหลักของมหาวิทยาลัยเชียงใหม่คือ การสร้างองค์ความรู้ งานวิจัยและนวัตกรรม รวมทั้งการบูรณาการความเชี่ยวชาญในหลากหลายสาขาวิชา เพื่อสร้างนวัตกรรมสู่ความยั่งยืน และตอบสนองต่อความเปลี่ยนแปลงที่เกิดขึ้นทั้งในระดับประเทศและระดับโลก ทั้งนี้เป็นไปตามวิสัยทัศน์ คือ “มหาวิทยาลัยชั้นนำที่รับผิดชอบต่อสังคม เพื่อการพัฒนาที่ยั่งยืน ด้วยนวัตกรรม” โดยในการก้าวสู่ทศวรรษที่ 7 มหาวิทยาลัยมีการวางแนวทางที่มุ่งเน้นการสร้างระบบนิเวศวิจัยและการพัฒนากำลังคนที่มีสมรรถนะสูง ตอบโจทย์ความต้องการของภาคอุตสาหกรรม สังคม ชุมชน และประเทศชาติ จึงนำมาสู่การประชุมในครั้งนี้ ในหัวข้อ “CMU Research and Innovation for Sustainability” ซึ่งสะท้อนถึงพันธกิจหลักของมหาวิทยาลัยในการนำองค์ความรู้ไปใช้ประโยชน์ทั้งด้านเศรษฐกิจ สังคม และสิ่งแวดล้อมอย่างยั่งยืน โดยครอบคลุมหลากหลายสาขาตาม Research Consortiums ของมหาวิทยาลัย

การประชุมครั้งนี้จึงนับเป็นเวทีสำคัญที่เปิดโอกาสให้นักวิจัยรุ่นใหม่ นักวิจัยรุ่นกลาง และนักวิจัยอาวุโสได้พบปะ แลกเปลี่ยนเรียนรู้ และสร้างความร่วมมือเพื่อให้เกิดมุมมองงานวิจัยและนวัตกรรมใหม่ ๆ ที่มีศักยภาพในการขับเคลื่อนการพัฒนาสังคมและประเทศต่อไป

ข้าพเจ้าขอแสดงความขอบคุณวิทยากรผู้ทรงคุณวุฒิ คณาจารย์ นักวิจัย ผู้จัดงาน ตลอดจนพันธมิตรจากทั้งภาครัฐและภาคอุตสาหกรรม ที่มีบทบาทสำคัญในการสนับสนุนให้การประชุมครั้งนี้ประสบผลสำเร็จ โดยความมุ่งมั่นและความร่วมมือของทุกท่านจะเป็นพลังสำคัญในการผลักดันให้ผลงานวิจัยมหาวิทยาลัยเชียงใหม่สามารถนำไปใช้ประโยชน์เชิงประจักษ์อย่างแท้จริง

ขอต้อนรับทุกท่านสู่การประชุมวิชาการ CMU Annual Research Summit 2025 ด้วยความยินดียิ่ง

ศาสตราจารย์ ดร.นพ.พงษ์รักษ์ ศรีบัณฑิตมงคล
อธิการบดีมหาวิทยาลัยเชียงใหม่
และกรรมการส่งเสริมวิทยาศาสตร์ วิจัยและนวัตกรรม (กสว.)



สารจากรองอธิการบดีมหาวิทยาลัยเชียงใหม่
ประธานคณะกรรมการอำนวยการงานประชุมวิชาการ CMU Annual Research Summit ประจำปี 2568

ในนามของมหาวิทยาลัยเชียงใหม่ และประธานคณะกรรมการอำนวยการจัดงาน ดิฉันรู้สึกเป็นเกียรติและยินดีอย่างยิ่งที่ได้ต้อนรับทุกท่านสู่งานประชุมวิชาการ CMU Annual Research Summit ประจำปี 2568 ซึ่งจัดขึ้นในระหว่างวันที่ 18-19 สิงหาคม 2568 ณ โรงแรมเชียงใหม่ แมริออท โฮเทล

การจัดงานประชุมในครั้งนี้เป็นไปตามพันธกิจสำคัญของมหาวิทยาลัยเชียงใหม่ ในการขับเคลื่อนความเป็นเลิศทางวิชาการ วิจัยและนวัตกรรม ที่มุ่งตอบโจทย์ความท้าทายของสังคมทั้งในระดับชาติและนานาชาติ ด้วยความมุ่งมั่นที่จะเชื่อมโยงองค์ความรู้จากหลากหลายสาขาวิชาไปสู่การใช้ประโยชน์อย่างยั่งยืน ภายใต้หัวข้อ “CMU Research and Innovation for Sustainability” โดยเน้นการส่งเสริมระบบนิเวศวิจัยเชิงบูรณาการ มีผู้เข้าร่วมงานมากกว่า 600 คน และมีการนำเสนอผลงานวิจัยของนักวิจัยที่ได้รับการสนับสนุนทุนวิจัยจากมหาวิทยาลัยเชียงใหม่ ได้แก่ ทุนพัฒนานักวิจัยรุ่นใหม่ ทุนพัฒนานักวิจัยรุ่นกลาง ทุนพัฒนากลุ่มวิจัย ศูนย์วิจัย ศูนย์ความเป็นเลิศ ทุนพัฒนางานวิจัยมุ่งเป้า ทุนสนับสนุนงานวิจัย PM2.5 และมลพิษอื่น ๆ นักวิจัยยุทธศาสตร์เชิงรุกและอาจารย์ที่ปรึกษา และทุนสนับสนุนประเภทงานมูลฐาน (Fundamental Fund) กว่า 400 ผลงาน ทั้งในรูปแบบการนำเสนอด้วยวาจา (Oral Presentation) และโปสเตอร์ (Poster Presentation) ครอบคลุมประเด็นสำคัญตาม Research Consortiums ของมหาวิทยาลัยเชียงใหม่ Frontier/Deep Tech; Digital & AI; Materials Innovation; Climate Crisis and Carbon Neutrality; Agriculture and Biodiversity; Herbs, Cosmetic, Supplements, Drugs and High Valued Food; Health and Well-being, Aging Society, Pandemics; Tourism, Hospitality & Creative Economy; Social Science, Humanities & Art; Social Engagement ซึ่งมีศักยภาพในการนำไปใช้ประโยชน์ทั้งด้านเศรษฐกิจ สังคม สิ่งแวดล้อม และเชิงนโยบาย โดยเวทีแห่งนี้ยังเปิดโอกาสให้เกิดการแลกเปลี่ยนทางวิชาการ การสร้างเครือข่ายความร่วมมือระหว่างนักวิจัยทุกระดับ ตลอดจนการบ่มเพาะแนวคิดใหม่ที่สามารถหลอมรวมเป็นกลไกขับเคลื่อนการวิจัยและนวัตกรรมในอนาคต

ในโอกาสนี้ดิฉันขอขอบคุณวิทยากรผู้ทรงคุณวุฒิทุกท่านที่ได้กรุณามาแลกเปลี่ยนประสบการณ์อันทรงคุณค่า ขอบคุณภาคีเครือข่าย และหน่วยงานสนับสนุนทุกฝ่ายที่มีบทบาทสำคัญในการทำให้งานครั้งนี้บรรลุผลสำเร็จอย่างสมบูรณ์แบบ และที่สำคัญยิ่งคือ ขอขอบคุณนักวิจัยและผู้เข้าร่วมประชุมทุกท่านที่ร่วมเป็นพลังขับเคลื่อนให้มหาวิทยาลัยเชียงใหม่เป็นแหล่งความรู้ สร้างงานวิจัยและนวัตกรรมเพื่อสังคมอย่างยั่งยืน ดิฉันเชื่อมั่นเป็นอย่างยิ่งว่าการประชุม CMU Annual Research Summit 2025 จะเป็นจุดเริ่มต้นของความร่วมมือ จุดประกายการสร้างสรรค์งานวิจัยนวัตกรรมที่มีคุณภาพ และต่อยอดสู่การใช้ประโยชน์ได้จริง เพื่อประโยชน์ของประเทศและประชาคมโลกในระยะยาว

รองศาสตราจารย์ ดร.วินิตา บุณโยดม
รองอธิการบดีมหาวิทยาลัยเชียงใหม่

ขอเชิญร่วมงาน

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18-19 สิงหาคม 2568

CHIANG MAI MARRIOTT HOTEL

"การนำเสนอ **ผลงานวิจัยนวัตกรรมต่อยอดไปสู่การใช้ประโยชน์ภายใต้ Research Consortiums มากกว่า 300 ผลงาน** ในรูปแบบ Oral และ Poster Presentations"

Frontier/Deep Tech | Digital & AI | Materials Innovation | Climate Crisis, Carbon Neutrality | Agriculture, Biodiversity | Herbs,Cosmetic, Supplements, Drugs, High Valued Food | Health and Well-being, Aging Society, Pandemics | Tourism, Hospitality & Creative Economy | Social Science, Humanities & Art | Social Engagement | Others

18 สิงหาคม 2568



ศาสตราจารย์ ดร.นพ. พงษ์รักษ์ ศรีบัณฑิตมงคล
อธิการบดีมหาวิทยาลัยเชียงใหม่ และ กรรมการส่งเสริมวิทยาศาสตร์ วิจัยและนวัตกรรม (กสว.)



ศาสตราจารย์เกียรติคุณ ดร.นพ.สิริฤกษ์ ทรงศิวิไล
ประธานกรรมการส่งเสริมวิทยาศาสตร์ วิจัยและนวัตกรรม (กสว.)



ศาสตราจารย์ ดร. คมกฤต เล็กสกุล
รองผู้อำนวยการ สำนักงานคณะกรรมการส่งเสริมวิทยาศาสตร์ วิจัยและนวัตกรรม (สกสว.)



ศาสตราจารย์เกียรติคุณ ดร.ปิยะวัติ บุญ-หลง
ที่ปรึกษาสมาคมพันธกิจสัมพันธ์มหาวิทยาลัยกับสังคม (Engagement Thailand: EnT)

08:00 - 09.00 น. ● **ลงทะเบียนเข้าร่วมงาน**

09.00 - 09.30 น. ● **พิธีเปิดงาน**
โดย ศาสตราจารย์ ดร.นพ.พงษ์รักษ์ ศรีบัณฑิตมงคล อธิการบดีมหาวิทยาลัยเชียงใหม่ และ กรรมการส่งเสริมวิทยาศาสตร์ วิจัยและนวัตกรรม (กสว.)

09.30 - 10.15 น. ● **ปาฐกถาพิเศษ**
"ระบบวิทยาศาสตร์ วิจัย และ นวัตกรรม เพื่อการพัฒนาประเทศอย่างยั่งยืน"
โดย ศาสตราจารย์เกียรติคุณ ดร.นพ.สิริฤกษ์ ทรงศิวิไล ประธานกรรมการส่งเสริมวิทยาศาสตร์ วิจัยและนวัตกรรม (กสว.)

10.15 - 11.00 น. ● **การบรรยายพิเศษ**
"S-Curve ใหม่ ด้วยนโยบายวิทยาศาสตร์ วิจัย นวัตกรรม (ววน.)"
โดย ศาสตราจารย์ ดร.คมกฤต เล็กสกุล รองผู้อำนวยการ สำนักงานคณะกรรมการส่งเสริมวิทยาศาสตร์วิจัยและนวัตกรรม (สกสว.)

13.40 - 14.15 น. ● **การบรรยายพิเศษ**
"มหาวิทยาลัยกับการยกระดับคุณภาพชีวิตชุมชน"
โดย ศาสตราจารย์เกียรติคุณ ดร.ปิยะวัติ บุญ-หลง ที่ปรึกษาสมาคมพันธกิจสัมพันธ์มหาวิทยาลัยกับสังคม (Engagement Thailand: EnT)

11.30 - 16.50 น. ● **Oral Presentation (10 Parallel Sessions)**

14.40 - 15.35 น. ● **Poster Presentation (Session 1)**

16.30 - 17.30 น. ● **Poster Presentation (Session 2)**

18.00 - 21.00 น. ● **CMU Research Summit Dinner**

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ดร.ณิรวัฒน์ ธรรมจักร์
ผู้อำนวยการหน่วยบริหารและจัดการทุนด้านการพัฒนากำลังคนและทุนด้านการพัฒนาสถาบันอุดมศึกษา การวิจัยและการสร้างนวัตกรรม (บพค.)



รองศาสตราจารย์ ดร. วินิตา บุณโยดม
รองอธิการบดีมหาวิทยาลัยเชียงใหม่



ศาสตราจารย์ ดร. ผดุงศักดิ์ รัตนเดโช



ศาสตราจารย์ ดร. รัศมี ชูทรงเดช



รองศาสตราจารย์ ดร. อภินภัส รุจิวัตร์

08:00 - 09.00 น. ● **ลงทะเบียนเข้าร่วมงาน**

09.00 - 09.45 น. ● **การบรรยายพิเศษ**
"บพค. กับนโยบายการพัฒนางานวิจัยขั้นแนวหน้าและเทคโนโลยีเชิงลึกเพื่อความยั่งยืนของประเทศ"
โดย ดร.ณิรวัฒน์ ธรรมจักร์ ผู้อำนวยการหน่วยบริหารและจัดการทุนด้านการพัฒนากำลังคนและทุนด้านการพัฒนาสถาบันอุดมศึกษา การวิจัยและการสร้างนวัตกรรม (บพค.)

09.45 - 10.15 น. ● **การบรรยายพิเศษ**
"นโยบายมหาวิทยาลัยเชียงใหม่: การนำงานวิจัยและนวัตกรรมไปใช้ประโยชน์เชิงเศรษฐกิจ สังคม และนโยบาย"
โดย รองศาสตราจารย์ ดร.วินิตา บุณโยดม รองอธิการบดีมหาวิทยาลัยเชียงใหม่

10.15 - 11.00 น. ● **เสวนา หัวข้อ**
"การพัฒนาเส้นทางอาชีพนักวิจัย กับการขอตำแหน่งทางวิชาการ"
โดย ศาสตราจารย์ ดร.ผดุงศักดิ์ รัตนเดโช ศาสตราจารย์ ดร.รัศมี ชูทรงเดช รองศาสตราจารย์ ดร.อภินภัส รุจิวัตร์ (Moderator)

11.30 - 16.15 น. ● **Oral Presentation (10 Parallel Sessions)**

14.30 - 15.15 น. ● **Poster Presentation (Session 3)**

16.15 - 16.45 น. ● **พิธีมอบรางวัล และ พิธีปิดการประชุมวิชาการฯ**

กำหนดการ https://cmu.to/z5Bys

รายละเอียดเพิ่มเติม https://cmuars.oou.cmu.ac.th/

สอบถามเพิ่มเติม
สำนักงานบริหารงานวิจัย มช.
053-943601 (อรนิตย์), 053-943608 (วันวิสาข์),
053-943616 (พรกนก)

CMU Annual Research Summit 2025

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Keynote Speakers

18 สิงหาคม 2568 | **CHIANG MAI MARRIOTT HOTEL**



ระบบวิทยาศาสตร์ วิจัย และนวัตกรรม เพื่อการพัฒนาประเทศอย่างยั่งยืน

ศาสตราจารย์เกียรติคุณ ดร.นพ.สิริฤกษ์ ทรงศิวิไล
ประธานกรรมการส่งเสริมวิทยาศาสตร์ วิจัยและนวัตกรรม (กสว.)

09.30 น.
ปาฐกถาพิเศษ



S-Curve ใหม่ ด้วยนโยบายวิทยาศาสตร์ วิจัย นวัตกรรม (ววน.)

ศาสตราจารย์ ดร. คมกฤต เล็กสกุล
รองผู้อำนวยการ สำนักงานคณะกรรมการส่งเสริมวิทยาศาสตร์วิจัยและนวัตกรรม (สกสว.)

10.15 - 11.00 น.
การบรรยายพิเศษ

SPECIAL KEYNOTE SPEAKER

18 สิงหาคม 2568
13.40 - 14.15 น.
ห้องประชุมสุเทพ 3 ชั้น 4
CHIANG MAI MARRIOTT HOTEL



มหาวิทยาลัยกับการยกระดับคุณภาพชีวิตชุมชน

ศาสตราจารย์เกียรติคุณ ดร.
ปิยะวัติ บุญ-หลง
ที่ปรึกษาสมาคมพันธกิจสัมพันธ์มหาวิทยาลัยกับสังคม (ENGAGEMENT THAILAND: ENT)

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CMU Annual Research Summit 2025

Keynote Speakers

19 สิงหาคม 2568 | **CHIANG MAI MARRIOTT HOTEL**



"บพค. กับนโยบายการพัฒนางานวิจัยขั้นแนวหน้าและเทคโนโลยีเชิงลึกเพื่อความยั่งยืนของประเทศ"

ดร.ณิรวัฒน์ ธรรมจักร์
ผู้อำนวยการหน่วยบริหารและจัดการทุนด้านการพัฒนากำลังคนและทุนด้านการพัฒนาสถาบันอุดมศึกษา การวิจัยและการสร้างนวัตกรรม (บพค.)

09.00 - 09.45 น.
การบรรยายพิเศษ



"นโยบายมหาวิทยาลัยเชียงใหม่: การนำงานวิจัยและนวัตกรรมไปใช้ประโยชน์เชิงเศรษฐกิจ สังคม และนโยบาย"

รองศาสตราจารย์ ดร. วินิตา มุณโยดม
รองอธิการบดีมหาวิทยาลัยเชียงใหม่

09.45 - 10.15 น.
การบรรยายพิเศษ

เสวนาพิเศษ
10.15 - 11.00 น.

"การพัฒนาเส้นทางอาชีพนักวิจัย กับการขอตำแหน่งทางวิชาการ"



ศาสตราจารย์ ดร. ผดุงศักดิ์ รัตนเดโช



ศาสตราจารย์ ดร. รัศมี ชูทรงเดช



รองศาสตราจารย์ ดร. อภินภัส รุจิวัตร์
MODERATOR การเสวนา

CMU Annual Research Summit 2025

Invited Speakers

FRONTIER DEEP TECH



บทบาทของดาราศาสตร์ในการขับเคลื่อนความก้าวหน้าทางเทคโนโลยีและการพัฒนาบุคลากร

ดร.ศรัณย์ โปษยะจินดา
อดีตผู้อำนวยการสถาบันวิจัยดาราศาสตร์แห่งชาติ

18 สิงหาคม 2568 CHIANG MAI MARRIOTT HOTEL
13.30-14.00 น.
Invited Speaker



What can be done with circular mRNA

รองศาสตราจารย์ ดร. ปฐมพล วงค์ตระกูลเกตุ
ผู้ช่วยคณบดีฝ่ายวิจัยและนวัตกรรม
คณะวิทยาศาสตร์ มหาวิทยาลัยมหิดล

18 สิงหาคม 2568 CHIANG MAI MARRIOTT HOTEL
15.15-15.45 น.
Invited Speaker

DIGITAL & AI



ความร่วมมือเพื่อการพัฒนางานวิจัยและนวัตกรรม AI ในระดับนานาชาติ

ผู้ช่วยศาสตราจารย์ ดร. อักฤทธิ์ สังข์เพ็ชร
DIRECTOR OF CMKL UNIVERSITY

18 สิงหาคม 2568 CHIANG MAI MARRIOTT HOTEL
13.30-14.00 น.
Invited Speaker

MATERIALS INNOVATION



Trend and Perspective on Semiconductor Industry and Workforce Development in Thailand

ดร.อดิสร เดือนตรานนท์
Thai Microelectronics Center (TMEC) สำนักงานพัฒนาวิทยาศาสตร์และเทคโนโลยีแห่งชาติ (สวทน.)

18 สิงหาคม 2568 CHIANG MAI MARRIOTT HOTEL
13.30-14.00 น.
Invited Speaker



เทคโนโลยีไฮโดรเจนเพื่อการเปลี่ยนผ่านสู่พลังงานสะอาดของประเทศไทย

ดร.วัชรินทร์ งามพึงพิศ
สถาบันนวัตกรรม ปตท.
บริษัท ปตท. จำกัด (มหาชน)

19 สิงหาคม 2568 CHIANG MAI MARRIOTT HOTEL
13.15-13.45 น.
Invited Speaker



การจัดการซากแบตเตอรี่ลิเทียมไอออน: แนวทาง เทคโนโลยี และโอกาสทางเศรษฐกิจ

ดร.อริวีณา กฤตยาวัฒนานนท์
สถาบันนวัตกรรม ปตท.
บริษัท ปตท. จำกัด (มหาชน)

19 สิงหาคม 2568 CHIANG MAI MARRIOTT HOTEL
14.45-15.15 น.
Invited Speaker

CLIMATE CRISIS CARBON NEUTRALITY



Deciphering Secondary Organic Aerosol, Sources, Economic Impacts and PM2.5 Solutions

รองศาสตราจารย์ ดร. สราวุธ เทพานนท์
คณะสาธารณสุขศาสตร์ มหาวิทยาลัยมหิดล

18 สิงหาคม 2568 CHIANG MAI MARRIOTT HOTEL
13.30-14.00 น.
Invited Speaker



Climate crisis research: Chiang Mai University Actions

รองศาสตราจารย์ ดร. พีรพงศ์ จิตเสงี่ยม
สถาบันวิจัยพหุศาสตร์ มหาวิทยาลัยเชียงใหม่

19 สิงหาคม 2568 CHIANG MAI MARRIOTT HOTEL
13.15-13.45 น.
Invited Speaker

CMU Annual Research Summit 2025

Invited Speakers

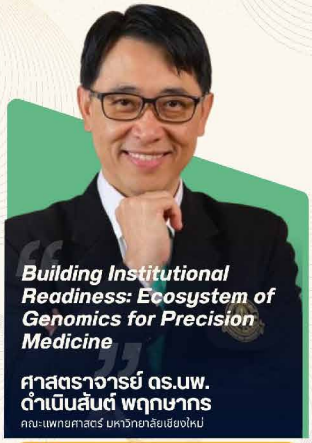
HEALTH AND WELL-BEING, AGING SOCIETY, PANDEMICS



Obesity Induces Premature Brain Aging: How to Intervene

ศาสตราจารย์ (เชี่ยวชาญพิเศษ) ดร.ทพญ.สิริพร ฉัตรทิพากร
คณะทันตแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่

18 สิงหาคม 2568 CHIANG MAI MARRIOTT HOTEL
13.30-14.00 น.
Invited Speaker



Building Institutional Readiness: Ecosystem of Genomics for Precision Medicine

ศาสตราจารย์ ดร.นพ. ดำเนินสันต์ พฤกษากร
คณะแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่

19 สิงหาคม 2568 CHIANG MAI MARRIOTT HOTEL
13.15-13.45 น.
Invited Speaker

AGRICULTURE BIODIVERSITY



Production and Utilization of Algal and Cyanobacterial Biomass for the SDGs and the BCG Industry

ดร.ศิรสิทธิ์ ศรีนวลปาน
สำนักงานบริหารงานวิจัย มหาวิทยาลัยเชียงใหม่

18 สิงหาคม 2568 CHIANG MAI MARRIOTT HOTEL
13.30-14.00 น.
Invited Speaker



Satellite-Powered Sustainability: Agricultures, Environemnts, Natural Resources, and Disaster Resilience

ดร.สยาม ลวอิโรจน์วงศ์
ผู้อำนวยการสำนักประยุกต์และบริหารภูมิสารสนเทศ สำนักงานพัฒนาเทคโนโลยีอวกาศและภูมิสารสนเทศ (องค์การมหาชน)

19 สิงหาคม 2568 CHIANG MAI MARRIOTT HOTEL
13.15-13.45 น.
Invited Speaker

TOURISM & HOSPITALITY & CREATIVE ECONOMY



Publishing with Impact: How to Position Your Research for International Recognition

ผู้ช่วยศาสตราจารย์ ดร. พีพัฒพงศ์ ฟักแฟ
คณะมนุษยศาสตร์และการจัดการการท่องเที่ยว มหาวิทยาลัยกรุงเทพ

18 สิงหาคม 2568 CHIANG MAI MARRIOTT HOTEL
14.15 - 14.45 น.
Invited Speaker



Lannatique" กรณีศึกษา โอกาสของการวิจัยและพัฒนาเพื่อสร้างผลกระทบทางเศรษฐกิจของเชียงใหม่

คุณรุ่งเรือง วิโรจน์ชีวัน
HEAD OF HOTEL OPERATIONS
บริษัท แอสเสท เวิร์ด คอร์ป จำกัด (มหาชน)

19 สิงหาคม 2568 CHIANG MAI MARRIOTT HOTEL
11.00 - 11.30 น.
Invited Speaker

HERBS, COSMETIC, SUPPLEMENTS, DRUGS, HIGH VALUED FOOD



ภาพรวมการพัฒนาอุตสาหกรรมสมุนไพรไทย: จากนโยบายสู่โอกาสทางธุรกิจและการเข้าถึงแหล่งทุน

ดร. พัชราภรณ์ วงษา
ผู้อำนวยการโปรแกรมบริหารโภชนเภสัชภัณฑ์และเวชสำอาง ศูนย์ความเป็นเลิศทางด้านชีววิทยาศาสตร์

18 สิงหาคม 2568 CHIANG MAI MARRIOTT HOTEL
13.30-14.00 น.
Invited Speaker



การคิดหัวข้องานวิจัย เพื่อนำไปสู่การค้นพบที่สามารถตีพิมพ์ได้ในวารสารที่ดีและนำไปสู่การใช้ประโยชน์

ศาสตราจารย์ ดร. ประสาท กิตตะคุปต์
สถาบันบัณฑิตศึกษาจุฬาภรณ์

19 สิงหาคม 2568 CHIANG MAI MARRIOTT HOTEL
13.15-13.45 น.
Invited Speaker

SOCIAL SCIENCE HUMANITIES ARTS



ประสบการณ์ด้านการวิจัยและการขอตำแหน่งทางวิชาการในสายสังคมศาสตร์และมนุษยศาสตร์"

ศาสตราจารย์ ดร. สิทธิพล เครือรัฐติกาล
อาจารย์ประจำวิทยาลัยสหวิทยาการ มหาวิทยาลัยธรรมศาสตร์

19 สิงหาคม 2568 CHIANG MAI MARRIOTT HOTEL
11.00-11.30 น.
Invited Speaker



มนุษยศาสตร์ใหม่ ?: ประสบการณ์ของนักวิจัยรุ่นกลาง

รองศาสตราจารย์ ดร. นัทธนัย ประสานนาม
อาจารย์ประจำภาควิชาวรรณคดี คณะมนุษยศาสตร์ มหาวิทยาลัยเกษตรศาสตร์

19 สิงหาคม 2568 CHIANG MAI MARRIOTT HOTEL
14.45-15.15 น.
Invited Speaker

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Scientific Themes

- Frontier/ Deep Tech
- Digital & AI
- Materials Innovation
- Climate Crisis, Carbon Neutrality
- Agriculture, Biodiversity
- Herbs, Cosmetic, Supplements, Drugs, High Valued Food
- Health and Well-being, Aging Society, Pandemics
- Tourism, Hospitality & Creative Economy
- Social Engagement
- Social Science, Humanities & Art
- Others

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CMU Annual Research Summit 2025

18-19 August 2025

CHIANG MAI UNIVERSITY

วันที่ 18 สิงหาคม 2568

ห้องประชุม & ชั้น จำนวนคน/ห้อง	Suthep Hall Floor 04 (1) 100	Suthep Hall Floor 04 (2) 150	Suthep Hall Floor 04 (3) 150	Voyage Room Floor 03 50	Journey Room Floor 03 50	Expedition Room Floor 03 50	Passage Room Floor 03 50	Excursion Room Floor 03 50	Tang Floor 02 Plaii Building 50	Yuam Floor 02 Plaii Building 50
9.00-9.30	**พิธีเปิดงานประชุมวิชาการ CMU ANNUAL RESEARCH SUMMIT ประจำปี 2568** พิธีกร: ผู้ช่วยศาสตราจารย์ ดร.กรวิทย์ ไชยสุ									
9.30-10.15	**กล่าวปาฐกถาพิเศษ หัวข้อ "ระบบวิทยาศาสตร์ วิจัย และ นวัตกรรม เพื่อการพัฒนาประเทศอย่างยั่งยืน"** โดย ศาสตราจารย์เกียรติคุณ ดร. นายแพทย์ สิริฤกษ์ ทรงศิริไล ประธานกรรมการส่งเสริมวิทยาศาสตร์ วิจัยและนวัตกรรม(กสว.) แนะนำวิทยากรโดย: รองศาสตราจารย์ ดร.วินิดา บุณโยดม									
10.15-11.00	**การบรรยายพิเศษ หัวข้อ "S-Curve ใหม่ด้วยนโยบายวิทยาศาสตร์ วิจัย นวัตกรรม (ววน.)"** โดย ศาสตราจารย์ ดร.คมกฤต เล็กสกุล รองผู้อำนวยการสำนักงานคณะกรรมการส่งเสริมวิทยาศาสตร์ วิจัยและนวัตกรรม (สกสว.) แนะนำวิทยากรโดย: รองศาสตราจารย์ ดร.อภินภัส รุจิวัลย์									
11.00-11.30	**พักรับประทานอาหารว่าง / การเตรียมความพร้อมสำหรับห้องย่อย**									
การนำเสนอผลงานวิจัยแบบบรรยาย (แยกตาม Sessions) **ทั้งหมด 10 ห้องย่อย** นำเสนอโครงการละ 15 นาที (รวมถาม/ตอบ) ชั้น 4: Suthep Hall 01 - 03 ชั้น 3: Voyage Room / Journey Room / Expedition Room / Passage Room / Excursion Room ชั้น 2 (Plaii Building): Tang / Yuam										
11.30 – 11.45	AgriBiodiv 1	Health 1	MatInno 1	Frontier 9	AgriBiodiv 12	Frontier 5	Climate 1	Herb 1	Frontier 1	Health 12
11.45 – 12.00	AgriBiodiv 2	Health 2	MatInno 2	Frontier 10	AgriBiodiv 13	Frontier 6	Climate 2	Herb 2	Frontier 2	Health 13
12.00 – 12.15	AgriBiodiv 3	Health 3	MatInno 3	Frontier 11	AgriBiodiv 14	Frontier 7	Climate 3	Herb 3	Frontier 3	Health 14
12.15 – 12.30	AgriBiodiv 4	Health 4	MatInno 4	Frontier 12	AgriBiodiv 15	Frontier 8	Climate 4	Herb 4	Frontier 4	Health 15
12.30-13.30	**รับประทานอาหารกลางวัน**									
13.30-14.00	**IV AgriBiodiv : ดร.ศิริสิทธิ์ ศรีนวลปาน**	**IV Health : ศ.(เชี่ยวชาญพิเศษ) ดร.เทพญ. สิงห์ ฉัตรทิพากร**	**การบรรยายพิเศษ หัวข้อ "มหาวิทยาลัยกับการยกระดับคุณภาพชีวิตชุมชน" โดย ศาสตราจารย์ (เกียรติคุณ) ดร. ปียะวัติ มุญ-เมือง**	**IV Frontier: ดร.ศรัณย์ โปษยะจินดา**	**AgriBiodiv 16 (13.30-13.45)** **AgriBiodiv 17 (13.45-14.00)**	**IV MatInno : ดร.อดิสร เอื้อนตรานนท์**	**IV Climate: รศ.ดร.สราวุธ เทพานนท์**	**IV Herb : ดร. พัชราภรณ์ วงษา**	**IV Digital: ผศ.ดร.อิกฤทธิ์ สังข์เพิ่ยร**	**Health 16 (13.30-13.45)** **Health 17 (13.45-14.00)**
14.00 – 14.15			พิธีกร: ผู้ช่วยศาสตราจารย์ ดร. จรากวิทย์ เฉลิมผล							
	AgriBiodiv 5	Health 5		Frontier 13	AgriBiodiv 18	**MatInno 5**	Climate 5	Herb 5	DigitAI 1	Health 18
14.15 – 14.30			**IV Tourism : ผศ.ดร. พีพัฒพงศ์ ฟักแฟ้ 14.15-14.45 น.**							
	AgriBiodiv 6	Health 6		Frontier 14	AgriBiodiv 19	**MatInno 6**	Climate 6	Herb 6	DigitAI 2	Health 19
14.30-15.15	**การนำเสนอผลงานวิจัยแบบโปสเตอร์ ช่วงที่ 1 / พักรับประทานอาหารว่าง**									
การนำเสนอผลงานวิจัยแบบบรรยาย (แยกตาม Sessions) **ทั้งหมด 10 ห้องย่อย** นำเสนอโครงการละ 15 นาที (รวมถาม/ตอบ) ชั้น 4: Suthep Hall 01 - 03 ชั้น 3: Voyage Room / Journey Room / Expedition Room / Passage Room / Excursion Room ชั้น 2 (Plaii Building): Tang / Yuam										
15.15-15.30	AgriBiodiv 7	Health 7	**SocEngage 1**	**IV Frontier: รศ.ดร.ปฐมพล วงศ์ตระกูลเกต**	AgriBiodiv 20	**MatInno 7**	Climate 7	Herb 7	DigitAI 3	Health 20
15.30-15.45	AgriBiodiv 8	Health 8	**SocEngage 2**		AgriBiodiv 21	**MatInno 8**	Climate 8	Herb 8	DigitAI 4	Health 21
15.45-16.00	AgriBiodiv 9	Health 9	**SocEngage 3**	Frontier 15	AgriBiodiv 22	**MatInno 9**	Climate 9	Herb 9	DigitAI 5	Health 22
16.00-16.15	AgriBiodiv 10	Health 10	**SocEngage 4**	Frontier 16	AgriBiodiv 23	**MatInno 10**	Climate 10	Herb 10	DigitAI 6	Health 23
16.15-16.30	AgriBiodiv 11	Health 11	**SocEngage 5**	Frontier 17	AgriBiodiv 24	**MatInno 11**	Climate 11	Herb 11	DigitAI 7	Health 24
16.30-17.30	**การนำเสนอผลงานวิจัยแบบโปสเตอร์ ช่วงที่ 2**									
18.30-21.00	**CMU Research Summit Dinner** **ร่วมรับประทานอาหารเย็น (buffet) และรับชมการแสดงดนตรี** **พิธีกร: ผู้ช่วยศาสตราจารย์พิชรากรานต์ อินทะนาค**									

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ห้องประชุม & ชั้น จำนวนคน/ห้อง	Suthep Hall Floor 04 (1) 100	Suthep Hall Floor 04 (2) 150	Suthep Hall Floor 04 (3) 150	Voyage Room Floor 03 40	Journey Room Floor 03 40	Expedition Room Floor 03 40	Passage Room Floor 03 40	Excursion Room Floor 03 40	Tang Floor 02 Plaii Building 40	Yuam Floor 02 Plaii Building 40
9.00-9.45	**การบรรยายพิเศษ หัวข้อ "บพค. กับนโยบายการพัฒนางานวิจัยขั้นแนวหน้าและเทคโนโลยีเชิงลึกเพื่อความยั่งยืนของประเทศ"** โดย ดร.ณิรวัฒน์ ธรรมจักร์ ผู้อำนวยการหน่วยบริหารและจัดการทุนด้านการพัฒนากำลังคน และทุนด้านการพัฒนาสถาบันอุดมศึกษา การวิจัยและการสร้างนวัตกรรม (บพค.) พิธีกร: รองศาสตราจารย์ ดร.ปัญชิกา ปรังเขียว									
9.45-10.15	**การบรรยายพิเศษ หัวข้อ "นโยบายมหาวิทยาลัยเชียงใหม่: การนำงานวิจัยและนวัตกรรมไปใช้ประโยชน์เชิงเศรษฐกิจ สังคม และนโยบาย"** โดย รองศาสตราจารย์ ดร.วินิดา บุณโยดม รองอธิการบดี มหาวิทยาลัยเชียงใหม่ พิธีกร: รองศาสตราจารย์ ดร.ปัญชิกา ปรังเขียว									
10.15-11.00	**เสวนา หัวข้อ "เส้นทางอาชีพอาจารย์-นักวิจัยกับตำแหน่งทางวิชาการ"** โดย ศาสตราจารย์ ดร.ผดุงศักดิ์ รัตนเตโช และ ศาสตราจารย์ ดร.รัศมี ชูทรงเดช ดำเนินการเสวนาโดย รองศาสตราจารย์ ดร.อภินภัส รุจิวัลย์									
10.45-11.00	**พักรับประทานอาหารว่าง / การเตรียมความพร้อมสำหรับห้องย่อย**									
การนำเสนอผลงานวิจัยแบบบรรยาย (แยกตาม Sessions) **ทั้งหมด 10 ห้องย่อย** นำเสนอโครงการละ 15 นาที (รวมถาม/ตอบ) ชั้น 4: Suthep Hall 01 - 03 ชั้น 3: Voyage Room / Journey Room / Expedition Room / Passage Room / Excursion Room ชั้น 2 (Plaii Building): Tang / Yuam										
11.00-11.15	AgriBiodiv 25	Health 25	Frontier 18	Health 31	Health 39	**MatInno 12**	Climate 12	Herb 12	**IV SSHA: ศ.ดร.สิทธิพล เครือรัฐติกาล**	**IV Tourism: คุณรุ่งเรือง วิโรจน์ชีวัน**
11.15-11.30	AgriBiodiv 26	Health 26	Frontier 19	Health 32	Health 40	**MatInno 13**	Climate 13	Herb 13		
11.30-11.45	AgriBiodiv 27	Health 27	Frontier 20	Health 33	Health 41	**MatInno 14**	Climate 14	Herb 14	**SSHA 1**	**Tourism 1**
11.45-12.00	AgriBiodiv 28	Health 28	Frontier 21	Health 34	Health 42	**MatInno 15**	Climate 15	Herb 15	**SSHA 2**	**Tourism 2**
12.00-13.15	**รับประทานอาหารกลางวัน**									
13.15-13.30	**IV AgriBiodiv: ดร.สยาม อวิโรจน์วงศ์**	**IV Health: ศ.ดร.นพ.ดำเนินสั่นต์ พฤกษากร**	Frontier 22	Health 35	Frontier 26	**IV MatInno: ดร.วัชชรินทร์ งามพิงพิศ**	**IV Climate: รศ.ดร.พีรพงศ์ จิตเสงี่ยม**	**IV Herb: ศ.ดร.ประสาท กิตตะคุปต์**	SSHA 3	**Tourism 3**
13.30-13.45			Frontier 23	Health 36	Frontier 27				SSHA 4	**Tourism 4**
13.45-14.00	AgriBiodiv 29	Health 29	Frontier 24	Health 37	Frontier 28	**MatInno 16**	Climate 16	Herb 16	SSHA 5	**Tourism 5**
14.00-14.15	AgriBiodiv 30	Health 30	Frontier 25	Health 38	Frontier 29	**MatInno 17**	Climate 17	Herb 17	SSHA 6	
14.15-14.45	**การนำเสนอผลงานวิจัยแบบโปสเตอร์ ช่วงที่ 3 / พักรับประทานอาหารว่าง**									
การนำเสนอผลงานวิจัยแบบบรรยาย (แยกตาม Sessions) **ทั้งหมด 10 ห้องย่อย** นำเสนอโครงการละ 15 นาที (รวมถาม/ตอบ) ชั้น 4: Suthep Hall 01 - 03 ชั้น 3: Voyage Room / Journey Room / Expedition Room / Passage Room / Excursion Room ชั้น 2 (Plaii Building): Tang / Yuam										
14.45-15.00	AgriBiodiv 31	Health 43	**MatInno 22**	Health 47	Health 51	**IV MatInno: ดร.อธิวัฒน์ กฤตยาวัฒนานนท์**	Climate 18	Herb 18	**IV SSHA: รศ.ดร.นัธนัย ประสานนาม**	SSHA 11
15.00-15.15	AgriBiodiv 32	Health 44	**MatInno 23**	Health 48	Health 52		Climate 19	Herb 19		SSHA 12
15.15-15.30	AgriBiodiv 33	Health 45	**MatInno 24**	Health 49	Health 53	**MatInno 20**	Climate 20	Herb 20	SSHA 7	SSHA 13
15.30-15.45	AgriBiodiv 34	Health 46	**MatInno 25**	Health 50	Health 54	**MatInno 20**	Climate 21	Herb 21	SSHA 8	SSHA 14
15.45-16.00									SSHA 9	SSHA 15
16.00-16.15									SSHA 10	SSHA 16
16.15-16.30										SSHA 17
16.30-16.45	**พิธีปิดการประชุมวิชาการฯ** **พิธีกร: รองศาสตราจารย์ ดร.เกียรติคุณ มะโนเครื่อง**									

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วันจันทร์ที่ 18 สิงหาคม 2568

เวลา	กำหนดการ
	Suthep hall, ชั้น 4 ณ โรงแรม เชียงใหม่ แมริออท โฮเทล
08.00 – 09.00	ลงทะเบียนเข้าร่วมงาน
09.00 – 09.30	พิธีเปิดงานประชุมวิชาการ CMU ANNUAL RESEARCH SUMMIT ประจำปี 2568 *พิธีกร: ผู้ช่วยศาสตราจารย์ ดร.กรวิทย์ ไชยสุ*
	กล่าวรายงาน **โดย รองศาสตราจารย์ ดร.วินิตา บุณโยดม** รองอธิการบดี มหาวิทยาลัยเชียงใหม่
	กล่าวต้อนรับและเปิดงาน **โดย ศาสตราจารย์ ดร.นพ.พงษ์รักษ์ ศรีบัณฑิตมงคล** **อธิการบดีมหาวิทยาลัยเชียงใหม่ และ กรรมการส่งเสริมวิทยาศาสตร์ วิจัยและนวัตกรรม (กสว.)**
	แขกผู้มีเกียรติและผู้บริหารร่วมถ่ายภาพเพื่อเป็นเกียรติในพิธีการเปิดงานประชุมวิชาการ CMU ANNUAL RESEARCH SUMMIT **ประจำปี 2568** (ถ่ายภาพร่วมกัน จำนวน 4 ชุด)
	อธิการบดี มอบช่อดอกไม้แสดงความยินดีแก่นักวิจัยผู้ได้รับรางวัลนักวิทยาศาสตร์ดีเด่น และนักวิทยาศาสตร์รุ่นใหม่ ประจำปี 2568 จากมูลนิธิส่งเสริมวิทยาศาสตร์และเทคโนโลยี ในพระบรมราชูปถัมภ์
09.30 – 10.15	กล่าวปาฐกถาพิเศษ หัวข้อ **“ระบบวิทยาศาสตร์ วิจัย และ นวัตกรรม เพื่อการพัฒนาประเทศอย่างยั่งยืน”** **โดย ศาสตราจารย์เกียรติคุณ ดร.นพ. สิริฤกษ์ ทรงศิวิไล** **ประธานกรรมการส่งเสริมวิทยาศาสตร์ วิจัยและนวัตกรรม (กสว.)** *กล่าวแนะนำวิทยากร โดย รองศาสตราจารย์ ดร.วินิตา บุณโยดม*
10.15 – 11.00	การบรรยายพิเศษ หัวข้อ **“S-Curve ใหม่ ด้วยนโยบายวิทยาศาสตร์ วิจัย นวัตกรรม (ววน.)”** **โดย ศาสตราจารย์ ดร.คมกฤต เล็กสกุล** **รองผู้อำนวยการสำนักงานคณะกรรมการส่งเสริมวิทยาศาสตร์ วิจัยและนวัตกรรม (สกสว.)** *กล่าวแนะนำวิทยากร โดย รองศาสตราจารย์ ดร.อภินภัส รุจิวัตร์*

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เวลา	กำหนดการ
11.00 – 11.30	**พักรับประทานอาหารว่าง / การเตรียมความพร้อมสำหรับห้องย่อย**
11.30 – 12.30	**การนำเสนอผลงานวิจัยแบบบรรยาย (แยกตาม Sessions)** **ทั้งหมด 10 ห้องย่อย** นำเสนอโครงการละ 15 นาที (รวมถาม/ตอบ) **ชั้น 2** (Plaii Building): Tang / Yuam **ชั้น 3**: Voyage Room / Journey Room / Expedition Room / Passage Room / Excursion Room **ชั้น** 4: Suthep Hall 01 - 03
12.30 – 13.30	**รับประทานอาหารกลางวัน** **ชั้น 1:** The Ping Cuisine and Bar (คูปองสีเหลือง) **ชั้น 2**: Grand Ballroom (คูปองแดง), Favola (คูปองสีม่วง) **ชั้น 2 (Plaii Building):** Kok + Pho, Ing, Ngat, Pai (คูปองสีเขียว)
13.40 – 14.15 Suthep hall 3 ชั้น 4	บรรยายพิเศษ หัวข้อ “มหาวิทยาลัยกับการยกระดับคุณภาพชีวิตชุมชน” **โดย ศาสตราจารย์เกียรติคุณ ดร.ปิยะวัฒน์ บุญ-หลง** **ที่ปรึกษาสมาคมพันธกิจสัมพันธ์มหาวิทยาลัยกับสังคม (Engagement Thailand: EnT)** *ผู้ดำเนินรายการ โดย ผู้ช่วยศาสตราจารย์ ดร.จุฑาทิพย์ เฉลิมผล*
13.30 – 14.00	**วิทยากรรับเชิญ (Invited Speakers) รูปแบบ Parallel Sessions**
Suthep Hall 1 ชั้น 4	**ดร.ศิรสิทธิ์ ศรีนวลปาน** สำนักงานบริหารงานวิจัย มหาวิทยาลัยเชียงใหม่ หัวข้อ: Production and Utilization of Algal and Cyanobacterial Biomass for the SDGs and the BCG Industry
Suthep Hall 2 ชั้น 4	**ศาสตราจารย์ (เชี่ยวชาญพิเศษ) ดร.ทพญ.สิริพร ฉัตรทิพากร** คณะทันตแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่ หัวข้อ: Obesity Induces Premature Brain Aging: How to Intervene
Voyage Room ชั้น 3	**ดร.ศรัณย์ โปษยะจินดา** อดีตผู้อำนวยการสถาบันวิจัยดาราศาสตร์แห่งชาติ หัวข้อ: บทบาทของดาราศาสตร์ในการขับเคลื่อนความก้าวหน้าทางเทคโนโลยีและการพัฒนาบุคลากร

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เวลา	กำหนดการ
Expedition ชั้น 3	**ดร.อดิสร เตือนตรานนท์** Thai Microelectronics Center (TMEC) สำนักงานพัฒนาวิทยาศาสตร์และเทคโนโลยีแห่งชาติ (สวทช.) หัวข้อ: Trend and Perspective on Semiconductor Industry and Workforce Development in Thailand
Passage Room ชั้น 3	**รองศาสตราจารย์ ดร.สราวุธ เทพานนท์** คณะสาธารณสุขศาสตร์ มหาวิทยาลัยมหิดล หัวข้อ: Deciphering secondary organic aerosol, sources, economic impacts, and PM2.5 solutions
Excursion Room ชั้น 3	**ดร.พัชราภรณ์ วงษา** ผู้อำนวยการโปรแกรมบริหารโภชนเภสัชภัณฑ์และเวชสำอาง ศูนย์ความเป็นเลิศทางด้านชีววิทยาศาสตร์ หัวข้อ: ภาพรวมการพัฒนาอุตสาหกรรมสมุนไพรไทย: จากนโยบายสู่โอกาสทางธุรกิจและการเข้าถึงแหล่งทุน
Tang ชั้น 2 Plaii Building	**ผู้ช่วยศาสตราจารย์ ดร.อักฤทธิ์ สังข์เพ็ชร** Director of CMKL University หัวข้อ: ความร่วมมือเพื่อการพัฒนางานวิจัยและนวัตกรรม AI ในระดับนานาชาติ
14.15 – 14.45 Suthep Hall 3 ชั้น 4	**ผู้ช่วยศาสตราจารย์ ดร.พิพัฒพงศ์ ฟักแฟ** คณะมนุษยศาสตร์และการจัดการการท่องเที่ยว มหาวิทยาลัยกรุงเทพ หัวข้อ: Publishing with Impact: How to Position Your Research for International Recognition
15.15 - 15.45 Voyage Room ชั้น 3	**รองศาสตราจารย์ ดร.ปฐมพล วงศ์ตระกูลเกต** ผู้ช่วยคณบดีฝ่ายวิจัยและนวัตกรรม คณะวิทยาศาสตร์ มหาวิทยาลัยมหิดล หัวข้อ: What can be done with circular mRNA
14.00 – 14.30	**การนำเสนอผลงานวิจัยแบบบรรยาย (แยกตาม Sessions)** **ทั้งหมด 10 ห้องย่อย** นำเสนอโครงการละ 15 นาที (รวมถาม/ตอบ) **ชั้น 2** (Plaii Building): Tang / Yuam **ชั้น 3**: Voyage Room / Journey Room / Expedition Room / Passage Room / Excursion Room **ชั้น** 4: Suthep Hall 01 - 03

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เวลา	กำหนดการ
14.30 – 15.15	**การนำเสนอผลงานวิจัยแบบโปสเตอร์ ช่วงที่ 1 / พักรับประทานอาหารว่าง** 1) โถงบริเวณชั้น 4: Frontier/Deep Tech 2) โถงบริเวณชั้น 3: Material Innovation, Climate Crisis, Carbon Neutrality
15.15 – 16.30	**การนำเสนอผลงานวิจัยแบบบรรยาย (แยกตาม Sessions)** **ทั้งหมด 10 ห้องย่อย** นำเสนอโครงการละ 15 นาที (รวมถาม/ตอบ) **ชั้น 2** (Plaii Building): Tang / Yuam **ชั้น 3**: Voyage Room / Journey Room / Expedition Room / Passage Room / Excursion Room **ชั้น** 4: Suthep Hall 01 - 03
16.30 – 17.30	**การนำเสนอผลงานวิจัยแบบโปสเตอร์ ช่วงที่ 2** 1) โถงบริเวณชั้น 4: Digital & AI 2) โถงบริเวณชั้น 3: Health and Well-being, Aging Society, Pandemics
18.30 – 21.00	**CMU Research Summit Dinner** **ร่วมรับประทานอาหารเย็น (buffet) และรับชมการแสดงดนตรี**

***กำหนดการอาจมีการเปลี่ยนได้ตามความเหมาะสม*

กำหนดการ งานประชุมวิชาการ
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เวลา	กำหนดการ
Suthep hall, ชั้น 4 ณ โรงแรม เชียงใหม่ แมริออท โฮเทล	
08.00 – 09.00	ลงทะเบียนเข้าร่วมงาน
09.00 – 09.45	การบรรยายพิเศษ หัวข้อ **“บพค. กับนโยบายการพัฒนางานวิจัยขั้นแนวหน้าและเทคโนโลยีเชิงลึกเพื่อความยั่งยืนของประเทศ”** **โดย ดร.ณิรวัฒน์ ธรรมจักร์** **ผู้อำนวยการหน่วยบริหารและจัดการทุนด้านการพัฒนากำลังคน และทุนด้านการพัฒนาสถาบันอุดมศึกษา การวิจัยและการสร้างนวัตกรรม (บพค.)** *กล่าวแนะนำวิทยากร โดย รองศาสตราจารย์ ดร.ปัญชิกา ปรังเขียว*
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11.00	**พักรับประทานอาหารว่าง / การเตรียมความพร้อมสำหรับห้องย่อย**
11.00 - 12.00	**การนำเสนอผลงานวิจัยแบบบรรยาย (แยกตาม Sessions)** **ทั้งหมด 10 ห้องย่อย** นำเสนอโครงการละ 15 นาที (รวมถาม/ตอบ) **ชั้น 2** (Plaii Building): Tang / Yuam **ชั้น 3**: Voyage Room / Journey Room / Expedition Room / Passage Room / Excursion Room **ชั้น** 4: Suthep Hall 01 - 03

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วิทยากรรับเชิญ (Invited Speakers) รูปแบบ Parallel Sessions	
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11.00 - 11.30 Yuam ชั้น 2 Plaii Building	**คุณรุ่งเรือง วิโรจน์ชีวัน** Head of Hotel Operations บริษัท แอสเสท เวิรด์ คอร์ป จำกัด (มหาชน) หัวข้อ: “Lannatique” กรณีศึกษา โอกาสของการวิจัยและพัฒนาเพื่อสร้างผลกระทบทางเศรษฐกิจของเชียงใหม่
13.15 – 13.45 Suthep Hall 1 ชั้น 4	**ดร.สยาม ลววิโรจน์วงศ์** ผู้อำนวยการสำนักประยุกต์และบริหารภูมิสารสนเทศ สำนักงานพัฒนาเทคโนโลยีอวกาศและภูมิสารสนเทศ (องค์การมหาชน) หัวข้อ: Satellite-Powered Sustainability: Agricultures, Environemnts, Natural Resources, and Disaster Resilience
13.15 – 13.45 Suthep Hall 2 ชั้น 4	**ศาสตราจารย์ ดร.นายแพทย์ดำเนินสันต์ พฤกษากร** คณะแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่ หัวข้อ: Building institutional readiness: Ecosystem of genomics for precision medicine
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13.15 – 13.45 Excursion Room ชั้น 3	**ศาสตราจารย์ ดร.ประสาท กิตตะคุปต์** สถาบันบัณฑิตศึกษาจุฬาภรณ์ หัวข้อ: การคิดหัวข้องานวิจัย เพื่อนำไปสู่การค้นพบที่สามารถตีพิมพ์ได้ในวารสารที่ดีและนำไปสู่การใช้ประโยชน์

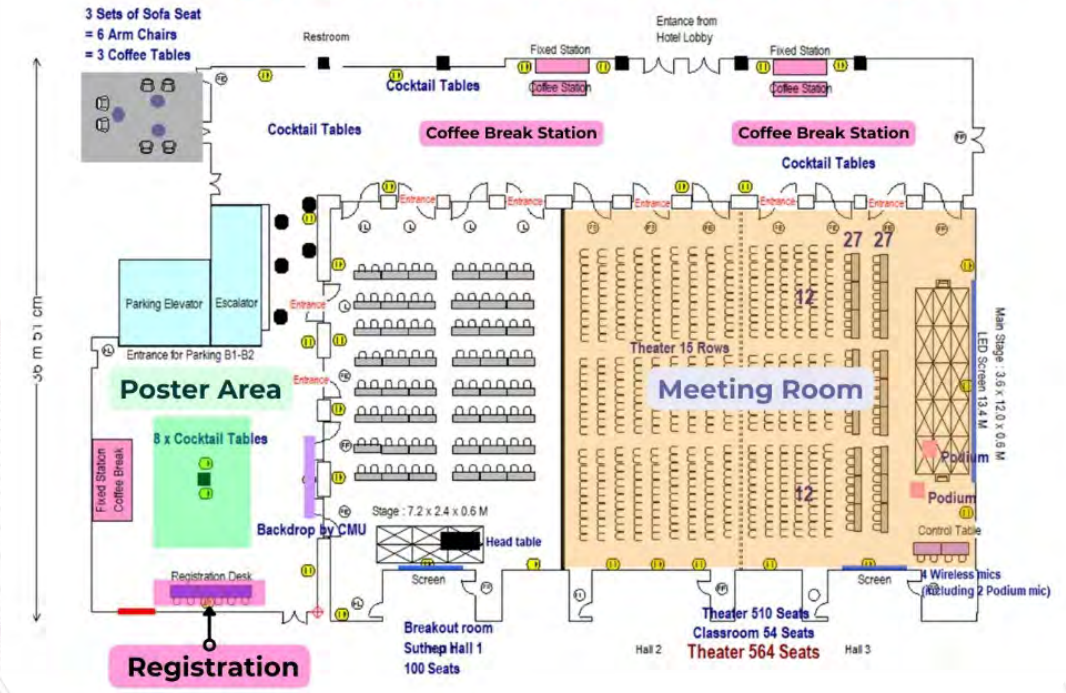
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14.45-15.15 Tang ชั้น 2 Plaii Building	**รองศาสตราจารย์ ดร.นัธนัย ประสานนาม** คณะมนุษยศาสตร์ มหาวิทยาลัยเกษตรศาสตร์ หัวข้อ: มนุษยศาสตร์ใหม่?: ประสบการณ์ของนักวิจัยรุ่นกลาง
13.15 - 14.15	**การนำเสนอผลงานวิจัยแบบบรรยาย (แยกตาม Sessions)** **ทั้งหมด 10 ห้องย่อย** นำเสนอโครงการละ 15 นาที (รวมถาม/ตอบ) **ชั้น 2** (Plaii Building): Tang / Yuam **ชั้น 3**: Voyage Room / Journey Room / Expedition Room / Passage Room / Excursion Room **ชั้น** 4: Suthep Hall 01 - 03
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***กำหนดการอาจมีการเปลี่ยนได้ตามความเหมาะสม*

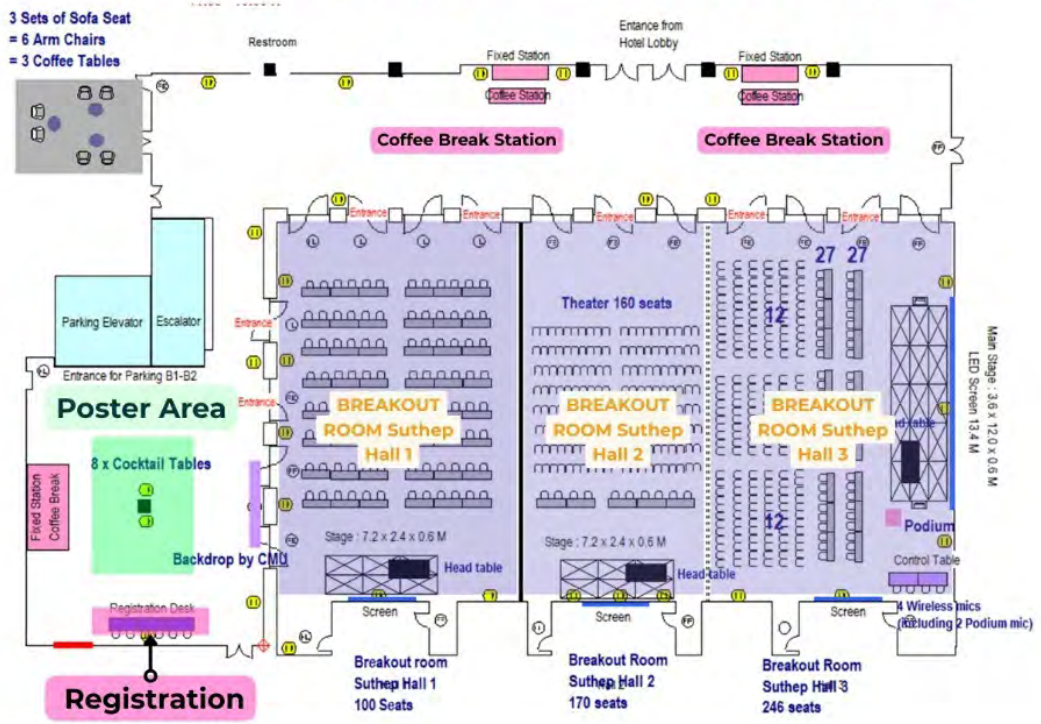
Floor Plan 18 สิงหาคม 2568

Meeting | Suthep Hall Floor 04 | 09.00 - 11.00

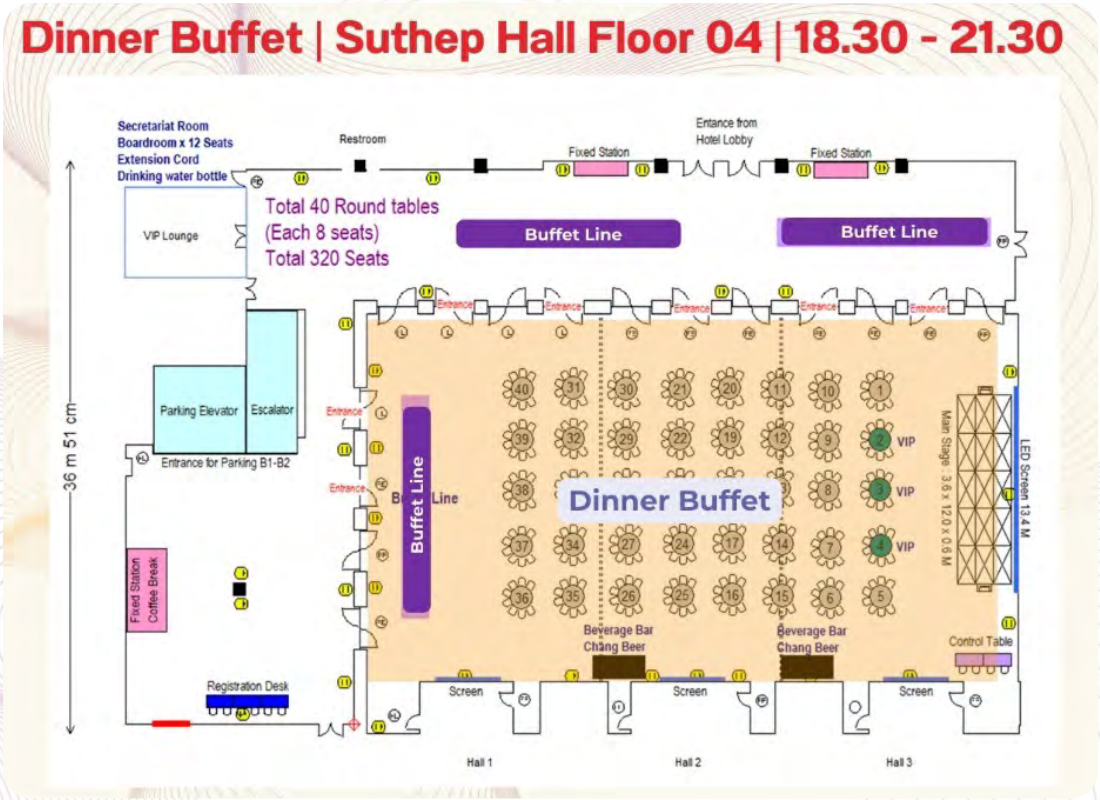


Floor Plan 18 สิงหาคม 2568

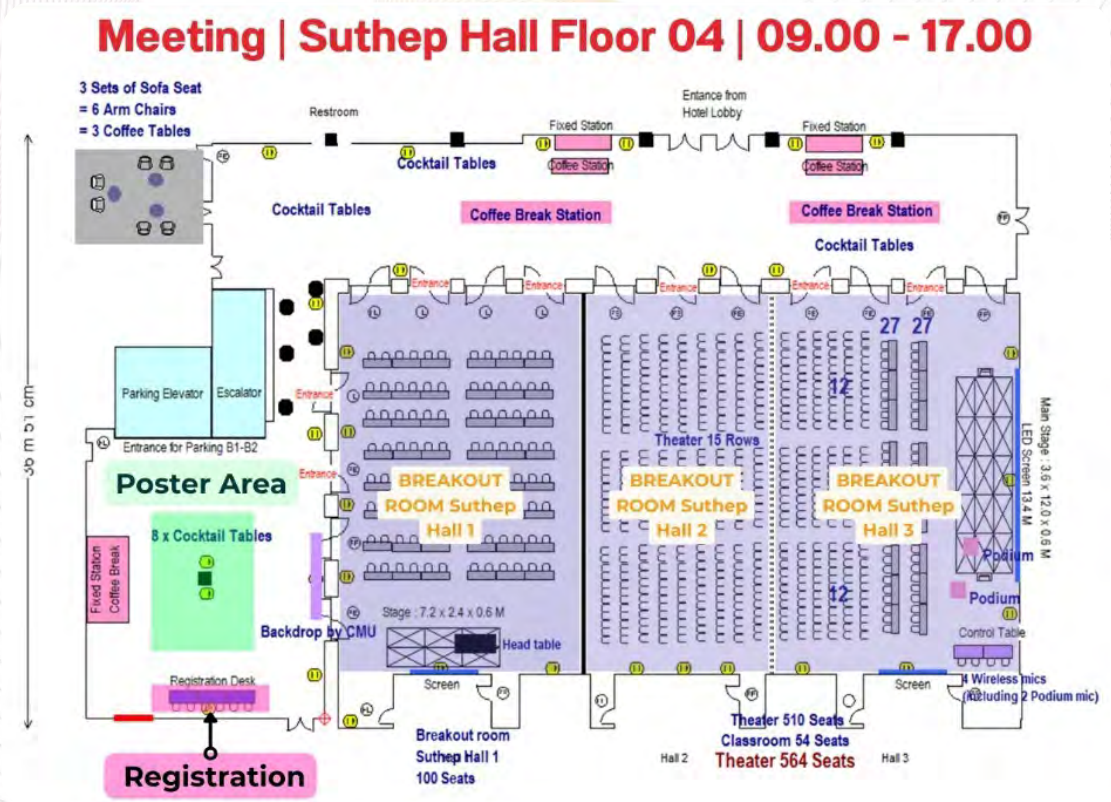
Meeting | Suthep Hall Floor 04 | 11.30 - 16.30



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Floor Plan 19 สิงหาคม 2568



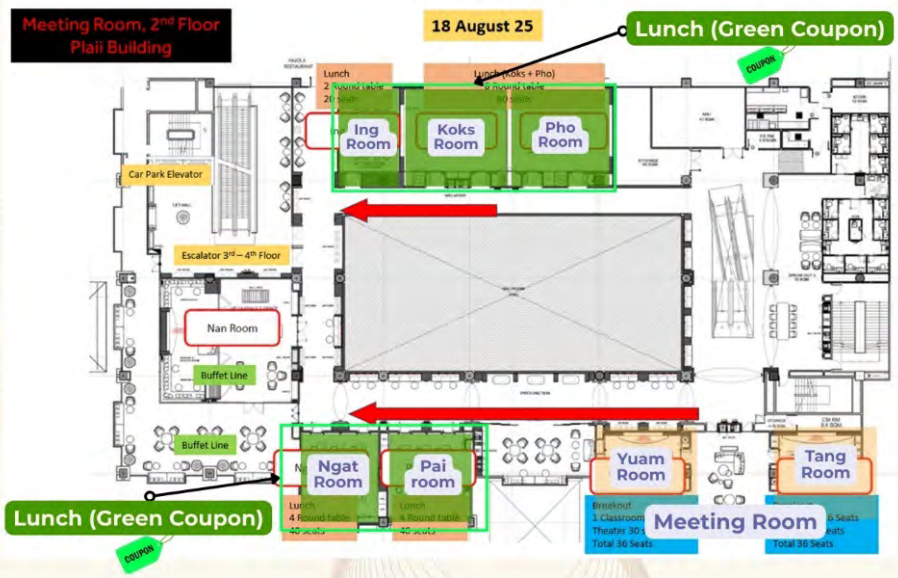
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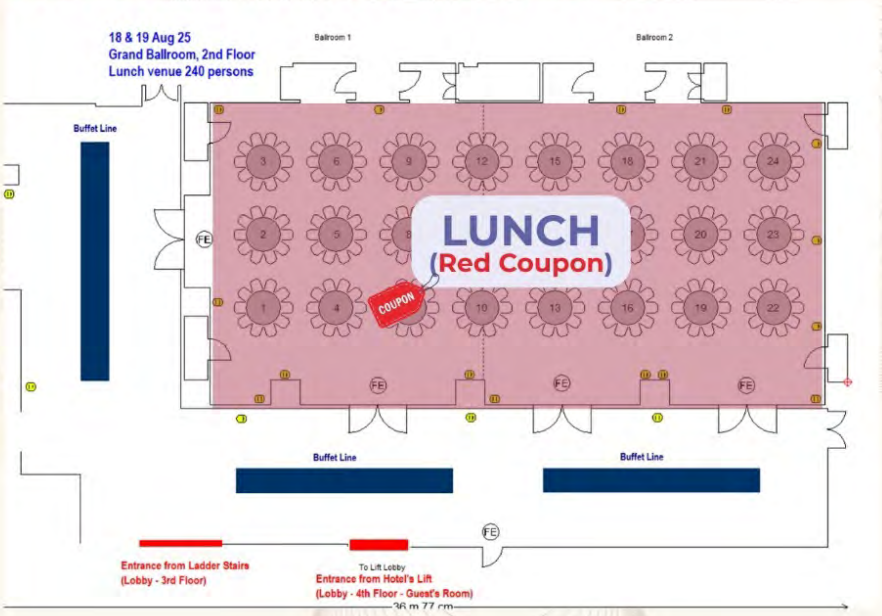
Lunch Venue | 2nd Floor | Plaii Building



Lunch Venue	Coupon Color
The Ping Cuisine and Bar, 1st Floor	Yellow
Grand Ballroom, 2nd Floor	Red
Favola, 2nd Floor	Purple
Plaii Building 2nd Floor • Kok + Pho • Ing • Ngat • Pai	Green

Floor Plan 18-19 สิงหาคม 2568

Lunch Venue | Grand Ballroom 2nd Floor



Lunch Venue	Coupon Color
The Ping Cuisine and Bar, 1st Floor	Yellow
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Plaii Building 2nd Floor • Kok + Pho • Ing • Ngat • Pai	Green

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Herbs, Cosmetic, Supplements, Drugs, High Valued Food

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Herbs, Cosmetic, Supplements, Drugs, High Valued Food

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CMU Annual Research Summit 2025

Oral Presentation



Frontier/ Deep Tech

Invited Speakers

ดร.ศรัณย์ โปษยะจินดา
อดีตผู้อำนวยการสถาบันวิจัยดาราศาสตร์แห่งชาติ

บทบาทของดาราศาสตร์ในการขับเคลื่อนความก้าวหน้าทางเทคโนโลยีและการพัฒนาบุคลากร

รศ.ดร.ปฐมพล วงศ์ตระกูลเกต
คณะวิทยาศาสตร์ มหาวิทยาลัยมหิดล

What can be done with circular mRNA

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Antibody Engineering to Target CD147 on Triple Negative Breast Cancer by NK cells

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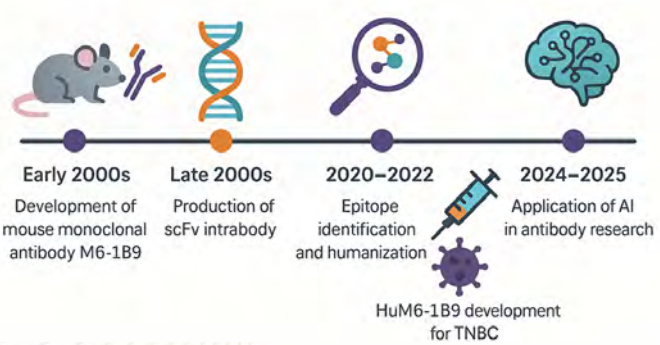
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CD147 is a transmembrane glycoprotein involved in tumor invasion, immune regulation, and cellular metabolism, emerging as a key modulator in cancer biology. Over two decades of research—initiated by the generation of the mouse monoclonal antibody M6-1B9—have highlighted its roles in monocyte migration, cytokine signaling, and tumor–immune interactions. The development of a single-chain variable fragment (scFv) intrabody targeting CD147 provided further mechanistic insight by enabling intracellular functional disruption. These foundational studies enabled rational antibody engineering, leading to the humanization of M6-1B9 (HuM6-1B9) for therapeutic application. In triple-negative breast cancer (TNBC), a subtype with limited targeted treatment options, CD147 is frequently overexpressed and associated with an immunosuppressive tumor microenvironment and poor prognosis. HuM6-1B9 binds with high affinity to CD147-expressing TNBC cells and induces robust antibody-dependent cellular cytotoxicity (ADCC) without enhancing tumor cell motility—addressing limitations of conventional antibody therapies. Artificial intelligence tools were employed to optimize humanness and enhance affinity, advancing its clinical potential. This progression from basic immunological discovery to a fully engineered therapeutic highlights the translational promise of CD147 as both a biomarker and a therapeutic target in TNBC.

Keywords: CD147, Triple-Negative Breast Cancer, Therapeutic Antibody, ADCC, NK cells

References: *Antibodies (Basel). 2025 Apr 11;14(2):36.*
Int J Mol Sci. 2024 Jun 16;25(12):6626.

Funding Source(s): Chiang Mai University (2569A10412029, TGCMU2567P007, and R68IN00231) and National Research Council of Thailand (N34E670096)



The Biomedical Engineering and Innovation Research Center (BMEI-RC) Chiang Mai University

Nipon Theera-Umpon[1,2,4*], Sansanee Auephanwiriyakul[1,2,4], Sarawut Kumphune[1,2], Pathinan Paengnakorn[1,2], Chawan Manaspon[1,2] , Phornsawat Baipaywad[1,2] , Sutthira Sutthasupa[1,3], Patiwet Wuttisarnwattana[1,4], Ukrit Mankong[1,4], Navadon Khunlertgit[1,4], Dome Potikanond[1,4], Kasemsit Teeyapan[1,4], Chayarop Supanchart[1,5], Kullapop Suttiat[1,5], Wanpitak Pongkan[1,6], Kittichai Wantanajittikul[1,7], Rattapol Pinnaratip[1,4], Anirut Watcharawipha[1,8]

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Thailand faces pressing national health challenges, including the rise of emerging and re-emerging infectious diseases, the growing burden of non-communicable diseases, and the pervasive impact of fine particulate matter (PM2.5) pollution. These issues collectively contribute to significant morbidity and diminish the overall quality of life for the population. In response, the Biomedical Engineering and Innovation Research Center (BMEI-RC) at Chiang Mai University, established in 2023, is dedicated to conducting high-quality research aimed at addressing these critical health concerns. We aim to improve disease diagnosis, treatment, monitoring, to improve Thai health, help the country develop, reduce dependence on imported medical equipment, and create commercializable products that boost national income and global competitiveness.

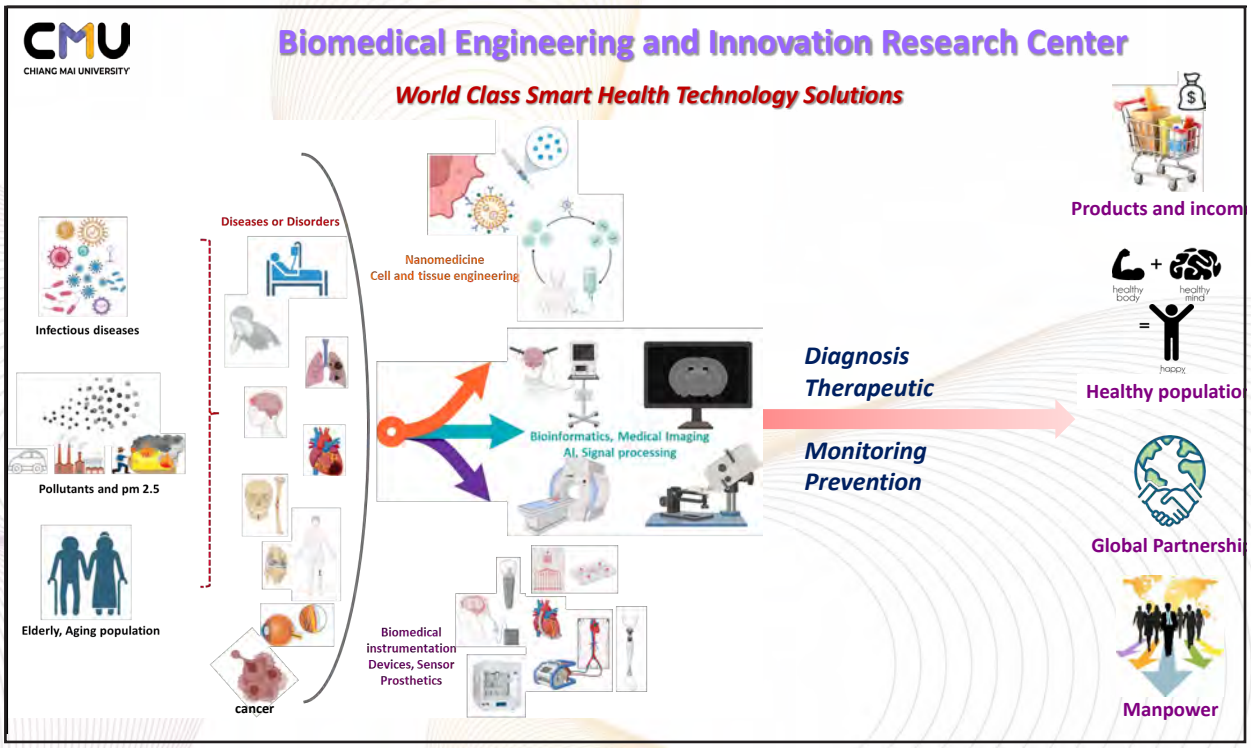
The BMEI-RC operates through a collaborative framework, strategically organizing its research into three specialized teams including Nanomedicine, Cell, and Tissue Engineering: Biomedical Instrumentation, Devices, Sensors, and Prosthetics: and Bioinformatics, Medical Imaging, Artificial Intelligence (AI), and Signal Processing. Each team meticulously executes sub-projects to apply core research findings. Beyond its academic output, the center develops top talent and fosters worldwide research cooperation.

Over the past two years, the BMEI-RC has consistently met the objectives outlined in its research development plan, marked by successful inter-team collaborative projects. The center actively promotes regular brainstorming sessions among its members to foster innovative solutions. Furthermore, the BMEI-RC has proactively established research collaborations with the private sector, evidenced by the execution of Memorandums of Understanding (MOUs) with various national and international organizations.

Keywords: Biomedical Engineering; Thailand Health Challenges; Medical Innovation; Research Center; Research Collaboration

Funding Source(s): The BMEI-RC is supported by Chiang Mai University Targeted Research and Chiang Mai University endowment fund.

Graphical Abstract (Compulsory)



Chemcatcher® Passive Sampler Reveals Emerging Pesticides in Canal Waters and Conducts Health Risk Assessment in Thailand

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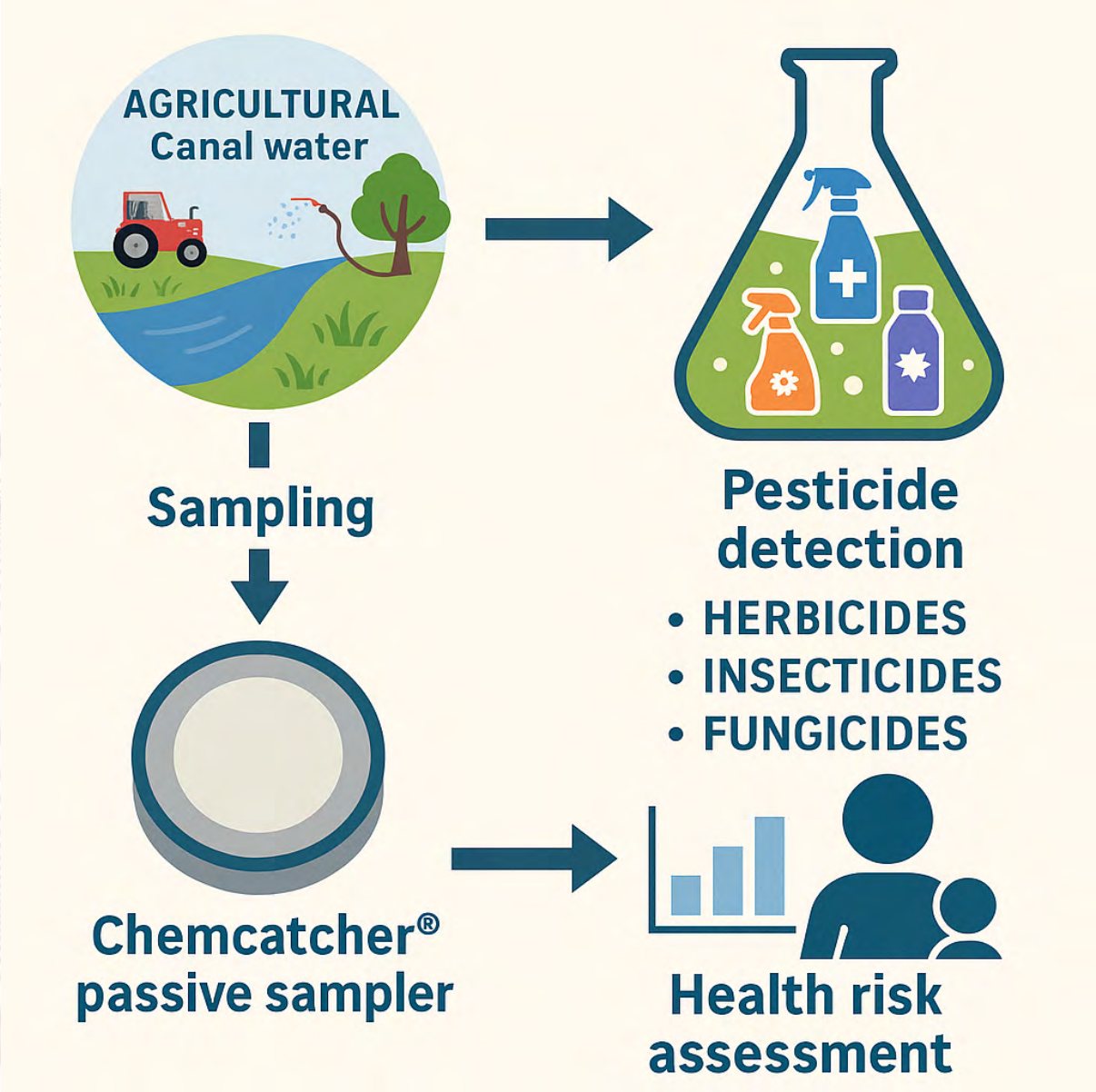
This research evaluated the performance of the Chemcatcher® passive sampling device, equipped with a Horizon Atlantic™ HLB-L SPE disk, for monitoring fungicides, insecticides, and herbicides in canal water across three locations during two sampling periods. The device showed strong reliability, capturing 62% of the targeted pesticides with consistent uptake trends. Herbicides accounted for the majority (60.9%), followed by insecticides (30.4%) and fungicides (8.7%). From the 36 pesticides screened, 25 with recovery rates above 80% in laboratory tests were selected for field uptake measurements. Field sampling rates (RS) ranged between 0.019 and 0.069 L d^{-1}. When compared to conventional spot sampling, Chemcatcher® demonstrated markedly improved sensitivity, especially for insecticides. Pesticide levels were generally higher in March than in April, likely due to increased application during the fruit drop period. Differences among sites also revealed spatial variability in contamination levels. Although the overall pesticide concentrations posed low health risks, exposure assessments showed higher Pesticide Daily Intake (PDI) values for infants and children. Hazard Quotient (HQ) analysis identified carbendazim, carbosulfan, and alachlor as key contributors to potential risk, particularly affecting infants. The cumulative risk, expressed as the Hazard Index (HI), ranged from 7.8–38.0 in March and 1.6–8.1 in April, varying by site and highlighting the increased vulnerability of infants to chronic pesticide exposure—most notably from carbosulfan.

Keywords: Contaminated water; Pesticides residue; Passive sampling; Health risks; Health hazard; Canal catchments

References: Environmental Monitoring and Assessment, 191. https://doi.org/10.1007/s10661-019-7221-x.
Journal of Hazardous Materials, 410, 124538, https://doi.org/10.1016/J.JHAZMAT.2020.124538.

Funding Source(s): This research was financially supported by the Fundamental Fund 2024 at Chiang Mai University and the NSRF through the Program Management Unit for Human

Resources & Institutional Development, Research, and Innovation (grant number B40G660030)



Generation of Neural Stem/Progenitor-like Cells from Cultured Human Peripheral Blood Mononuclear Cells Combined with Cannabidiol

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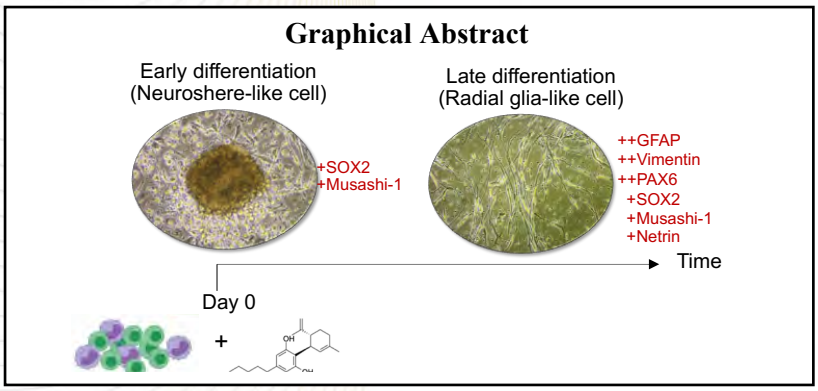
Recent advances in chemical reprogramming with small molecule combination have enabled the direct conversion of somatic cells into different cell lineages without genetic modification. This study aimed to investigate reprogramming and differentiation capacity of peripheral blood mononuclear cells (PBMCs) after treating with only a single small molecule, cannabidiol (CBD). The differentiated reprogrammed cells exhibited high expression of neuronal stem/progenitor cell (NSPCs) markers without pluripotency markers, suggesting cellular identity was switched to NSPCs via direct reprogramming. Transcriptomics and proteomic analyses of the differentiated reprogrammed cells showed the remarkable expression of genes specific to NSPCs and endocannabinoid system along with regenerative parameters and morphogenesis. Unexpectedly, we have found that PBMCs may inherently possess certain levels of plasticity or potency, possibly through dedifferentiation or transdifferentiation mechanisms. Our findings convey the idea that CBD together with intrinsic plasticity of PBMCs might be able to induce the transdifferentiation of PBMCs.

Keywords: PBMC, regenerative capacity, cell reprogramming, transdifferentiation, cannabidiol

References: *BioRxiv preprints (2025), doi:10.1101/2025.07.18.665629.*

Funding Source(s): Fundamental Fund 2023 (grant code: FF66/031)

Graphical Abstract



FAST-COLD PCR-Based Detection of XPO1E571K Mutation in Circulating Cell-Free DNA from Lymphoma Patients

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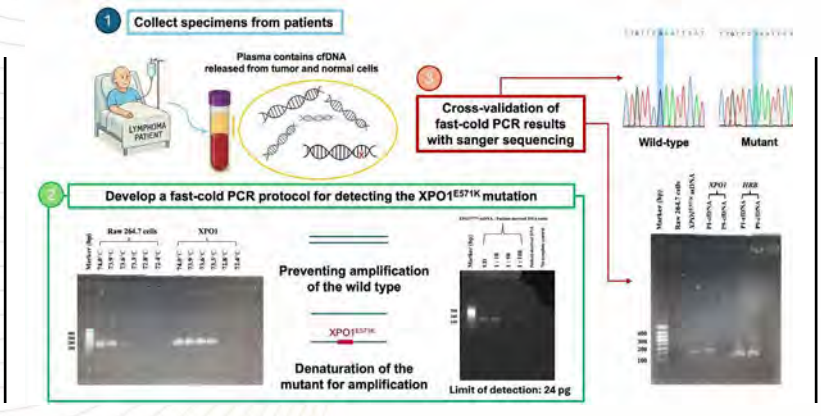
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The *XPO1* gene encodes exportin 1, a nuclear export protein responsible for transporting proteins and RNA from the nucleus to the cytoplasm. It has been identified as a biomarker for lymphoma, with the XPO1^{E571K} mutation frequently observed and associated with good prognosis in patients. Detection of cell-free circulating tumor DNA (cfDNA), released by lymphoma cells into the bloodstream, offers a non-invasive alternative to tissue biopsy. However, cfDNA is present at very low levels in the blood of cancer patients, necessitating a highly sensitive detection method. In this study, cfDNA was extracted from patient samples and the *XPO1* gene was amplified by conventional PCR. Sanger sequencing confirmed the DNA sequences. To enhance detection sensitivity, a FAST-COLD-PCR assay was developed using the CFX96 Touch Real-Time PCR System. The optimal critical denaturation temperature (Tc) was determined to be 73.3°C, enabling selective amplification of mutant XPO1^{E571K} DNA, while suppressing the wild-type allele. This method allows for rapid and accurate detection of the XPO1^{E571K} mutation with high specificity and sensitivity. The optimized FAST-COLD-PCR conditions provide a reliable and practical approach for non-invasive mutation detection in lymphoma patients and can serve as a prototype for future diagnostic applications.

Keywords: cell-free DNA, FAST-COLD-PCR, cancer, lymphoma, XPO1^{E571K}

Funding Source(s): Fundamental Fund 2023, Chiang Mai University, Chiang Mai Thailand.



The Study of Tooth Maldevelopment in Man and Dinosaurs

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At the Center of Excellence in Medical Genetics Research, Chiang Mai University, we are deeply committed to the study of human malformations, with a particular focus on dental anomalies. Supported by grants from Chiang Mai University and Health System Research Institute, our team has conducted both whole-exome sequencing in patients with human malformations. We have identified novel genes involved in a range of dental conditions, including extra teeth, tooth agenesis, natal teeth, gingival overgrowth, and pain sensation.

In collaboration with The Dinosaur Unit at Mahasarakham University, we utilized advanced imaging techniques such as microCT and SEM at the Faculty of Dentistry, CMU, we have examined various fossil specimens including dinosaur teeth, dinosaur ribs, turtle shell sutures, and fish jaws. One of our notable findings is the presence of enamel tubules in the teeth of *Siamosaurus sutheetorni*—the first dinosaur discovered in Thailand. Further analysis using synchrotron radiation in collaboration with the Synchrotron Light Research Institute has provided deeper insight into the enamel structure of *Siamosaurus sutheetorni*.

Our research in human malformations enhances our understanding of human biology, development, and genetic mechanisms, while our study of dinosaur fossils enriches our knowledge of evolution, ancient life, and the history of biodiversity. Together, these efforts bridge past and present, and help us better prepare for the future.

Keywords: Tooth development, Dinosaur teeth, Human malformation

References: *Kantaputra et al., Int Dent J. 2025;75(4):100821. doi: 10.1016/j.identj.2025.04.002. Chainaphaphorn et al. In Press*

Funding Source(s): ทุนพัฒนางานวิจัยมุ่งเป้า มหาวิทยาลัยเชียงใหม่ TGCMU2567P001/2567



Predictive Model for Northeastern Thailand Rainfall Using ENSO Indexes and Novel Sea Surface Height Anomalies Index

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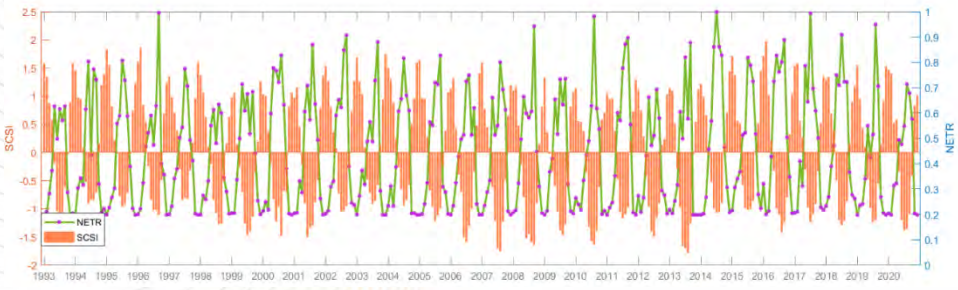
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Rainfall in Northeastern Thailand (NETR) is vital due to the region's reliance on rain-fed agriculture, especially for rice, cassava, and sugarcane. Climate variability makes the area vulnerable to both droughts and floods, threatening crop yields and farmer incomes. To enhance resilience, better rainfall forecasting and climate adaptation strategies are essential. In this work, we aim to improve the NETR forecasting by combining ENSO indices and a new oceanic indicator called South China Sea Index (SCSI) which derived based on sea surface height anomaly in the South China Sea. Our result reveals that correlations of NETR-Niño1+2 (4-month lead) is 0.734 and correlation of NETR-Niño3 (3-month lead) is 0.599. While NETR-SCSI shows a significantly negative relation of -0.859. Next, we investigate the performances of six SARIMAX models for predicting NETR with various exogenous oceanic-index inputs including Niño3 (3-month lead) and Niño1+2 (4-month lead) and SCSI. To choose the best model, we adopt the decision based on the AIC (better model with lower AIC). Results show that the best model is SARIMAX SARIMAX$(0,1,1)(0,1,1)_{12}$, obtained by using only SCSI as exogenous input, while models with two or three exogenous inputs yield larger AIC.

Keywords: northeastern Thailand rainfall, Principal Component Analysis, sea surface height anomaly, ENSO

References: *Journal of Marine Science and Engineering,*12(1) (2024) 35.

Funding Source(s): This work was partially supported by Fundamental Fund 2024, Chiang Mai University.



Geochemical Modeling of Scale Formation due to Cooling and CO_2-degassing in San Kamphaeng Geothermal Field, Northern Thailand

Schradh Saenton

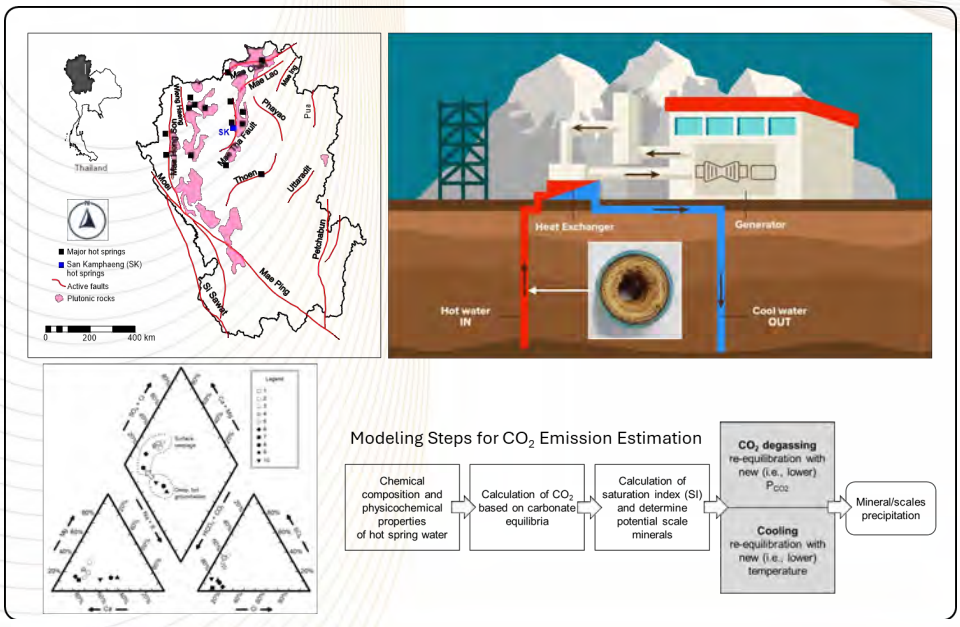
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The study investigates scale formation in the San Kamphaeng geothermal field, Northern Thailand, through geochemical modeling. Scaling occurs due to mineral precipitation triggered by cooling and CO_2 degassing as geothermal fluid ascends from deep reservoirs to surface seepage. Water samples collected from natural seepages and groundwater wells at depths of up to 267 m were analyzed for chemical and physical properties. Results identified the hot spring waters as Ca–HCO_3 facies, exhibiting significantly elevated dissolved CO_2 concentrations compared to atmospheric levels. Geochemical simulations using PHREEQC predicted a maximum scaling potential of 582.2 mg/L, primarily comprising calcite, dolomite, and quartz, with minor precipitates including goethite and pyrolusite. Comparison of modeling predictions with observed scale buildup indicated actual mineral precipitation rates at approximately 50.4% of the calculated maximum, suggesting incomplete CO_2 degassing and kinetically limited reactions. Additionally, the degassing process could release up to 6,960 tons of CO_2 annually into the atmosphere, highlighting the geothermal system's role as a source of greenhouse gas emissions. The findings emphasize the importance of preventive measures, such as controlled depressurization and chemical pretreatment, to mitigate scale formation and maintain operational efficiency of geothermal extraction systems.

Keywords: Scaling, Degassing, Geochemical modeling, PHREEQC, Hot Springs

References: *CMUJ. Nat. Sci.* 20(3) (2021) 1-12 *Toxics* (submitted)

Funding Source(s): Chiang Mai University – Mid-career Research Grant



Optimal Placement and Capacity of BESS and PV in EV Integrated Distribution Systems: The Tenth Feeder of Phitsanulok Substation Case Study

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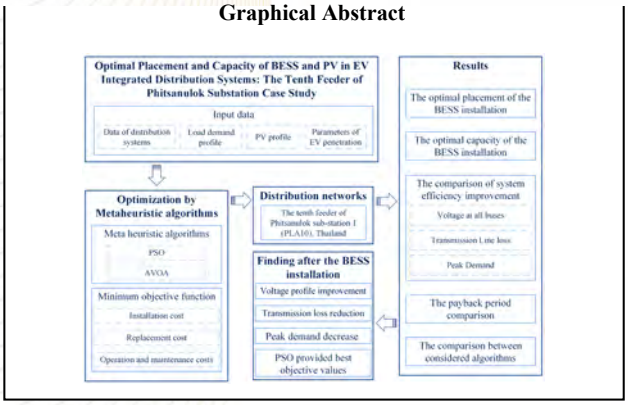
This work proposes a solution for determining the optimal placement and capacity of a BESS and photovoltaic (PV) in a distribution system by considering EV penetrations. The objective function is to reduce system costs, comprising installation, replacement, and operation and maintenance costs of the BESS and PV. The replacement cost is considered over 20 years, and the maintenance and operation costs incurred in the distribution system include transmission loss, voltage regulation, and peak demand costs. To solve the problem, two metaheuristic algorithms including particle swarm optimization (PSO) and the African vulture optimization algorithm (AVOA) are utilized. The tenth feeder of Phitsanulok sub-station 1 (PLA10), Thailand, is tested to evaluate the performance of the proposed approach. The results obtained from the considered algorithms are compared based on distribution system performance enhancement, payback period, and statistical analysis. It is found from the simulation results that the installation of the BESS and PV could significantly minimize system cost, improve the voltage profile, reduce transmission line loss, and decrease peak demand. The voltage deviation could be reduced by 86%, line loss was reduced by 0.78 MW, and peak demand could be decreased by 5.706 MW compared to the case without BESS and PV installations.

Keywords: African vultures optimization algorithm, battery energy storage systems, distribution systems, electric vehicles, particle swarm optimization

References: *Batteries* 10 (2024) page 212.

Funding Source(s): This research was supported by the CMU Junior Research Fellowship Program, grant number JRCMU2566R_049.

Graphical Abstract



CMU Annual Research Summit 2025

Oral Presentation



Digital & AI

Invited Speaker

ผศ.ดร.อักฤทธิ์ สังข์เพ็ชร
Director of CMKL University

ความร่วมมือเพื่อการพัฒนางานวิจัยและนวัตกรรม AI ในระดับนานาชาติ

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Toward Smart City with Opportunistic Wi-Fi Data: CMU campus case study

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This presentation demonstrates the potential of opportunistic Wi-Fi data in supporting smart city development, using Chiang Mai University (CMU) campus as a case study. Drawing on three interconnected studies, we show how passive Wi-Fi probe requests from mobile devices can be utilized to gain valuable insights into urban dynamics. The first study presents a framework for estimating real-time population density and crowd mobility patterns across the campus, offering a scalable approach for dynamic crowd monitoring. The second study investigates the relationship between space utilization and electricity consumption, revealing how occupancy patterns and mobility behaviors correlate with energy usage in campus buildings. The third study introduces a passive Wi-Fi-based positioning system that enables accurate indoor and outdoor human localization without requiring active user input. Collectively, these studies highlight how existing Wi-Fi infrastructure can be harnessed as a rich data source to support applications in mobility monitoring, facility management, and urban planning. The CMU campus serves as a living lab for exploring these possibilities, offering a practical model for smart city innovation through the integration of digital infrastructure and data analytics.

Keywords: urban informatics, opportunistic sensing, Wi-Fi data, remote sensing, smart city

References:
IEEE Access 11 (2023) 63351-63364.
IEEE Access 12 (2025) 105792-105802.

Funding Source(s): CMU Mid-Career Grant (R67IN00601)



A Smart Home DataBank: A Privacy-Preserving Solution for Smart Homes

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Sarit Theppitak[3], Kan Tippayamontri[1]

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Data collected from inter-connected smart home devices can enhance users' quality of life and safety and optimise energy consumption in households; however, it poses serious privacy concerns due to potential data breaches and unauthorised data access. This study proposes a privacy-preserving solution for a smart home environment to overcome these challenges. The proposed architecture supports data collection, management and sharing for users, developers and manufacturers of IoT devices in smart homes. Also, it improves the transparency in user privacy control and ensures compliance with privacy regulations such as the General Data Protection Regulation (GDPR) for the European Union (EU) and the Personal Data Protection Act (PDPA) for Thailand. We implemented a prototype and tested it with both non-technical and technical users. The result from the questionnaires shows that all participants reported successfully completing all tasks and noted that the proposed prototype, with its graph visualisation and user-friendly design, makes understanding the policy's scope easy. In the performance testing, over 90% of the participants were satisfied with the speed of setting up the privacy requirements through the designed tool. In the privacy-preserving test, 30% of participants admitted they typically do not read privacy agreements before accepting the use of any service. However, 60% of them felt reassured that the integrity and confidentiality of data are maintained. This is because the graphical tool clearly shows how their data is collected and shared, providing better transparency.

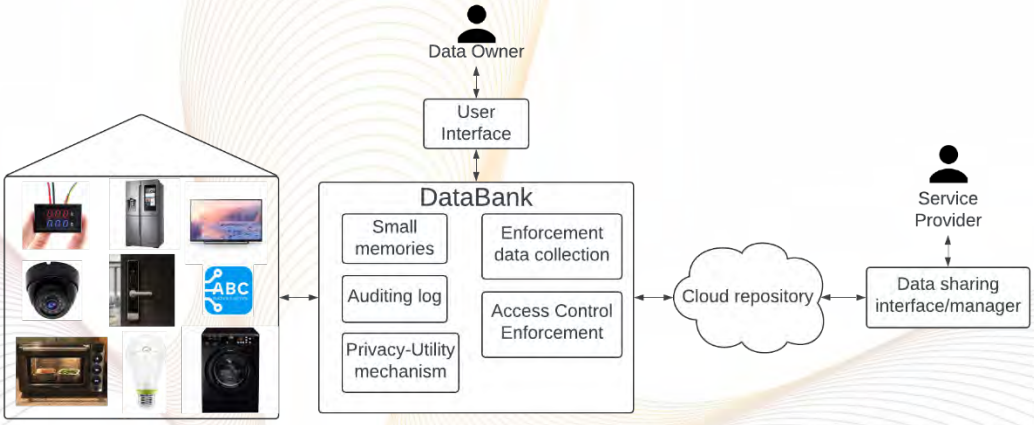
Keywords: Smart Home Policy, Privacy-Preserving Architecture, Default User-Centric Policy, Data Collection Control, Privacy.

References:

Chaichana, C., Fernández, M., Jaimunk, J., Theppitak, S., Tippayamontri, K. (2026). A Smart Home DataBank:. In: Miraz, M.H., Southall, G., Ali, M., Ware, A. (eds) Emerging Technologies in Computing. iCETiC 2024. Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering, vol 623. Springer, Cham. https://doi.org/10.1007/978-3-031-92625-9_14

J. Jaimunk, "The Analysis of Security Properties for Dynamic Privacy-Policy in Data Collection and Access Control," 30th International Conference on Systems Engineering (ICSEng 2023), Las Vegas, Nevada, USA August 22-24, 2023, Lecture Notes in Networks and Systems (LNNS), volume 761, Pages 175-182, Advances in Systems Engineering, Springer.

Funding Source(s): This research is supported by CMU Junior Research Fellowship Program.



Factory Logistics Improvement Challenges, Opportunities and Trends: A Case Study Analysis of Companies in Northern Thailand 2025

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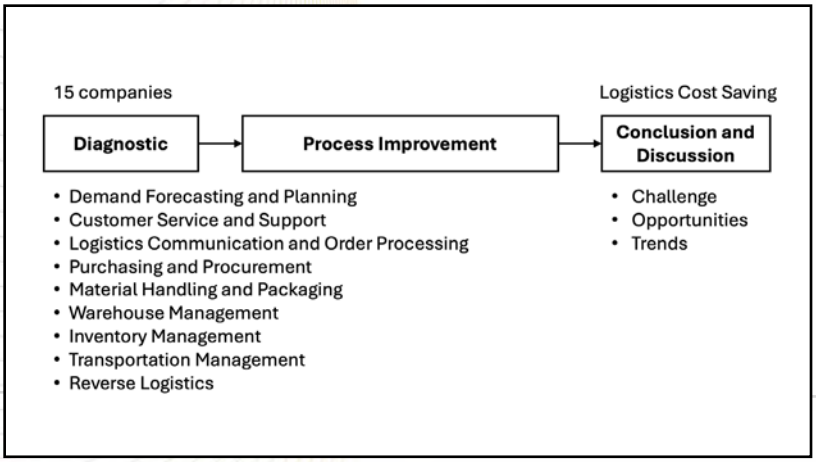
This study examines the challenges, opportunities, and trends in factory logistics improvement through a case study analysis of 15 companies in Northern Thailand during 2025. The research was conducted as part of a collaborative project between Chiang Mai University and the Department of Industrial Promotion, targeting companies across northern Thailand provinces. Through direct consultation and implementation of logistics management techniques, the study identified nine key logistics activities requiring improvement, ranging from demand forecasting and inventory management to warehouse operations and transportation. The research methodology involved hands-on collaboration with participating companies to diagnose logistics challenges and implement tailored solutions. Results demonstrate significant potential for logistics cost reduction, with participating companies achieving an average 30.83% decrease in overall logistics costs through process optimization and management improvements. The study reveals that Northern Thailand's manufacturing sector faces common logistics challenges including inefficient warehouse layouts, suboptimal inventory control, and transportation coordination issues. Key opportunities identified include technology adoption, supply chain integration, and sustainable logistics practices. These findings provide valuable insights for regional industrial development and logistics optimization strategies in emerging economies.

Keywords: Logistics and Supply Chain Optimization, Northern Thailand Manufacturing

References:

Ramingwong, Sakgasem, Apichat Sopadang, Korrakot Yaibuathet Tippayawong, and Jutamat Jintana. 2024. "Factory Logistics Improvement: A Case Study Analysis of Companies in Northern Thailand, 2022–2024", *Logistics 8*(3), 88.

Funding Source(s): Industrial Promotion Center Region 1, CM Smart Innovation Co.,Ltd.



Post Weld Heat Treatment Optimization of Dissimilar Friction Stir Welded AA2024-T3 and AA7075-T651 Electric Vehicle Components Using Machine Learning and Metaheuristics

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Post-weld heat treatment (PWHT) is widely implemented to improve the mechanical properties of welded materials. Several publications have investigated the effect of the PWHT process using experimental designs. However, the modeling and optimization using the integration of machine learning (ML) and metaheuristics have yet to be reported, which are fundamental steps toward intelligent manufacturing applications, especially for welding Electric Vehicle (EV) components. This research proposes a novel approach using ML techniques and metaheuristics to optimize PWHT process parameters. The goal is to determine the optimal PWHT parameters for both single and multiple objective perspectives. In this research, Support vector regression (SVR), K-nearest neighbors (KNN), decision tree (DT), and random forest (RF) were ML techniques employed to obtain relationship model between PWHT parameters and mechanical properties; ultimate tensile strength (UTS) and elongation percentage (EL). The results show that the SVR demonstrated superior performance among ML techniques for both UTS and EL models. Then, SVR is used with metaheuristics; differential evolution (DE), particle swarm optimization (PSO), and genetic algorithm (GA). SVR-PSO shows fastest convergence among other combinations. The final solutions of single-objective and the Pareto solutions were also suggested in this research.

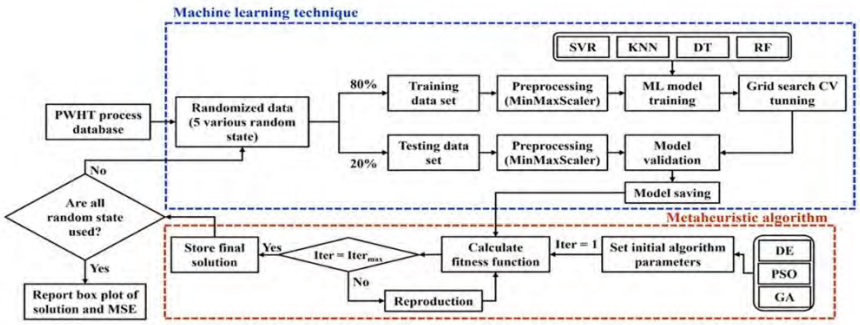
Keywords: electric vehicle, dissimilar friction stir welding, post weld heat treatment, machine learning, metaheuristics, process optimization

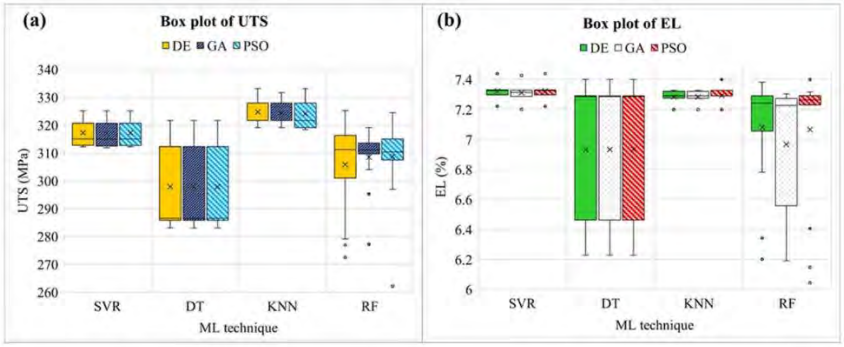
References:

Materials, Vol. 16 (2023), 2081.

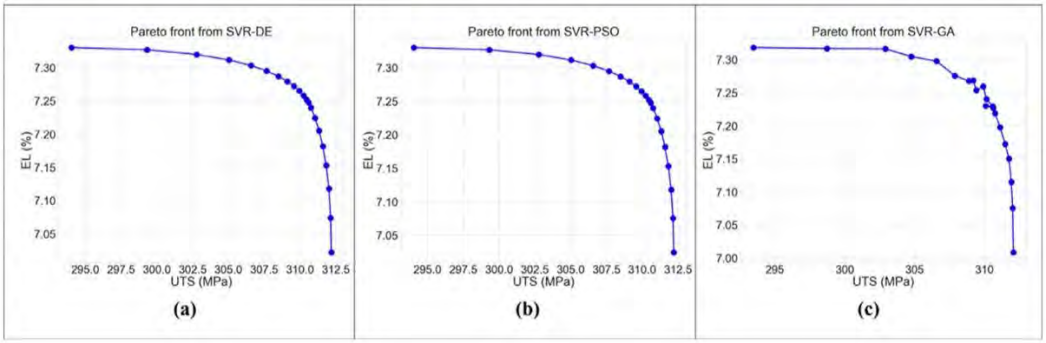
Funding Source(s): Targeted Research-2023 Chiang Mai University

Graphical Abstract





Objective	Algorithm	Optimal parameter				Predicted value
		A (hr)	B (°C)	C (hr)	D (°C)	
UTS (MPa)	SVR-DE	0.50	500.00	6.00	133.87	325.16
	SVR-PSO	0.50	500.00	6.00	133.87	325.16
	SVR-GA	0.50	499.91	6.02	133.78	325.10
EL (%)	SVR-DE	0.50	476.44	6.00	190.00	7.30
	SVR-PSO	0.50	476.43	6.00	190.00	7.30
	SVR-GA	0.51	475.85	6.00	189.81	7.30



AI laws in BRICS countries: A comparative analysis

Phillip Freiberg[1],* Parot Ratnapinda[2], Michael John Harris[3],
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[*]*E-mail: phillip.freiberg@cmu.ac.th*

This research investigates the evolving legal frameworks regulating artificial intelligence (AI) in three BRICS countries – Russia, India, and China – focusing on their convergence/divergence, and implications for Sustainable Development Goals (SDGs), particularly SDG 8 (Decent Work), SDG 10 (Reduced Inequalities), and SDG 11 (Sustainable Cities). The central research problem addresses the fragmented nature of AI governance in emerging economies and the lack of comparative legal analysis to inform harmonized, ethical, and effective AI regulation. Using a mixed-methods approach, the project conducts a systematic review of AI-related policies, legislative texts, and ethical guidelines in each country. This is complemented by semi-structured interviews with policymakers, legal scholars, and industry stakeholders to examine how de jure legal frameworks are applied in de facto contexts. Preliminary findings indicate divergent approaches in data governance, liability, and algorithmic ethics, but also reveal emerging commonalities such as a shared emphasis on data sovereignty. The project produces a comparative legal report, policy briefs, and academic outputs aimed at informing regulatory best practices. Conclusions emphasize the need for international dialogue, policy harmonization, and inclusive digital governance in the Global South. This research contributes to responsible AI development and offers a policy framework for future legal reform across BRICS and beyond.

Keywords: Artificial Intelligence Law, BRICS Countries, Comparative Legal Analysis, Data Governance, Sustainable Development Goals (SDGs)

References:

BRICS Brasil. Artificial Intelligence Governance in BRICS: Cooperation and Development for Social Inclusion. 3 (2024) 45–58.

Law.asia. Shape of China's AI Regulations and Prospects. 17 (2024) 91–105.

Funding Source(s): This research is funded by the ICDI Research Group Grant of the International College of Digital Innovation, CMU Fiscal Year 2025.


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8 DIFENT WORK ANY LCONONITY
10 REDUCTO INTOUNTTIES
11 SUSTAINABLE CHILL AND COMMONITIES

CMU
Annual Research Summit 2025

Oral Presentation



Materials Innovation

Invited Speakers

ดร.อดิสร เตือนตรานนท์ Thai Microelectronics Center (TMEC), National Science and Technology Development Agency (NSTDA)	Trend and Perspective on Semiconductor Industry and Workforce Development in Thailand
ดร.วัชชรินทร์ งามพึงพิศ สถาบันนวัตกรรม ปตท. บริษัท ปตท. จำกัด (มหาชน)	เทคโนโลยีไฮโดรเจนเพื่อการเปลี่ยนผ่านสู่พลังงานสะอาดของประเทศไทย
ดร.อธิวีณา กฤตยาวัฒนานนท์ สถาบันนวัตกรรม ปตท. บริษัท ปตท. จำกัด (มหาชน)	การจัดการซากแบตเตอรี่ลิเทียมไอออน: แนวทาง เทคโนโลยี และโอกาสทางเศรษฐกิจ

Unlocking sustainable energy storage with high-efficiency anodes from porous carbon, POPs, and MOFs in lithium-ion batteries

Natthawat Semakul[1,3], Saranphong Yimklan[1,3], Thanapat Autthawong[2,3], Yothin Chimupala[2,3], Thapanee Sarakonsri[1,3]*

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[2]*Department of Industrial Chemistry, Faculty of Science, Chiang Mai University, Thailand*
[3]*Materials Science Research Center, Faculty of Science, Chiang Mai University, Thailand*
[*]*E-mail: thapanee.s@cmu.ac.th*

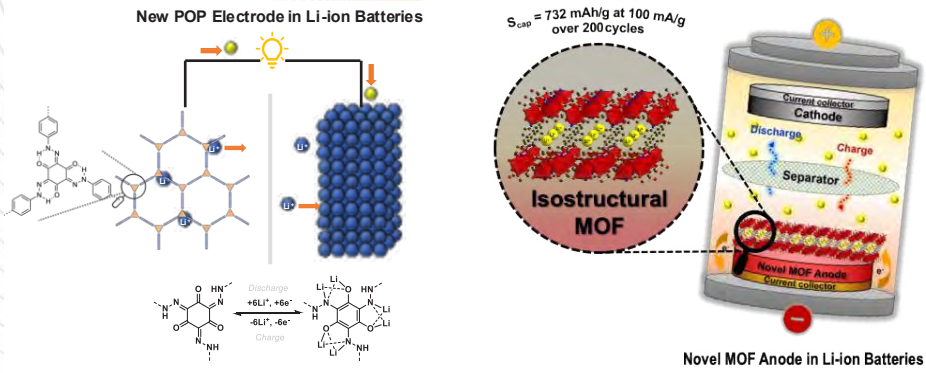
Batteries have long been essential for energy storage in various devices, with the anode material being a key factor in determining the efficiency of lithium-ion batteries (LIBs). This presentation focuses on the development of sustainable anode materials, including high-surface-area porous carbon, porous organic polymers (POPs), and metal-organic frameworks (MOFs), all derived from eco-friendly sources. High-surface-area porous carbon materials (>1500 m^2/g) were synthesized, demonstrating excellent electrochemical properties for energy storage. Porous Organic Polymers (POPs) synthesized via a simple azo coupling reaction demonstrated impressive reversible capacity, with POP-1, derived from *o*-tolidine and phloroglucinol, exhibiting superior cycling stability and high capacity. [1] Three MOFs (Mn, Co, and Zn) were synthesized using a rapid microwave-heating technique, with Co-MOF outperforming the others, achieving 732 mA h g^{-1} after 200 cycles. [2] These projects contribute to the development of high-performance, sustainable LIB anode materials with applications in electric vehicles and energy storage systems, advancing energy storage technologies and human resource development in this field.

Keywords: Lithium–ion Batteries, Anode Materials, Porous Carbon, Metal-Organic Frameworks, Porous Organic Polymers

References:

[1] *Chemical Engineering Journal*, 466 (2023) 143090.
[2] *Chemical Engineering Journal*, 482 (2024) 148904.

Funding Source(s): Fundamental Fund 2023, Chiang Mai University



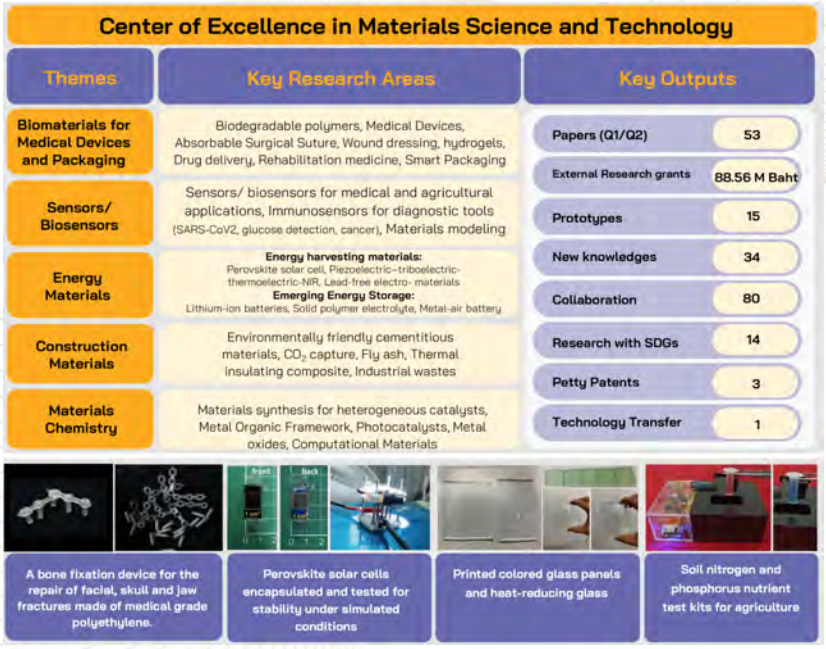
Center of excellence in materials science and technology

Chaiyasit Banjongpraser[1*], Puttinan Meepowpan[1], Jaroon Jakmunee[1], Thapanee Sarakornsri[1], Kedsarin Pimraksa[1], Saranphong Yimklan[1]
[1]*Materials Science Research Center, Faculty of Science, Chiang Mai University*
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The Center of Excellence in Materials Science and Technology conducts integrated research to advance cutting-edge knowledge and technologies across five key areas in line with the sustainable development goals (SDGs): (I) Biomaterials and Devices for Medical Use and Packaging focuses on biodegradable polymers for medical use, rehabilitation devices for stroke patients, and sustainable smart packaging, supporting both the medical and bioplastics industries. (II) Advanced Materials for Innovative Sensors and Biosensors develop sensor technologies for medical, agricultural, and environmental applications. (III) Energy Harvesting and Storage Materials targets high-performance energy solutions, including perovskite solar cells, thermoelectric and lead-free piezoelectric materials, lithium-ion batteries, and metal-air batteries. (IV) Environmentally Friendly Construction Materials explores sustainable cements and functional materials to reduce pollution and enhance building performance. (V) Materials Chemistry for Sustainable Technology and Catalysis integrates experimental and computational approaches to develop novel heterogeneous catalysts and high-performance adsorbents. To advance both academic and applied materials science, the center delivers innovative, practical solutions through a strong research ecosystem, including pilot plants that scale basic research into industrial applications.

Keywords: Biomaterials, Sensors and Biosensors, Energy Materials, Construction Materials, Materials Chemistry

Funding Source(s): Chiang Mai University (Grant No. R68IN00006)



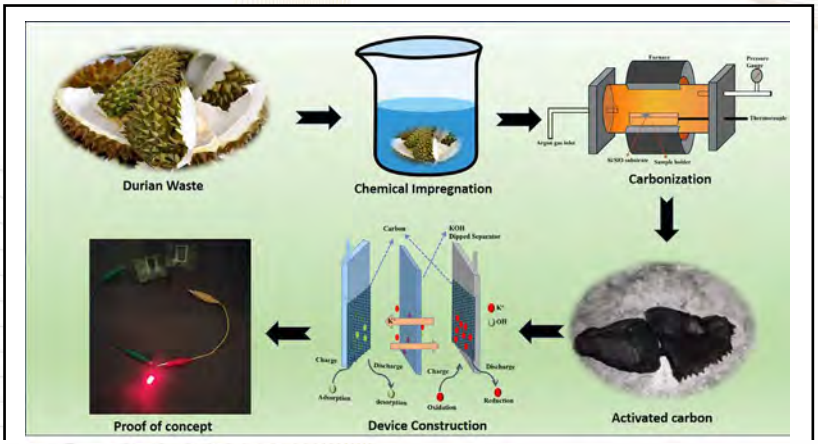
One-step activation of biomass-derived carbon for electrochemical energy storage applications

Siwakorn Chitpreecha[1], Uma Shankar Veerasamy[1], Sirikanya Loedsud[1], and Yuttana Mona[1,*]
[1] *Department of Mechanical Engineering, Faculty of Engineering, Chiang Mai University, 239, Huay Kaew Road, Muang District,Chiang Mai, 50200, Thailand,*
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Porous carbon materials are known for their excellent chemical and thermal stability, ease of synthesis, widespread availability, and large specific surface area. In this work, biomass obtained from durian waste was converted into activated carbon using a one-step thermal and chemical activation (different chemicals like KOH, NaOH, H_2SO_4 and H_3PO_4) process. The underwent raw biomass an impregnation step followed by high-temperature activation to develop porosity and enhance surface functionality. Also, the samples are denoted as DK, DN, DS and DP for KOH, NaOH, H_2SO_4 and H_3PO_4, respectively. These DK, DN, DS and DP activated carbon samples were thoroughly characterized in terms of their structural, morphological, and elemental features using standard analytical techniques. In addition, the DK, DN, DS and DP samples were utilized for the electrochemical testing to identify the capacitance values of the samples. While compare to the DK, the DN, DS and DP samples are showing lowest capacitance value and higher surface area. This indicates the KOH utilized activation process has more effective and higher porosity compare to other chemical activations. At the final, the DK electrode was utilized for practical demonstration to fabricate the symmetric capacitor device (DK as positive and negative electrode). The serially connected two DK devices are successfully glowing the LED light is the proof of the concept. From these results, the biomass derived activated carbon is suitable for energy storage applications.

Keywords: activated carbon, electrochemical, supercapacitor, capacitance, symmetric device

Funding Source(s): Supported by CMU Junior Research Fellowship Program



Electrochemical sensor and Lateral-flow Platforms for Ultralow AFP and AFP-L3 Screening at the Point of Care

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[a]*Research Laboratory for Analytical Instrument and Electrochemistry Innovation, Department of Chemistry, Faculty of Science, Chiang Mai University, Chiang Mai, 50200, Thailand*
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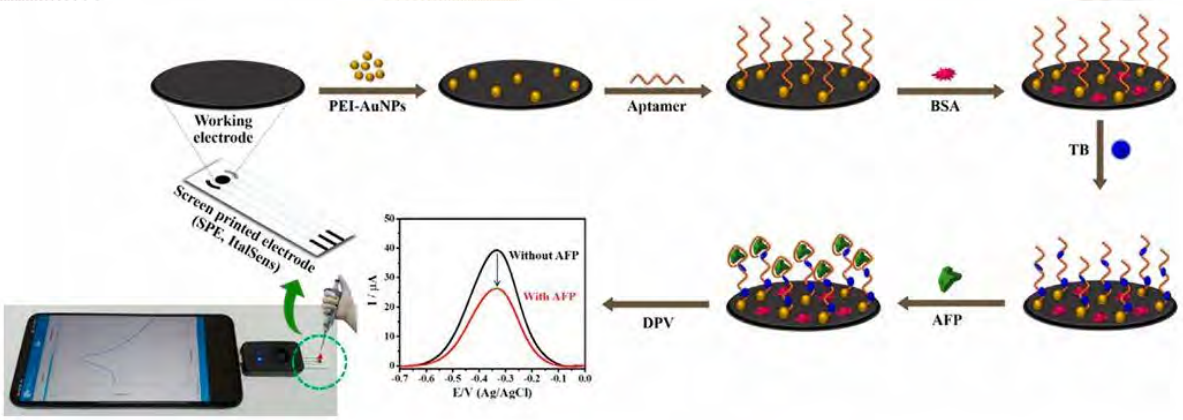
Early hepatocellular carcinoma (HCC) diagnosis relies on detecting α-fetoprotein (AFP) and its fucosylated isoform AFP-L3, yet both circulate at sub-ng mL^{-1} levels during initial disease stages. We introduce two complementary point-of-care sensors that meet this analytical challenge. (i) A label-free electrochemical aptasensor is built on a disposable ItalSens screen-printed carbon electrode successively modified with polyethyleneimine-coated Au nanoparticles (PEI-AuNPs) for enhanced surface area, an AFP-specific DNA aptamer for selectivity, bovine serum albumin for antifouling, and toluidine blue (TB) as a redox probe. AFP binding forms insulating AFP/aptamer complexes that attenuate the TB current, yielding a linear response from 10 to 50 000 pg mL^{-1} (R^2 = 0.9977) and a 9.5 pg mL^{-1} detection limit, read by a smartphone-linked Sensit/Smart potentiostat. (ii) A lectin-based lateral-flow assay employs Lens culinaris agglutinin (LCA) to capture AFP-L3 on the test line; Au-nanoparticle conjugates provide a green signal measured with a portable reader. The strip displays 1.5–160 ng mL^{-1} linearity, a 0.8 ng mL^{-1} LOD, and <9 % RSD in spiked serum within 10 min. Together, these rapid, low-cost tools potentially enable on-site HCC screening, therapy monitoring, and broader clinical deployment.

Keywords: Alpha-fetoprotein, Aptasensor, PEI-AuNPs, Fucosylated alpha-fetoprotein, Hepatocellular carcinoma, Lateral flow assay, Lectin

References:

Front. Bioeng. Biotechnol., 2023, 11:1182880. [doi: 10.3389/fbioe.2023.1182880]
J. Cell Biochem., 2023, 1–11. [doi:10.1002/jcb.30463]

Funding Source(s): Fundamental Fund 2023



Engineered cellular-targeted therapeutic nanocarriers for PM2.5 or pollutant related non-communicable diseases

Farathan Pikwong[1,2], Jiraporn Kamsarn[1,2], Wattanased Jarisarapurin[1,2,3], Phornsawat Baipaywad[1,2], Hansoo Park[4], Sarawut Kumphune[1,2,*]

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Cardiomyopathies, which contribute to heart failure, represent a significant cause of mortality globally. A proficient administration of pharmaceuticals aims to improve therapeutic outcomes while reducing adverse effects. Nanoparticles (NPs) are utilized for the delivery of therapeutic agents and demonstrate potential in reducing cardiac ischemia/reperfusion injury. However, significant limitations of nanoparticles include nonspecific targeting and immunogenicity. Cardiac cell membrane (cCM) coatings on nanoparticles (NPs) have been suggested as a method to improve cardiac targeting and biocompatibility. cCM was extracted from the human ventricular cell line AC16, and mesoporous silica nanoparticles (MSNs) were synthesized and subsequently coated with cCM. The cardiac cell membrane-coated mesoporous silica nanoparticle (cCMCMSN) did not significantly influence the encapsulation efficiency or the release profile of the loaded drug (Rhodamine B, RhB) compared to MSN. Additionally, cCMCMSN demonstrated a significantly enhanced distribution of RhB specifically to cardiac cells, unlike other cell types, while not causing cytotoxicity. To evaluate immune evasion, cCMCMSN were exposed to activated macrophages, demonstrating that cCMCMSN were phagocytosed to a lesser extent than MSN. This study demonstrated the fabrication of cardiac cell membranes attached to MSNs, showcasing nanomedicine technologies that enhance targeted drug delivery to cardiac cells, potentially offering an alternative method for medication administration in cardiovascular diseases.

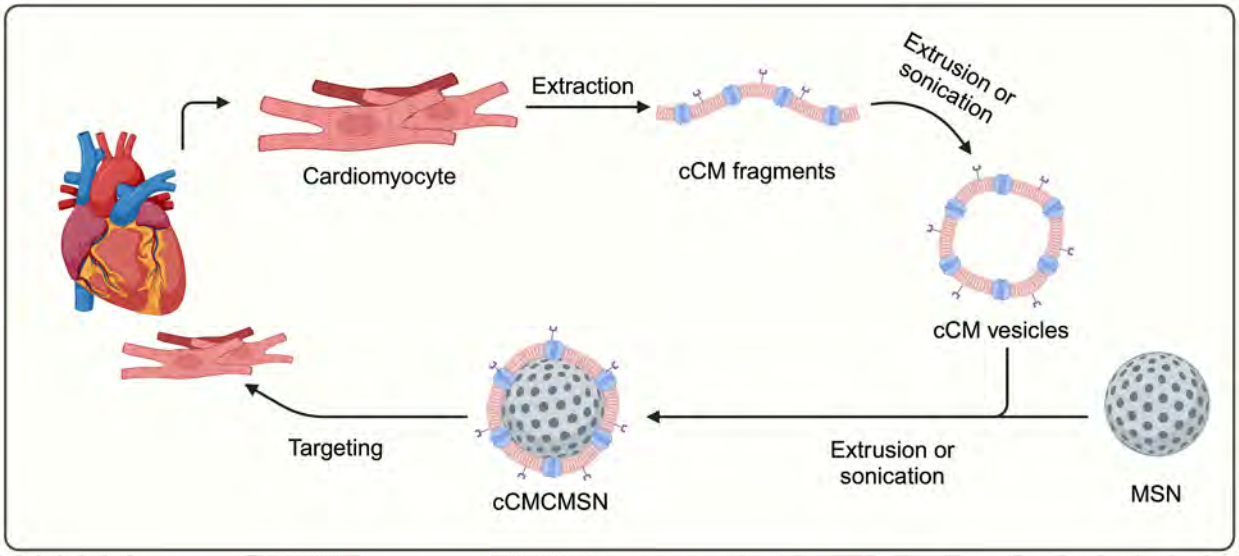
Keywords: targeted drug delivery, cardiovascular diseases, nanoparticles, cardiac cells, cell mem-brane-coated nanoparticles, mesoporous silica nanoparticle

References:

Biomimetics. 2025; 10, 141-158

Funding Source(s): The present study was supported by Chiang Mai University Targeted Research and Chiang Mai University endowment fund through Biomedical Engineering and Innovation Research Centre Chiang Mai University for SK, and CMU Presidential Scholarship for FP, J.K. This project is funded by the National Research Council of Thailand (NRCT): High-Potential Research Team Grant Program Contract no. N42A650870, National Research Council of Thailand (NRCT) via NRCT-NRF visiting grant 2024 (N11E670069) for SK

Graphical Abstract (Compulsory)



Innovative $PM_{2.5}$ sampling and direct $PM_{2.5}$ exposure via an ALI culture system: assessing air pollution toxicity during Chiang Mai haze

Phornsawat Baipaywad[1,2], Pathinan Paengnakorn[1,2], Nipapon Ngoyteja[1,2], Chakrit Wiboonsuntharangkoon[1,2,3], Pakorn Sangngam[1,2], Kritsana Kanthasap[1,2], Ritipong Wongkhuenkaew[1,2,3], Sarawut Kumphune[1,2], Sansanee Auephanwiriyakul[1,2], Suruk Udomsom[1,2,3], Nipon Theera-Umpon[1,2,*]

[1]*Biomedical Engineering Institute, Chiang Mai University, Chiang Mai 50200, Thailand*
[2]*Biomedical Engineering and Innovation Research Center, Chiang Mai University, Chiang Mai, 50200 Thailand*
[3]*Office of Research Administration, Chiang Mai University, Chiang Mai 50200, Thailand*
[*]*E-mail: nipon.t@cmu.ac.th*

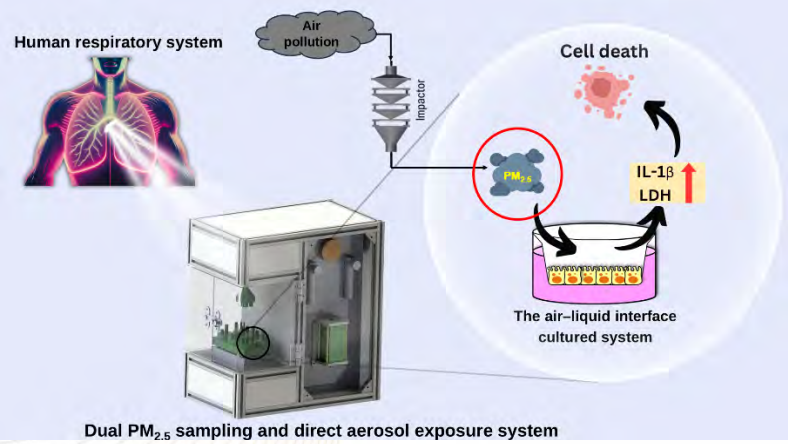
Ambient air pollution is linked to multiple noncommunicable diseases and significantly impacts the respiratory system. This study developed a dual system combining $PM_{2.5}$ sampling with direct exposure of air–liquid interface-cultured human respiratory cells. The exposure chamber was designed to mimic the physiology of the human respiratory tract and inhalation. Using PM2.5 samples collected during the haze season in Chiang Mai, the system was employed to assess cytotoxic and proinflammatory responses in A549 and BEAS-2B cell lines. The results demonstrated that direct $PM_{2.5}$ exposure induced cell toxicity and cytokine release, highlighting biological risks relevant to local air pollution events. This dual system offers a promising in vitro model for directly evaluating the cellular impacts of ambient air pollution and may serve as a valuable tool for toxicological and environmental health studies.

Keywords: air pollution, particulate toxicity, air-liquid interface culture, inflammatory response, pulmonary cell culture

References:

Environmental Pollution, Volume 367 (2025), 125606

Funding Source(s): Fundamental Fund 2023 (FF66/047), Chiang Mai University



Dual $PM_{2.5}$ sampling and direct aerosol exposure system

Tryptophan-derived polynorbornene–multiwalled carbon nanotube fluorescent chemosensor

Sutthira Sutthasupa[1,*], Sirilak Wangngae[1,2], Theerada Khunpiluek[1], Sukanya Thisan[3], Wattanased Jarisarapurin[2,3], Sarawut Kumphune[3], Weerawut Chaiwat[4]

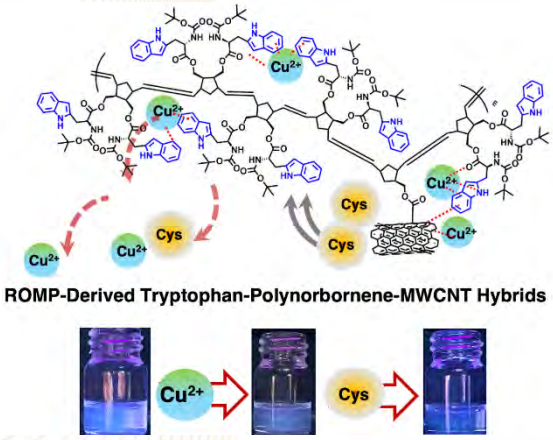
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Polymer–carbon nanotube hybrid materials were developed through ring-opening metathesis polymerization (ROMP) using a tryptophan-based polynorbornene and norbornene-modified multi-walled carbon nanotubes (MWCNTs) in the presence of a Grubbs M31 catalyst. The successful copolymerization and structural integrity of the resulting hybrids were confirmed by proton nuclear magnetic resonance (^{1}H NMR) spectroscopy, transmission electron microscopy (TEM), thermogravimetric analysis (TGA), and Raman spectroscopy. These hybrid materials acted as fluorescent chemosensors, showing efficient quenching responses toward Cu^{2+}, Fe^{3+}, Pb^{2+}, and Zn^{2+} ions, with the MWCNTs contributing to enhanced metal ion binding. The hybrids demonstrated detection limits between 16.23 and 47.40 µM for Cu^{2+} and Fe^{3+}, and selective fluorescence recovery was observed with cysteine (Cys) compared to homocysteine and glutathione. Their sensing performance was further validated in human serum, confirming their applicability in complex biological environments. Cytotoxicity and cellular uptake assays indicated good biocompatibility, highlighting the potential for safe in vivo applications. Overall, these findings underscore the promise of ROMP-derived polymer–nanotube hybrids for use in biomedical diagnostics and environmental monitoring.

Keywords: ROMP, tryptophan, MWCNTs, polymer nanocomposites, fluorescent chemosensor

Funding Source(s): This research was financially supported by Targeted Research (TGCMU2566P035/ 2566), Chiang Mai University



The development of gas-sensing prototypes for volatile sulfide compounds detections for preliminary assessment of periodontitis stages in elderly patients

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The research framework includes both the process of material production and the fabrication of gas-sensing prototypes that can specifically detect gases of volatile sulfur compounds (VSCs) via exhaled breath. This will assist dentists in the preliminary assessment of periodontitis stages in elderly patients. Based on preliminary hypotheses derived from research evidence, the measurement of concentration rates in the VSCs group, primarily released from the oral cavity of the elderly populations, was often found at higher rates compared to young populations [1,2]. It significantly correlates with the assessment of initial periodontitis lesions, which has led to the idea of developing gas-sensing prototypes with highly sensitive and selective detection of VSCs. This device aims to calibrate the measured values in significant correlation with the diagnostic historical patients, believing it can indicate the level of lesion occurrence. The fabricated prototype is designed to operate and display multiple functions simultaneously, including qualitative and quantitative measurements. From the experimental results, it was effectively found that the selective catalyst-functionalized metal oxides exhibited highly selective response to VSCs, which can be used to design the gas-sensing prototypes for specific detection via exhaled breath with specificity, reliability, accuracy, and effectiveness, which beneficial for practical use in elderly population.

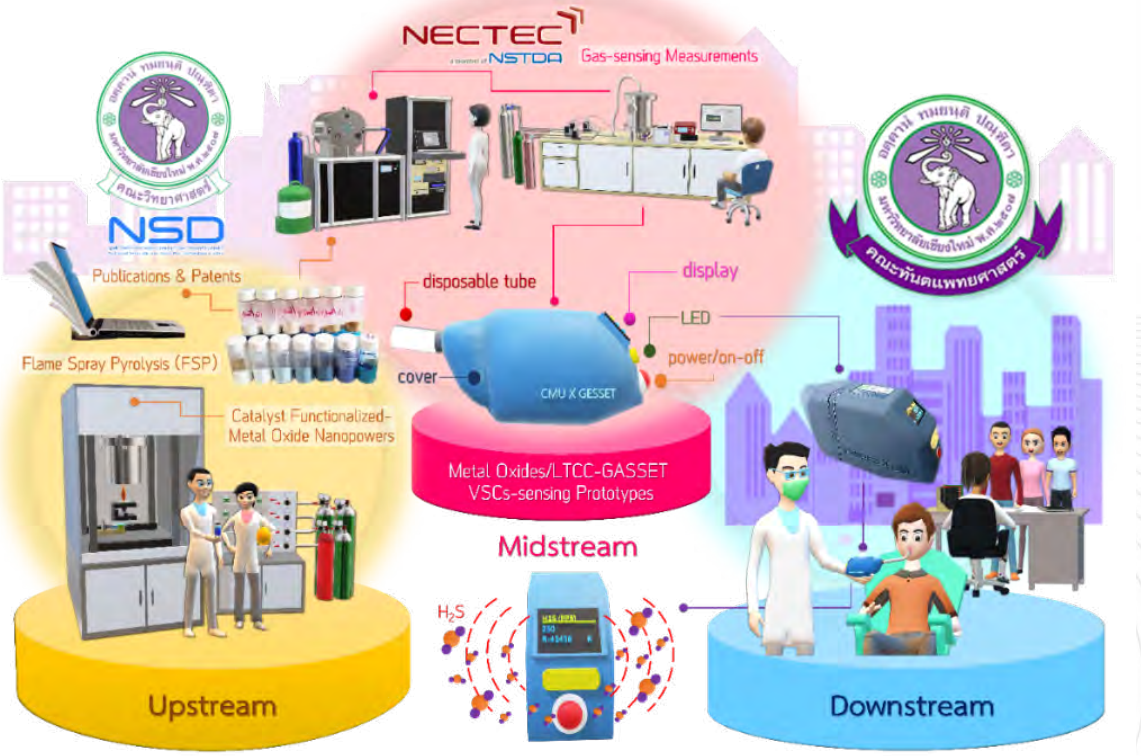
Keywords: Gas-sensing prototypes, VSCs detections, periodontitis stages, elderly patients

References:

[1] *International Dental Journal* 54 (2004) 149-153.
[2] *Journal of Periodontology* 83 (2012) 635-643.

Funding Source: Targeted Research Grant 2023-2025 supported by Chiang Mai University

Graphical Abstract



Development of electrochemical biosensor based on conducting polymers for detection of targeted biomolecules

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In this work, a label-free electrochemical dopamine (DA) biosensor based on polyaniline (PANI) and its aminated derivative, i.e., poly(3-aminobenzylamine) (PABA), composited with functionalized multi-walled carbon nanotubes (f-CNTs), was developed to utilize a conducting polymer as a transducing material. The electrospun nanofibers of the composites were fabricated on the surface of fluorine-doped tin oxide (FTO)-coated glass substrate under the optimized condition. The PANI/f-CNTs and PABA/f-CNTs electrospun nanofibers were characterized by ATR-FTIR spectroscopy, XPS, SEM and TEM, which confirmed the existence of f-CNTs in the composites. The electroactivity of the electrospun nanofibers was investigated in phosphate buffer saline solution using cyclic voltammetry (CV) before being employed for label-free electrochemical detection of DA using differential pulse voltammetry (DPV). The sensing performances including sensitivity, selectivity, stability, repeatability and reproducibility of the fabricated electrospun nanofiber films were also electrochemically evaluated. The obtained electrochemical DA biosensor exhibited a sensitivity of 6.88 $\mu A \cdot cm^{-2} \cdot \mu M^{-1}$ and 7.27 $\mu A \cdot cm^{-2} \cdot \mu M^{-1}$ in the linear range of 50–500 nM ($R^2 = 0.98$) with a limit of detection (LOD) of 0.0974 µM and 0.1554 µM, respectively. The DA biosensor showed great stability, repeatability and reproducibility with precious selectivity under the common interferences, i.e., glucose, ascorbic acid and uric acid.

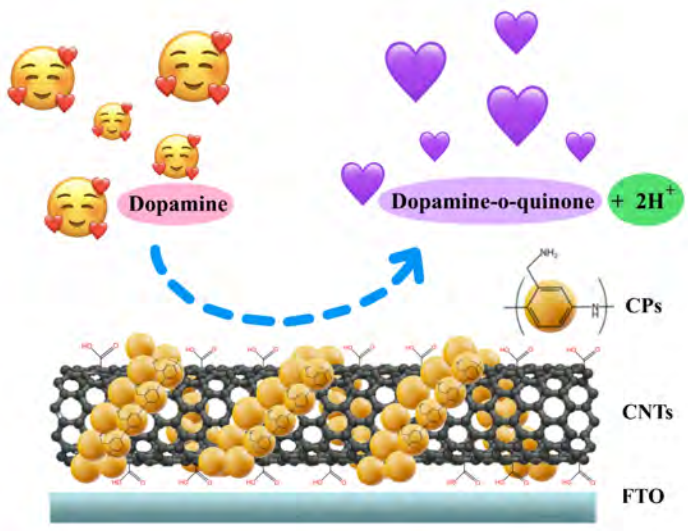
Keywords: Biosensor, Conducting Polymer, Biomolecules, Dopamine, Uric Acid

References:

1. *Biosensors* (2024) 14:349.
2. *Polymers* (2021) 13:1488.

Funding Source(s): CMU Mid-Career Research Fellowship program of Chiang Mai University

Graphical Abstract (Compulsory)



The Center of Radiation Research and Medical Imaging (CRMI)

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The Center of Radiation Research and Medical Imaging (CRMI), under the Faculty of Associated Medical Sciences at Chiang Mai University, is a multidisciplinary research hub dedicated to advancing radiation science and practical application in medicine and health sciences. The center conducts leading-edge research in developing novel scintillators and luminescent materials such as rare-earth-doped glasses and crystals for medical radiation detectors and high-resolution imaging systems. It also focuses on designing and optimizing medical X-ray imaging technologies to enhance image quality while minimizing patient exposure. In the field of nuclear medicine, CRMI contributes to the advancement of radiopharmaceutical applications and image-guided diagnostics. Radiation dosimetry research supports precise measurement of radiation doses for patients and medical personnel, ensuring compliance with safety standards and improving treatment accuracy in radiotherapy. The center also explores the development of advanced radiation shielding materials, including lightweight and lead-free composites, to strengthen the protection in clinical and industrial environments. Through interdisciplinary collaborations, both nationally and internationally, CRMI bridges fundamental research with clinical practice, fostering translational innovations. The center plays a key role in academic capacity building by mentoring graduate students, training researchers, and publishing in high-impact journals. Ultimately, CRMI significantly contributes to the progress of medical physics, radiologic technology, and sustainable innovations in healthcare.

Keywords: Radiation research, medical imaging, scintillators, luminescent materials, rare-earth doping, X-ray imaging, radiopharmaceuticals, dosimetry, radiation shielding, medical physics, radiologic technology, translational research, healthcare innovation.

References:

Radiation Physics and Chemistry 237 (2025) 113112.

Funding Source: This research was partially supported by Chiang Mai University.



Smart packaging innovation from bio-based materials

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This research aimed to develop intelligent and active packaging from biodegradable materials. A time-temperature indicator was developed using polyvinyl alcohol (PVOH), polydiacetylene (PDCA), and metal oxide nanoparticles, while an oxygen indicator was prepared using carboxymethyl cellulose (CMC), natural extracts, and metal nanoparticles. A pH indicator was developed using hybrid polymer gel and carbon nanotubes. Biodegradable packaging was developed from modified thermoplastic cassava starch (MTPS), chlorhexidine gluconate (Ch), glycerol, and epoxy) and polybutylene succinate (PBS) with high mechanical properties, antibacterial, and antifungal properties. An ethanol emitter for active bakery packaging application was developed from biopolymer using bead technology, which presented excellent antimicrobial agents and extended the shelf life of bread. In the second year, the focus shifted to real testing and optimization. The chemically modified surface of cellulose nanofibers for PHMB loading were found to achieve high porosity, good mechanical properties, appropriate gel content, and good maximum swelling degree. The ethanol emitter was developed from biopolymer blending with antimicrobial agents using bead technology with the inhibition of *Rhizopus spp*. and extending the shelf life of bread. Calcium oxide (CaO) was synthesized using a facile technique for application in antibacterial films, which presented an excellent antimicrobial agent for active packaging applications.

Keywords: Sustainable packaging, active packaging, biodegradable materials, nanotechnology, intelligent indicators, food packaging

Funding Source(s): The Fundamental Fund 2023−2024, Chiang Mai University.

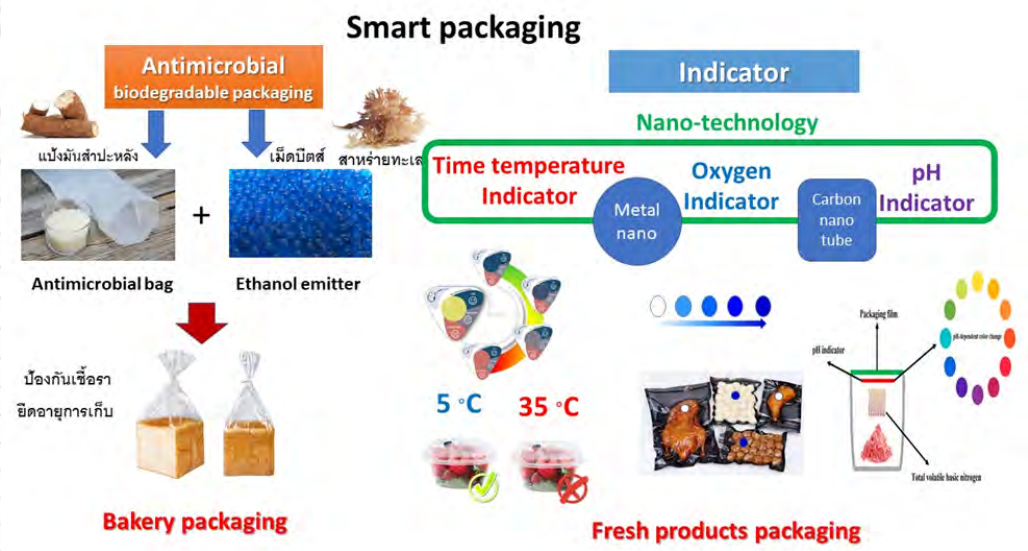


Figure 1 project diagram

Design of metamaterials using a topology optimization approach for sustainable design and manufacturing

Pana Suttakul[1,*], Thongchai Fongsamootr[1], Yuttana Mona[1]
[1]*Department of Mechanical Engineering, Faculty of Engineering, Chiang Mai University, Chiang Mai, Thailand*
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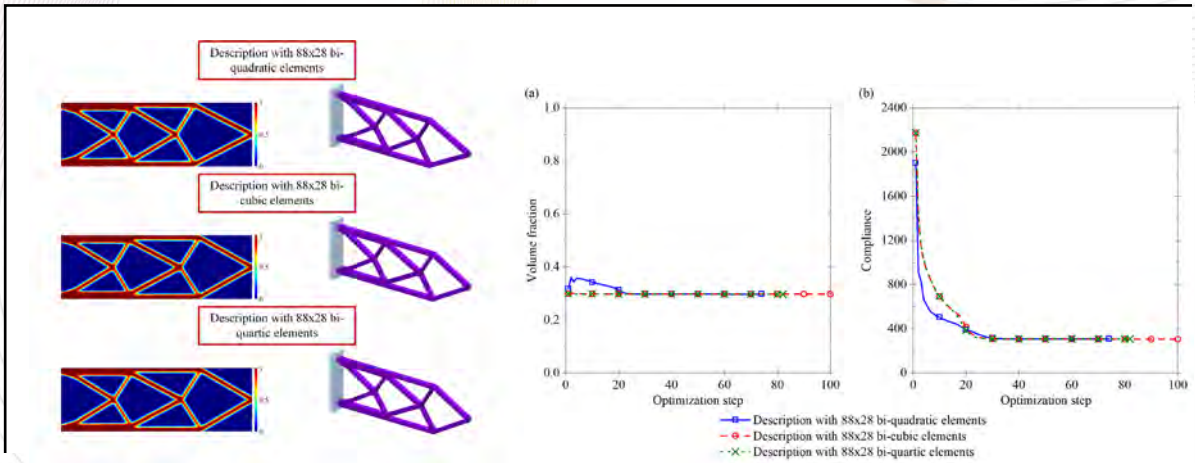
This study presents the incorporation of the effective gradient-free proportional topology optimization algorithm into the framework of isogeometric analysis. The minimization of the compliance is considered, and the solid isotropic material with penalization method is used. The geometry, displacements, and density are all described by non-uniform rational B-spline (NURBS) basis functions. The density at an integration point is determined proportionally to its compliance. Then, the NURBS description of the density is constructed elementwise by deriving a relation between densities assigned to integration points and control points. The global NURBS description of the density for the whole domain is a blend of those from elements. Furthermore, a multiresolution scheme is presented by means of k-refinement technique to enable the efficient performance for large-scale problems. The accuracy and efficiency of the proposed approach are assessed through three numerical examples of two-dimensional structures, with several rigorous tests and comparisons with the gradient-based optimality criteria algorithm.

Keywords: Topology optimization, isogeometric, multiresolution, NURBS basis functions

References:

[1] *European Journal of Mechanics - A/Solids* 89 (2021) 104280.
[2] *Computer Methods in Applied Mechanics and Engineering* 380 (2021) 113808.

Funding Source(s): The CMU Junior Research Fellowship Program, Chiang Mai University, Thailand.



A novel material for radiation detection applications of zinc bismuth lithium boro-tellurite glass doped with Dy_2O_3

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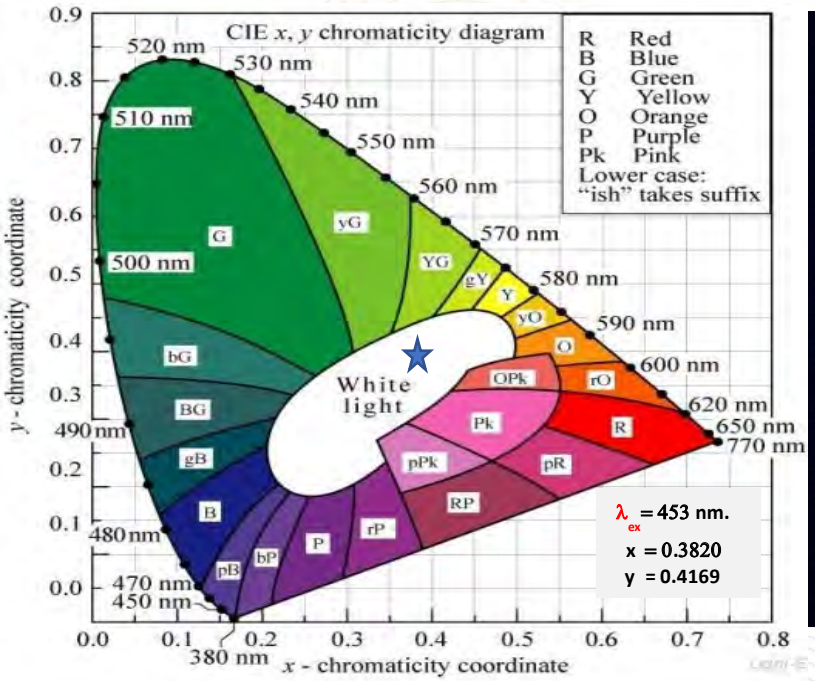
[*]*Email: Siriprapa.k@cmu.ac.th*

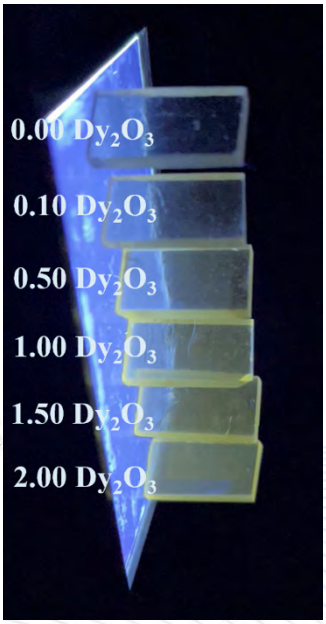
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Radiation detection glass with the following chemical composition B2O3-TeO2-Li2O3-Bi2O3-ZnO doped with Dy2O3 where x = 0.00, 0.10, 0.50, 1.00, 1.50 and 2.00 mol% was developed for characterization on physical; density, molar volume (Vm), and refractive index, optical, luminescence, CIE's diagram, and radiation detection properties. The density and refractive index of glass samples increases with the increase of Dy2O3 composition. The optical property of glass shows eight strongest peaks from $^6H_{15/2}$ centering at 263 nm ($^4I13/2$ + $4F_{7/2}$), 298 nm ($^4G1_{1/2}$), 357 nm ($4I_{15/2}$), 803 nm ($^6F_{5/2}$), 897 nm ($^6F_{7/2}$), 1090 nm ($^6H_{7/2}$ + $^6F_{9/2}$), 1272 nm ($^6F_{11/2}$ + $^6H_{9/2}$) and 1671 nm ($^6H_{11/2}$) respectively. The emission peaks under excited at 453 nm from 4F9/2 centering at 481 nm ($^6H_{15/2}$), 575 nm ($^6H_{13/2}$), 664 nm ($^6H_{11/2}$) and 751 nm ($^6H_{9/2}$) respectively. The excitation peaks under emission at 575 nm from 6H15/2 centering at 350 nm ($^6P_{7/2}$), 365 nm ($^4P_{3/2}$), 388 nm ($^4K_{17/2}$), 425 nm ($^4G_{11/2}$), 453 nm ($^4I_{15/2}$) and 471 nm ($^4F_{9/2}$) respectively. The study of luminescence characteristics, which include emission, excitation, and CIE diagrams, reveals white emission bands that coincide with the CIE diagram. Furthermore, measuring the parameters of the thermoluminescence dosimeter (TLD) recorded with a heating rate of 5◦C/s in the temperature up to maximum of 400 ◦C yields good results in low dose radiation detection. Based on all the results, it was determined that this glass can be candidates for radiation detection materials in the future.

Keyword: boro-tellurite glass, radiation detection, luminescence, thermoluminescence dosimeter, TLDs

Funding Source(s): S. Kaewjaeng would like to thank CMU Mid-Career Research Fellowship Program.


CIE x, y chromaticity diagram
R Red
B Blue
G Green
Y Yellow
O Orange
P Purple
Pk Pink
Lower case:
"ish" takes suffix
520 nm
530 nm
540 nm
550 nm
560 nm
570 nm
580 nm
590 nm
600 nm
620 nm
650 nm
770 nm
510 nm
500 nm
490 nm
480 nm
470 nm
450 nm
380 nm
G
yG
YG
gY
Y
yO
O
rO
R
OPk
Pk
pPk
pR
RP
rP
P
bP
pB
B
gB
BG
bG
White light
λex = 453 nm.
x = 0.3820
y = 0.4169
y - chromaticity coordinate
x - chromaticity coordinate
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9


0.00 Dy_2O_3
0.10 Dy_2O_3
0.50 Dy_2O_3
1.00 Dy_2O_3
1.50 Dy_2O_3
2.00 Dy_2O_3

Selectivity towards methyl mercaptan of Pt-PtO functionalized WO_3 nanostructures made by flame spray pyrolysis

Kanittha Inyawilert[1,2], Matawee Punginsang[1,2], Chonlada Dechakiatkrai Theerakarunwong[3], Anurat Wisitsoraat[4], Chaikarn Liewhirana[1,*]

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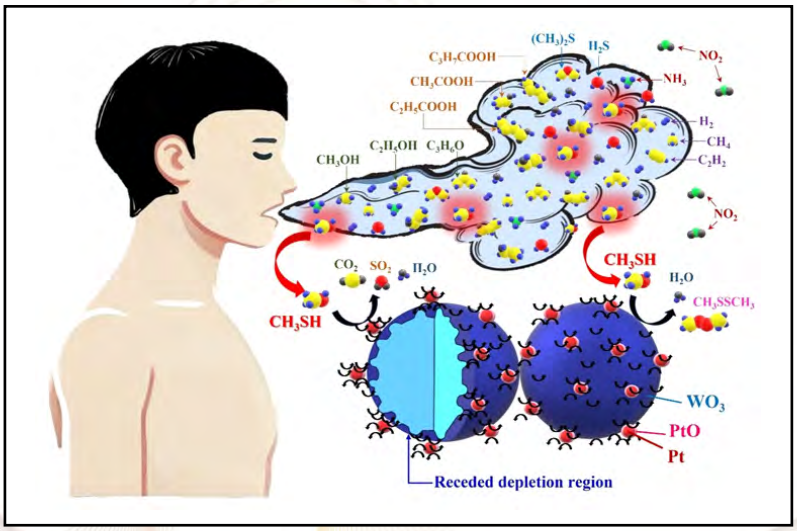
Research studies on gas sensors for breath analysis can make significant contributions to the fields of medicine and healthcare. Methyl mercaptan, a volatile sulfur compound, is a marker associated with Halitosis and Periodontal diseases, which are contionally diagnosed by smelling to evaluate dental hygiene in clinical dentistry. CH_3SH gas sensors are needed for dental disease diagnosis and environmental monitoring. This work presented 0–1 wt% Pt-PtO functionalized WO_3 nanostructures synthesized by flame spray pyrolysis for methyl mercaptan-sensing applications. According to electron microscopic and X-ray spectroscopic analysis, 1–3 nm Pt-PtO core-shell nanoparticles were decorated on 5–20 nm primary monoclinic WO_3 nanoparticles. The gas-sensing data revealed that Pt-PtO loading with an optimum Pt content of 0.5 wt% provided a remarkably enhanced CH_3SH response of 204 to 500 ppb CH_3SH at the best sensing temperature of 250 °C with a low detection limit of 26 ppb and high CH_3SH selectivity relative to $(CH_3)_2S$, H_2S, CH_3OH, C_2H_5OH, C_3H_6O, NH_3, NO_2, H_2, CH_4, C_2H_2 and short-chain fatty acids including CH_3COOH, C_2H_5COOH, C_3H_7COOH. Therefore, the flame-synthesized Pt-PtO functionalized WO_3 nanosensors could be potential for CH_3SH detection at ppb levels in the medical applications particularly noninvasive breath diagnosis of halitosis and serious infection of periodontitis.

Keywords: Pt-PtO functionalized WO_3, methyl mercaptan (CH_3SH), gas sensor, flame spray pyrolysis (FSP), halitosis and periodontal diagnosis

References:

J. Chromatography. B. 853 (2007) 54-61.
J. Breath. Res. 4 (2010) 017003.

Funding Source(s): CMU Junior Research Fellowship Program (JRCMU2566R-088), Office of Research Administration, Chiang Mai University.



Flame-synthesized Pt-PtO functionalized WO_3 nanosensors could be potential for selective CH_3SH detection at ppb levels for noninvasive breath diagnosis of halitosis and periodontitis.

Durable & transparent superhydrophobic coatings: a novel approach for future automotive industrial applications

Taksana Sreejun[1,2], Nidchamon Jumrus[1,3], Arisara Panthawan[1,3], Manikandan Maruthappan[1,3], Tewasin Kumpika[1], Wattikon Sroila[1], Ekkapong Kantarak[1], Niwat Jhuntama[4], Pisith Singjai[1], Wiradej Thongsuwan[1,*]

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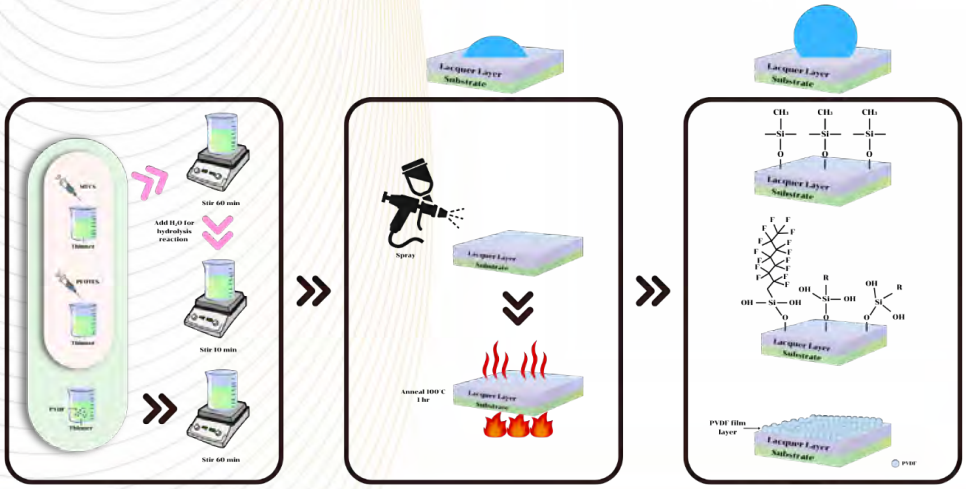
In previous work, methyltrichlorosilane (MTCS)-modified SiO_2-TiO_2 nanoparticles (NPs) were successfully applied onto a wet lacquer layer using a simple spraying technique. This method proved to be scalable and cost-effective for fabricating durable, self-cleaning surfaces. The resulting coating exhibited superhydrophobicity with good mechanical durability. However, the incorporation of nanoparticles significantly reduced the optical transparency of the coating. To address this limitation, a new approach was developed by modifying the lacquer surface using MTCS, perfluorooctyltrichlorosilane (PFOTES), and polyvinylidene fluoride (PVDF). The effects of MTCS and PFOTES (each at 1% v/v) and PVDF (at 1% w/v in thinner solution), with a reaction time of 60 minutes, were investigated in terms of surface morphology and wettability. The water contact angle (WCA) of PFOTES-coated surfaces increased from below 90° to 114°, indicating a significant enhancement in hydrophobicity. Furthermore, PVDF coatings annealed at 100 °C exhibited higher light transmittance than non-annealed samples, highlighting the importance of thermal treatment in preserving transparency. Overall, the developed coating offers a promising solution for achieving transparent, robust, and hydrophobic surfaces, making it well-suited for industrial coating applications.

Keywords: Hydrophobic, lacquer, MTCS, PFOTES, PVDF

Reference:

Applied Surface Science 680 (2025) 161444.

Funding Source(s): CMU Mid-Career Research Fellowship program, Chiang Mai University, Chiang Mai, Thailand.



Integrated morphological and mechanical characterization of deteriorated railway ballast for sustainable reuse

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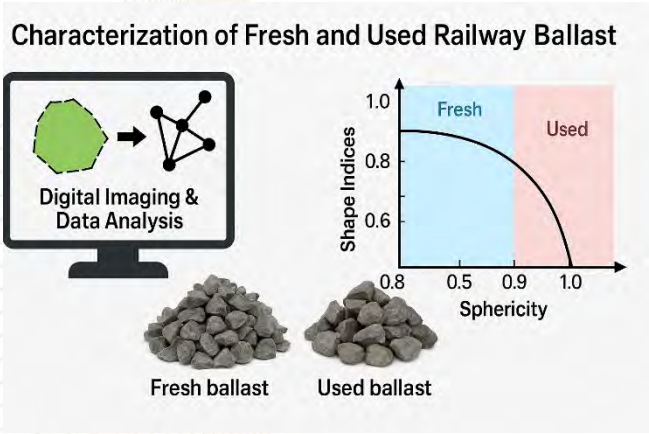
With the increasing scarcity of high-quality fresh ballast, sustainable railway track maintenance practices require a better understanding of the properties of deteriorated (used) ballast. This study combines advanced morphological and mechanical analyses of both fresh and used ballast to evaluate their potential for reuse. The used ballast was produced through extended Los Angeles abrasion (LAA) tests, aiming for a fouling index above 40%. Three-dimensional scanning and image processing were employed to extract shape descriptors, including flatness, elongation, sphericity, and convexity, revealing consistent morphological differences between fresh and used samples. Meanwhile, discrete element modeling (DEM) with 2D polygonal grain shapes derived from imaging analysis was employed to simulate mechanical behavior under bi-axial loading. Results indicated that while both fresh and used ballast assemblies showed similar stress-strain responses at peak, the fresh ballast exhibited slightly higher residual shear strength and force anisotropy. These findings suggest that some used ballast can maintain mechanical adequacy and be selectively reused, reducing material demand and environmental impact.

Keywords: Ballast morphology, Used ballast, DEM simulation, Shape indices, Sustainable railway

References

Case Studies in Construction Materials, Volume 19, 2023, e02272, ISSN 2214-5095
Construction and Building Materials, Volume 420, 2024, 135525, ISSN 0950-0618,

Funding Source(s): Fundamental Funds (FF)-Chiang Mai University 2565-2566



The promise of modified titanium for bone and dental tissue regeneration

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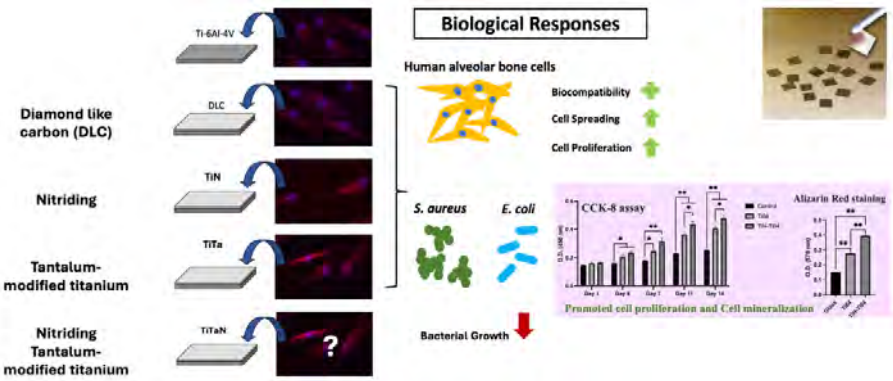
This research explores various surface modification techniques for titanium alloys (Ti-6Al-4V) to improve their properties for bone and dental regeneration. We investigated diamond-like carbon (DLC), plasma nitriding (TiN), titanium-tantalum (Ti-Ta) and titanium-tantalum-nitride (TiTaN) coatings. Each modification profoundly influenced surface characteristics like roughness, wettability, and hardness, directly impacting biological responses. Our findings consistently showed that these modified surfaces significantly promote the proliferation of human alveolar bone cells. Specifically, DLC and TiN surfaces led to enhanced cell proliferation and initial cell attachment compared to unmodified titanium. Regarding calcification and osteogenic differentiation, DLC surfaces promoted higher mineral deposition, and TiN significantly increased mineralization, alongside upregulating key osteogenic marker genes (e.g., *BMP2*, *OCN*, *OPN*, *RUNX2*). While Ti-Ta supported cell proliferation, it did not show evidence of calcium accumulation. TiN also augmented calcium deposition, but TiTaN, while supporting proliferation, demonstrated a superior and sustained anti-inflammatory response. These diverse surface engineering approaches offer promising avenues for developing advanced biomaterials with tailored properties for enhanced osseointegration and reduced inflammation in dental implant applications.

Keywords: bone cells, diamond-like carbon, nitriding, surface modification, titanium

References:

Journal of Biomedical Materials Research Part A 113 (2025) e37853.
Diamond & Related Materials 136 (2023) 110022.

Funding Source(s): CMU Junior Research Fellowship Program (JRCMU2566R_110)



Spray-dried mannitol-leucine microparticles for dry powder inhalation: optimization and characterization

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Dry powder inhalation (DPI) is an effective method for pulmonary drug delivery, requiring particles with optimal aerodynamic properties to ensure deep lung deposition. This study aimed to develop large porous mannitol-leucine microparticles (MALs) using a spray drying technique, with ammonium bicarbonate (AB) as a porogen and leucine as a surface-modifying excipient. Mannitol was co-spray dried with varying concentrations of AB (0–50% w/w) and leucine (1–20% w/w). Among all formulations, MAL-10 (containing 10% leucine and 30% AB) exhibited the most favorable characteristics, including hollow, corrugated morphology, low bulk density (0.08 g/cm³), and high specific surface area (7.85 m²/g). These features resulted in an aerodynamic diameter within 1–5 µm, suitable for deep lung penetration. Leucine co-processing significantly improved powder flowability, reduced cohesiveness (angle of repose: 28.33°), and enhanced storage stability. A 30-day hygroscopicity study at 75% RH demonstrated that MAL-10 exhibited minimal moisture sorption (<0.05%), indicating excellent physical stability. Thermal analysis (DSC) and X-ray diffraction (XRD) confirmed that MAL-10 retained a stable mixture of α- and β-mannitol polymorphs after storage, while FT-IR analysis showed no chemical interaction between components. These findings suggest that co-processing mannitol with leucine not only improves aerosol performance but also enhances the physicochemical stability of the particles. The optimized MAL-10 formulation shows strong potential as a DPI carrier for pulmonary drug delivery.

Keywords: Spray drying, mannitol, leucine, ammonium bicarbonate, co-process, dry powder inhalation

Funding Source: CMU Junior Research Fellowship Program [grant number JRCMU2566R_015]

CMU Annual Research Summit 2025

Oral Presentation



Climate Crisis, Carbon Neutrality

Invited Speakers

รศ.ดร.สราวุธ เทพานนท์ คณะสาธารณสุขศาสตร์ มหาวิทยาลัยมหิดล	Deciphering secondary organic aerosol, sources, economic impacts, and PM2.5 solutions
รศ.ดร.พีรพงศ์ จิตเสงี่ยม สถาบันวิจัยพหุศาสตร์ มหาวิทยาลัยเชียงใหม่	Climate crisis research: Chiang Mai University Actions

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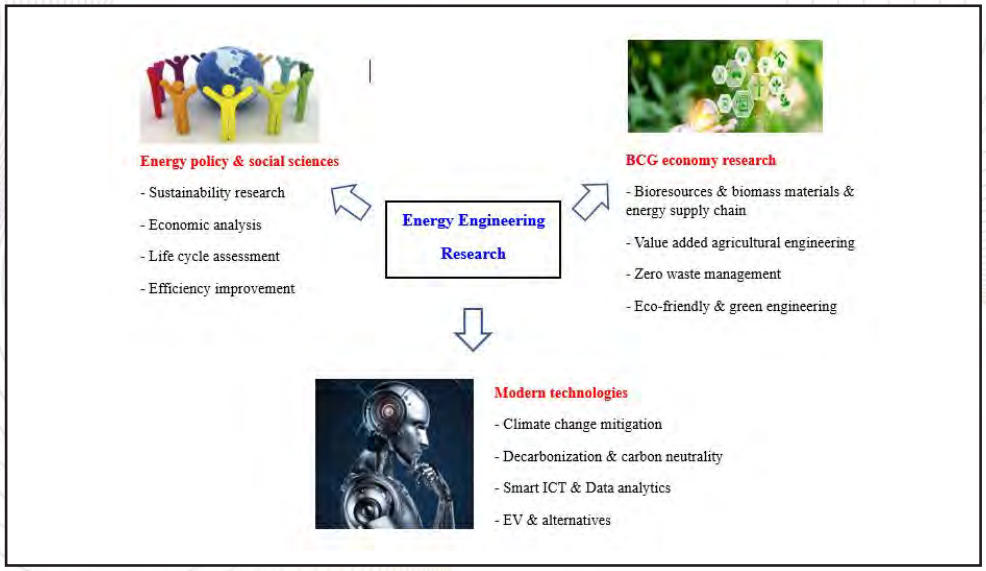
Sustainable energy and decarbonization engineering research towards carbon neutrality

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This research project addresses the global imperative of decarbonization by advancing sustainable energy engineering solutions to support the transition toward carbon neutrality. In response to the climate crisis driven by extensive fossil fuel use, the project focuses on reducing carbon emissions through energy conservation, renewable energy deployment, and carbon capture technologies. The core research areas include biomass energy conversion, material innovations for energy applications, and advanced decarbonization techniques. Experimental studies are conducted for biomass pretreatment and conversion via pyrolysis, hydrothermal processing, and gasification. Feedstocks such as agricultural residues, energy crops, and microalgae are considered. The effects of operating conditions on process efficiency are evaluated, and the resulting biochar, bio-oil, and gases are characterized and upgraded for potential use in combustion systems, engines, or fuel cells. Complementary modeling using AI/machine learning, CFD, and process simulation tools will support optimization of energy conversion systems and designs to maximize energy efficiency in mobility and industrial applications.

Keywords: biomass conversion, clean energy, climate mitigation, data analytics, renewables

Funding Source(s): National Research Council of Thailand & Chiang Mai University



Integrated Energy Systems for Carbon Neutrality: Innovations in Hydrogen Technology and Supercapacitor

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[2]*Energy Harvesting and Storage Laboratory, Chiang Mai University, Thailand*
[*]*E-mail: konlayutt.p@cmu.ac.th*

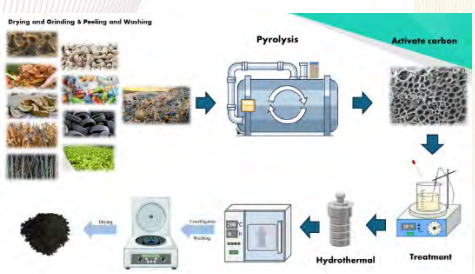
The Research Group of Energy Harvesting and Storage for Net Zero Emissions at Chiang Mai University is pioneering clean energy solutions to achieve carbon neutrality and enhance national energy security. Our research is heavily focused on hydrogen technology, where we develop low-cost, non-platinum catalysts and fabricate proprietary Membrane Electrode Assemblies (MEAs) for advanced Polymer Electrolyte Membrane (PEM) fuel cells. This expertise culminates in our functional prototype of a hydrogen-powered two-wheeled electric vehicle with a 130 km range, currently patent-pending. Complementing our hydrogen focus, we employ a waste valorization strategy aligned with circular economy principles. We convert diverse agricultural residues and plastics into high-performance porous activated carbon via pyrolysis for use as anodes in portable pouch-type supercapacitors. These devices have successfully powered small electronics, confirming their practical application. Through these focused innovations, we aim to translate laboratory success into commercially viable technologies to support sustainable development.

Keywords: Hydrogen Technology, Fuel Cells, Supercapacitors, Activated Carbon, Electrolyzers

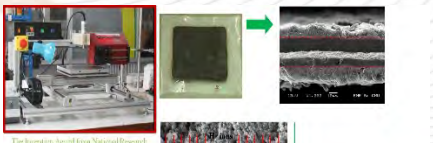
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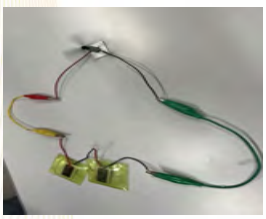
Journal of Power Sources, Volume 649, 1 September 2025, page 237467
Energy Nexus, Volume 19, September 2025, page 100468

Funding Source(s): Research Group, Chiang Mai University











Comparative analysis of energy consumption in semi-autonomous vehicles: The influence of adaptive cruise control across various powertrains

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[3]*Multidisciplinary Research Institute, Chiang Mai University, Chiang Mai, Thailand*
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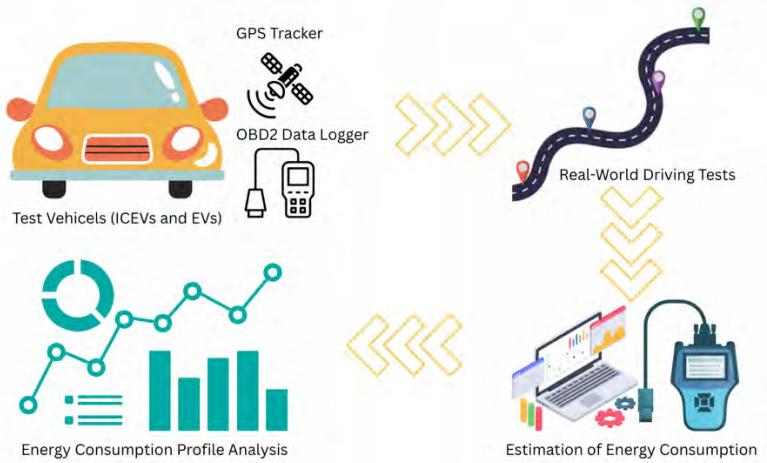
Greenhouse gas (GHG) emissions present a formidable obstacle to sustainable development, particularly within the transportation sector, contributing to nearly a quarter of global emissions. Notably, in Thailand, road transport accounts for over half of the transport sector's energy-related emissions. Driving behavior plays a key role in vehicle energy use, with acceleration and braking patterns affecting consumption levels. Adaptive Cruise Control (ACC), an Advanced Driver Assistance System (ADAS), automates speed control and behaves differently from human drivers. While enhancing driving ease, ACC may also influence energy consumption. The current study compares the energy consumption patterns between driving with and without ACC functionality under real-world driving conditions. Three different drivetrains were tested, including a battery electric vehicle (BEV), hybrid electric vehicle (HEV), and internal combustion engine vehicle (ICEV). The driving tests were conducted on various rural routes. Vehicle sensor data was collected utilizing an onboard diagnostics-II system. The empirical findings of the current study indicate that the deployment of ACC led to an approximate escalation in energy consumption rates of 0.26% for the HEV, 1.43% for the BEV, and 2.26% for the ICEV. The findings significantly contribute to understanding the potential environmental impacts of utilizing ACC technology across different drivetrains.

Keywords: Electric vehicles, Energy, Transport technology, Adaptive cruise control

References:

AIP Conference Proceedings Vol. 3236 No. 1 (2024) page 080004-1–080004-8.

Funding Source(s): CMU Junior Research Fellowship Program



Behavioral Based Optimization Factors in Solar Energy Production and Storage

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[1]*Faculty of Engineering, Chiang Mai University*
[2]*Energy Research and Development Institute Nakornping, Chaing Mai University*
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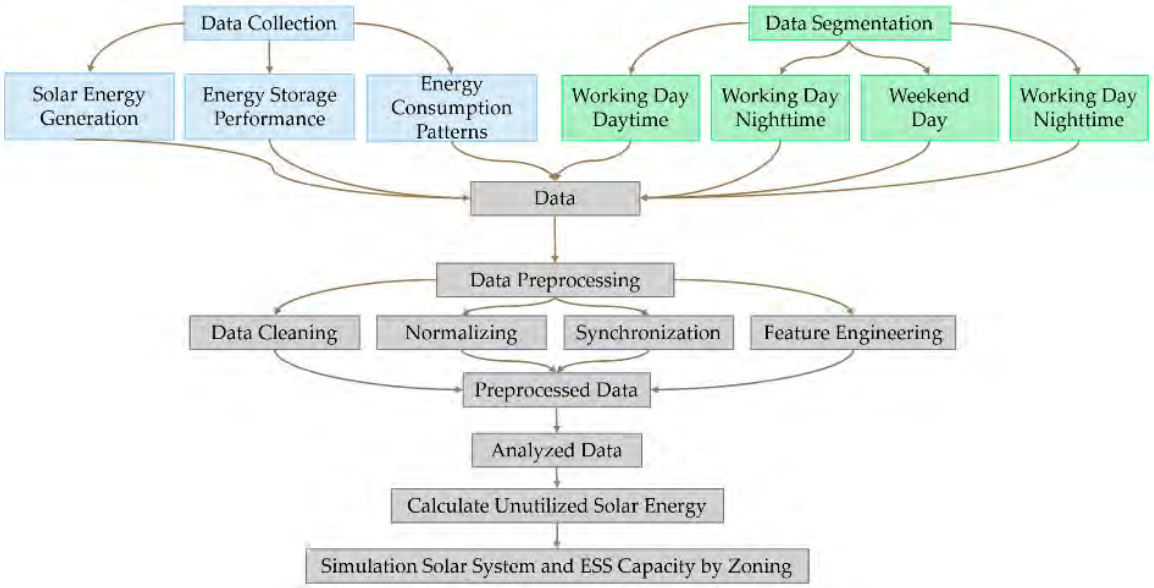
This research focuses on finding sensitivity of key parameters affecting designed capacity of solar energy production coupled with energy storage based on consumption behavior profiles. Actual data was collected from government office building located in Chiang Mai Thailand using transformer level monitoring platform. Rooftop PV system with capacity of approximately 1:1 ratio to peak daytime energy consumption is installed leading to significant possibility of overproduction. This study aims to optimize energy storage capacity based on actual behavioral profile. Scenarios are simulated to identify impacts of variables including storage capacity, day-night consumption / weekdays-weekends consumption gaps etc. The result suggests that for proposed behavioral profile, installation ratios are optimized for cases of limited roof area, adequate daytime demand and near zero energy consumption are presented and can lead to future applications in other behavioral profiles.

Keywords: solar PV and ESS, Installation Optimization, Behavioral Consumption Profile.

References:

Hongvityakorn, B.; Jaruwasupant, N.; Khongphinitbunjong, K.; Aggarangsi, P. Achieving Nearly Zero-Energy Buildings through Renewable Energy Production-Storage Optimization. *Energies* 2024, *17*, 4845. https://doi.org/10.3390/en17194845

Funding Source(s): This research project was supported by Fundamental Fund 2023 and 2024, Chiang Mai University and Thailand Science Research and Innovation (TSRI).



Research Activities on Green Energy and Waste-to-Energy for Near Zero Carbon Emissions

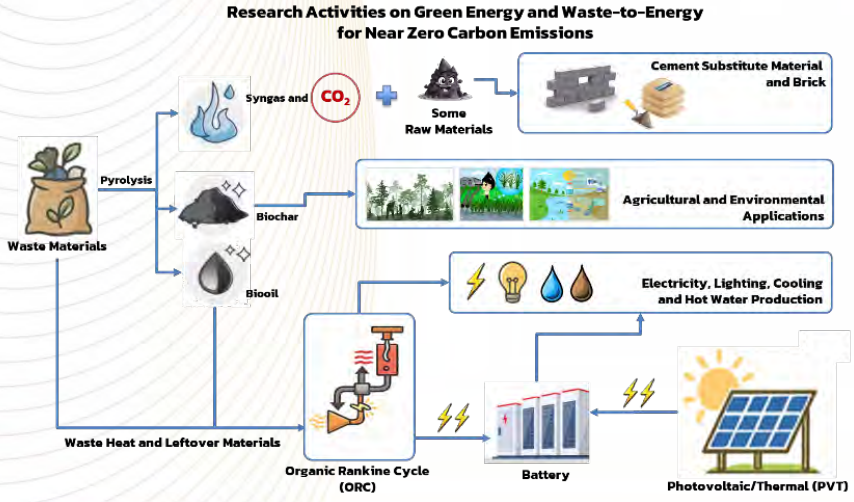
Tanongkiat Kiatsiriroat[1,*], Saisamorn Lumyong[2], Puangrat Kaewlom[1], Thoranis Deethayat[1], Attakorn Asanakham[1], Jeeraporn Pekkho[2], Nuttapol Noirungsee[2], Khomsan Ruangri[3], Wassana Kamopas3, Nuapon Doungbia[4], Kritsana Jatuwong[4], Worawoot Aiduang[4]
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The Thermal Systems Research Laboratory, Department of Mechanical Engineering, Faculty of Engineering, Chiang Mai University is an organization focused on research development, and innovation in the fields of renewable energy, energy efficiency enhancement, waste and biomass conversion into green energy, and high-value products. The research is divided into four parts: **Part 1** involves research on converting waste materials—including household, community, agricultural, and industrial residues—through the pyrolysis process to produce biochar, bio-oil, and pyrolysis oil. The quality of these products is subsequently improved for agricultural and environmental applications (FF 66-1, RG66). **Part 2** focuses on electricity and heat generation through the development of hybrid Photovoltaic/Thermal (PVT) systems for electricity, lighting, cooling, and hot water production, including studies on battery management (FF66-2). **Part 3** utilizes waste heat and leftover materials from Part 2 to generate electricity and heat through the Organic Rankine Cycle (ORC) (FF66-2). **Part 4** involves recovering exhaust gases from the various processes to produce high-value materials. For example, cement substitute materials are produced as a byproduct of carbon dioxide capture using industrial waste materials (RG67). In addition to these four parts, the research group conducts cost analysis, economic feasibility assessments, and environmental impact evaluations.

Keywords: Green Energy, High value-added product, Waste-to-Energy, Near Zero Carbon Emissions

Reference:
Sustainability, 17(1), 2025, 342. / *Energy Nexus*, 18, 2025, 100454. / *Life*, 15, 2025, 284 / *PLoS ONE*, 20(3), 2025, e0318416. / *Results in Engineering*, 23, 2024, 102736. / *Life*, 15, 2025, 317. / *Developments in the Built Environment*, 18, 2024, 100469.

Funding Source: FF66-1: R65EX00065 / FF66-2: R65EX00032 / RG66: R66IN00348 / RG67: R68IN00115 that support the reported work



Sustainable, Climate-Urban-Water Resilience and Food Cycle Eco-community Chiang Mai City Management

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[2]*Urban Environmental Planning and Development Program at the Faculty of Architecture and Planning, Thammasat University*
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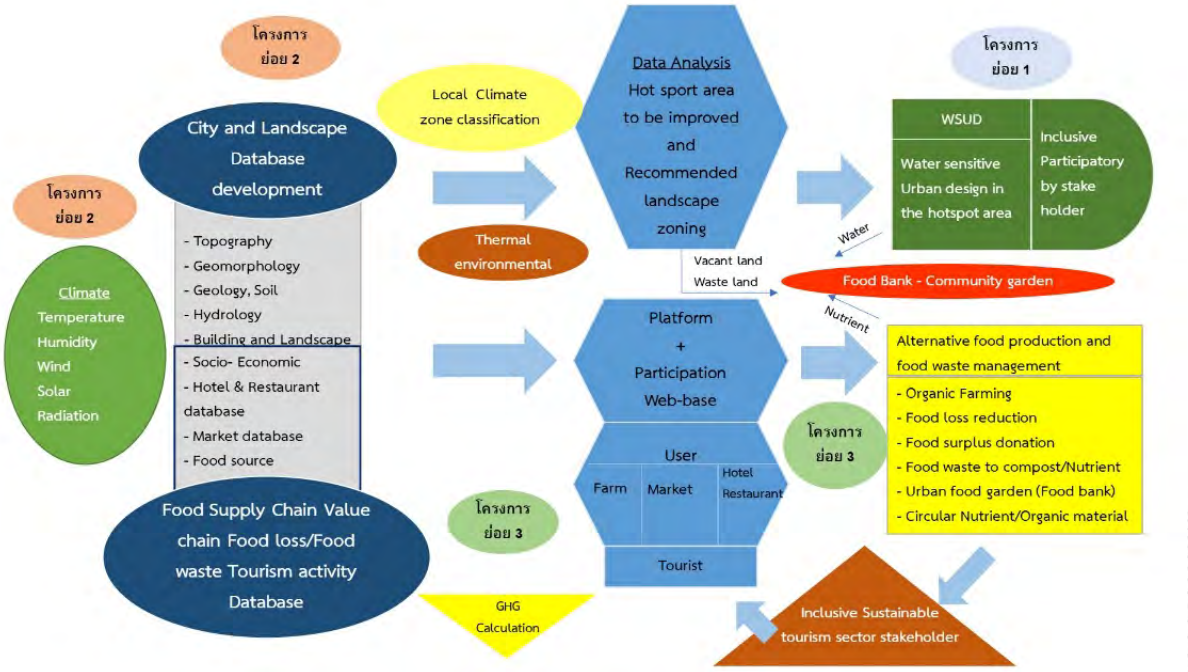
This study addresses the challenges posed by rapid urbanization, climate change, and food security in Chiang Mai. The research focuses on (1) evaluating the effectiveness and public perception of green stormwater infrastructure and water sensitive urban design (WSUD); (2) analyzing local climate zones and blue-green landscape changes and their relation to urban heat island dynamics using land surface temperature and biophysical indices and (3) examining sustainable food supply chain management for a Bio-Circular City. Surveys revealed similar user preferences, emphasizing thermal comfort and safety in infrastructure designs. Modeling showed that LST variability across land use zones is strongly influenced by surface factors (explaining 45.7%–53.2% of variations), guiding adaptive planning strategies for the city's comprehensive plan. Supply chain analysis indicated that nearly 50% of fruits and vegetables are imported and that food loss and waste are significant but largely inedible. Scenario analyses demonstrated environmental benefits from improved food waste management, including composting and biogas production. The findings suggest that integrated green infrastructure, climate-sensitive planning, and sustainable food systems can collectively reduce emissions, enhance food security, mitigate flooding, and lower urban heat island effects in Chiang Mai.

Keywords: Circular City, Land Surface Temperature, Green Infrastructure, Urban Resilience

References:

Sustainability, 15(22),(2023) 16127 doi:https://doi.org/10.3390/su152216127
International Journal of Geo-Information, 13(7),(2024) 228

Funding Source(s): *Fundamental Fund 2566 Chiangmai University*


โครงการ ย่อย 2
City and Landscape Database development
โครงการ ย่อย 2
Climate
Temperature
Humidity
Wind
Solar
Radiation
- Topography
- Geomorphology
- Geology, Soil
- Hydrology
- Building and Landscape
- Socio- Economic
- Hotel & Restaurant database
- Market database
- Food source
Food Supply Chain Value chain Food loss/Food waste Tourism activity Database
Local Climate zone classification
Thermal environmental
โครงการ ย่อย 3
GHG Calculation
Data Analysis
Hot sport area to be improved and Recommended landscape zoning
Vacant land
Waste land
Platform + Participation Web-base
User
Farm
Market
Hotel Restaurant
Tourist
โครงการ ย่อย 1
WSUD
Water sensitive Urban design in the hotspot area
Inclusive Participatory by stake holder
Water
Food Bank - Community garden
Nutrient
Alternative food production and food waste management
- Organic Farming
- Food loss reduction
- Food surplus donation
- Food waste to compost/Nutrient
- Urban food garden (Food bank)
- Circular Nutrient/Organic material
โครงการ ย่อย 3
Inclusive Sustainable tourism sector stakeholder

Expanding Knowledge Impact: Multidisciplinary Strategies for Air Pollution Management in Northern Thailand

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[2] *Faculty of Education Chiang Mai University, Thailand*
[3] *Faculty of Science, Chiang Mai University, Thailand*
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This project aims to advance and disseminate integrated knowledge on air pollution management in Northern Thailand by combining interdisciplinary academic expertise with local wisdom. The initiative centers on three core components: (1) developing an academic curriculum on air pollution management, (2) cultivating community-based change leaders, and (3) producing public media for education and outreach.

The curriculum was developed through multidisciplinary collaboration, bridging academic theory and local knowledge, and is now part of Chiang Mai University's Master of Arts and Science in Integrative Studies and the CMU Lifelong Education platform for broad access. To foster change leaders, the project assessed the needs of students, teachers, community members, and officials, informing curriculum design and implementation, which included focus groups, pilot testing, workshops, exhibitions, and the establishment of pilot learning centers on haze management. For media outreach, instructional and public content—including videos and digital media—was produced and distributed via YouTube, Facebook, and TikTok (ACAirCMU channel). The "HazeEdu Creator" video contest further encouraged public engagement.

Key outcomes are a locally relevant, interdisciplinary curriculum, the emergence of student-driven community leaders, and accessible educational media, all enhancing public access to air pollution management knowledge and supporting sustainable development in Northern Thailand.

Keywords: air pollution, multidisciplinary curriculum, local wisdom, community leadership, public media

Funding Source(s): PM2.5 and Other Pollutants Related to Non-Communicable Diseases/ Chiang Mai University

Youth Change Agents Leading Sustainable Solutions to the Smoke Haze Crisis: Brave Sprouts Challenging the Haze (Ton Kla Tha Mok Kwan)

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Pichamon Sudecha[3] and Somporn Chantara[1,2]

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In response to Northern Thailand's severe annual haze crisis, the "Ton Kla Tha Mok Kwan" (Brave Sprouts Challenging the Haze) project flips the conventional paradigm by transforming youth from passive victims into active agents of change. The initiative's core aims are to transfer knowledge and innovation, instill environmental consciousness and awareness, and build a powerful network of youth and schools across Northern Thailand. Over nine years, the project has cultivated a powerful ecosystem of change, engaging over 1200 students from 50 schools. These young leaders have generated many innovations and small projects for their communities, launched grassroots initiatives like the "5-Color Flag" air quality alert system, and created digital campaigns reaching over 500,000 people. This has driven measurable economic, social, and environmental impact. The "Ton Kla Tha Mok Kwan" project provides a powerful, replicable model for environmental stewardship that moves beyond awareness to action. By equipping the next generation with scientific knowledge and practical skills, we have catalyzed a grassroots movement that builds local resilience and forges a sustainable, clear-skied future, proving that empowering youth is the most critical investment in solving persistent environmental challenges.

Keywords: PM2.5, smoke haze, young, sustainable, change agents

References:

Participation and Learning Chapter 17 (2008) page 268 – page 284
City and Environment Interactions Volume 19 (2023) page 1– page 12

Funding Source(s): PM2.5

Development of a Database for Assessing Green Gross Provincial Product (Green GPP) in the Industrial Sector

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[2]*Department of Industrial Engineering, Faculty of Engineering, Chiang Mai University, Chiang Mai, Thailand.*
[*]*E-mail: eakkaporn.n@cmu.ac.th*

The project aims to establish a data to evaluate the environmental impacts of industrial activities at the provincial level. The approach combines environmental life cycle assessment (LCA) with macroeconomic indicators, specifically the Gross Provincial Product (GPP), to calculate Green GPP. The research methodology comprises three main components: 1) Collection of life cycle inventory (LCI) data on materials and energy use, as well as emitted emissions from industrial production in Chiang Mai Province; 2) Compilation and analysis of GPP data specific to the industrial sector in monetary terms; and 3) Green GPP calculation which monetizes the environmental costs associated with environmental degradation, and depletion of natural resources, and deducts these costs from the conventional GPP. The result shown that Green GPP values in Chiang Mai's industrial sector are reduced by approximately 6.5–8.2% compared to conventional GPP figures. Notably, the food sectors exhibit the highest environmental cost due to the use of materials and energy, as well as emitted emissions. These findings the urgency of promoting environmentally responsible production practices alongside economic growth. The integrated database developed provides for policymakers in sustainable public procurement. Ultimately, supports national objectives on net-zero GHGs by 2065, in alignment with global sustainable development goals (SDGs).

Keywords: Gross Provincial Product, LCIA, Degradation cost, Depletion cost, SDGs

Funding Source(s): Target Research, Chiang Mai University, Chiang Mai, Thailand.

Size-Fractionated Particulate Matter and PAH-Related Health Risks Across Haze and Non-Haze Periods at Urban and Border Sites in Northern Thailand

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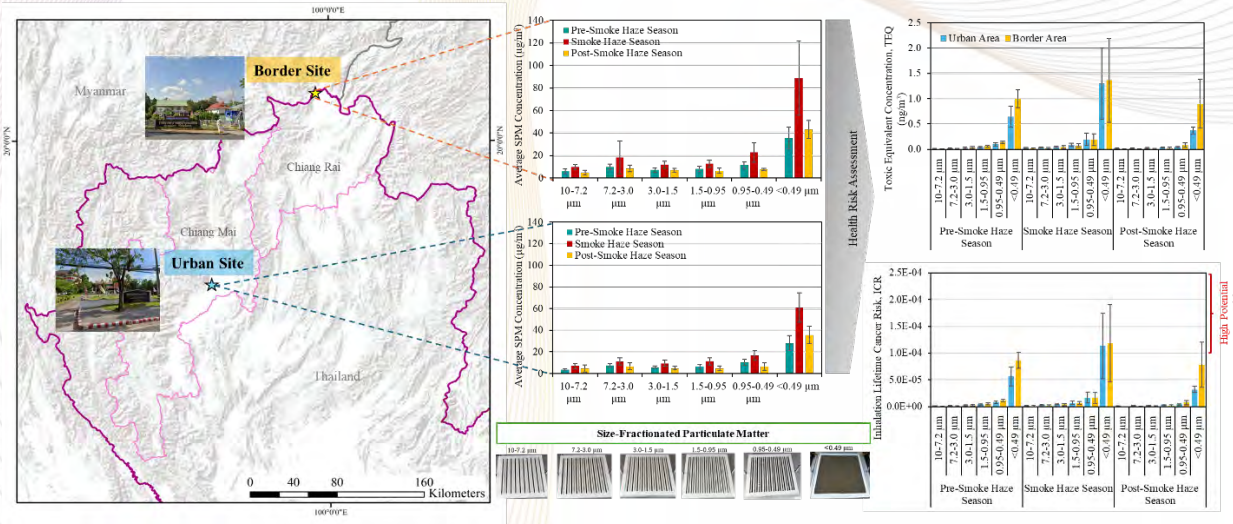
Atmospheric polycyclic aromatic hydrocarbons (PAHs) associated with size-fractionated particulate matter pose significant health concerns during seasonal haze episodes in Northern Thailand. This study quantified 16 priority PAHs in particulate matter fractions (PM_{10}–$PM_{0.49}$) and assessed associated inhalation cancer risks across pre-haze, haze, and post-haze periods in 2024 at an urban site in Chiang Mai and a border site in Chiang Rai. Particulate concentrations were highest during the haze period, particularly in particles smaller than 0.49 µm, reaching 61.0 ± 13.5 µg/m³ (urban) and 88.6 ± 32.9 µg/m³ (border). PAH concentrations followed a similar pattern, peaking at 5.45 ± 0.28 ng/m³ and 6.41 ± 0.27 ng/m³, respectively, during haze and dropping below 1 ng/m³ in larger particles. Toxic equivalent concentrations and inhalation cancer risks were also greatest in the smallest particles during haze (TEQ ~1.3 ng/m³; ICR ~10^{-4}), exceeding the commonly accepted risk threshold of 10^{-6}. Both metrics declined with increasing particle size and after the haze period. These findings demonstrate that the smallest size fractions of particulate matter are the dominant carriers of PAHs and related cancer risks during haze events, underscoring the need for size-targeted air quality management strategies in affected regions.

Keywords: Air pollution, Polycyclic Aromatic Hydrocarbons, Health Risk, Fine particle, Open burning

References:

Environmental Pollution, 293 (2022), 118488.

Funding Source(s): This research was partially supported by Chiang Mai University in 2023.



Water-Soluble Ions as Tracers of Submicron $PM_{0.49}$ from Transboundary Biomass-Burning Haze in Northern Thailand

Radshadaporn Janta[1,2], Nuttipon Yabeung[2], Sarana Chansuebsri[2], Supattarachai Saksakulkrai[2]
Pavidarin Kraisitnitikul[1,2], Somporn Chantara[2,3,*]

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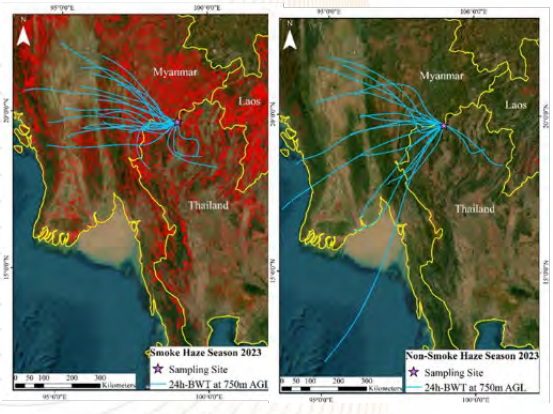
Very fine particles ($PM_{0.49}$) have pronounced effects on atmospheric chemistry and human health due to their fine size and large surface area. Their chemical composition and sources, however, remain poorly understood in rural regions affected by biomass burning (BB) and transboundary haze. This study characterized $PM_{0.49}$ in Chiang Dao, northern Thailand, during the smoke haze (SH; March–April) and non-smoke haze (NSH; May–August) periods of 2023. Daily samples collected with a five-stage cascade high-volume sampler were analyzed for water-soluble ions and BB markers. $PM_{0.49}$ concentrations were substantially higher in SH ($67.9 \pm 46.0\ \mu g\ m^{-3}$) than NSH ($10.9 \pm 4.4\ \mu g\ m^{-3}$). Secondary inorganic aerosols (SO_4^{2-}, NO_3^-, NH_4^+) dominated, with elevated K^+ and levoglucosan indicating BB influence; K^+ also contributed to aerosol neutralization. Positive matrix factorization attributed 48% of $PM_{0.49}$ during SH to BB, while soil dust dominated NSH (81%). Backward trajectory and fire hotspot analyses confirmed transboundary BB as a major haze driver. These findings provide new insights into ultrafine particle sources in BB-impacted rural Southeast Asia and highlight the importance of cross-border mitigation strategies to reduce exposure risks.

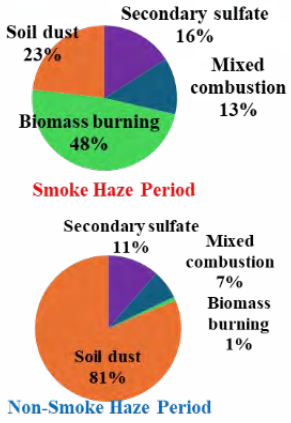
Keywords: Air pollution, biomass burning, water-soluble ions , source apportionment, health impact

References:

Atmospheric environment, 327 (2024) 1-13.
Chemosphere, 286 (2022) 1-9.

Funding Source(s): This research project was supported by Fundamental Fund 2023, Chiang Mai University and also Thailand Science Research and Innovation (TSRI).





The Integrated Earth Sciences and Geoinformatics to Mitigate Geological Hazards along Mae Chan Fault, Chiang Rai Province, Northern Thailand

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[2]*Environmental Geology Division, Department of Mineral Resources, Rama VI, Bangkok 10400, Thailand*
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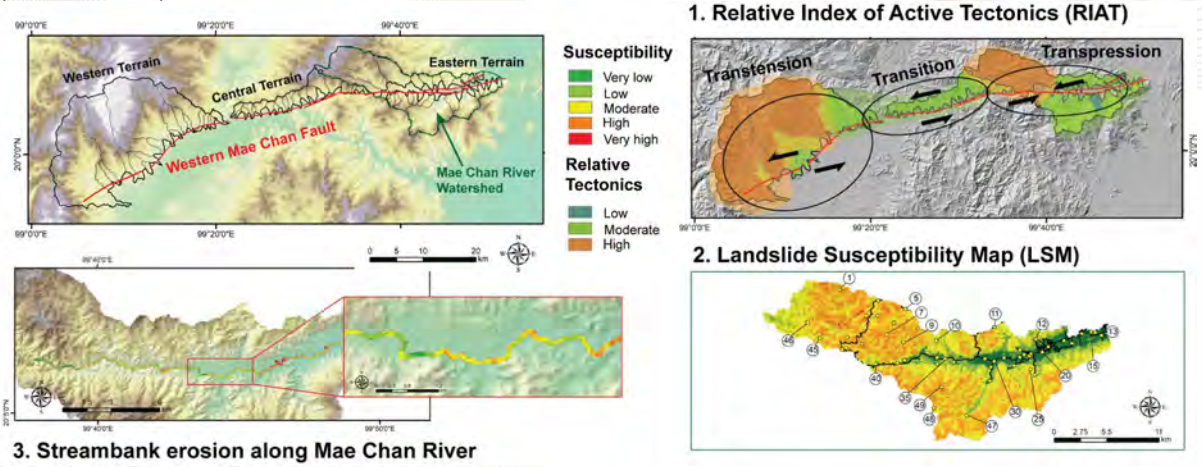
This research examines geological hazards in northern Thailand's Mae Chan River watershed, with a focus on landslide susceptibility, tectonic activity along the Western Mae Chan Fault (WMCF), and streambank erosion. The research's findings reveal that approximately 36% of the watershed, particularly the northwestern and southern high mountain areas, is highly susceptible to landslides. A susceptibility index, based on 173 historical landslides and causative factors, shows good precision and accuracy (AUC values of 0.738). Morphotectonic analysis of the active WMCF reveals moderate overall tectonic activity, with higher activity in the western terrain and high eastern topography. Remote sensing and geomorphic indices identify ENE-WSW fault segments and variations in transtensional and transpressional regimes, indicating the fault's long-term impact on the landscape. Moreover, streambank erosion is significant in the watershed, with 70% of hotspots in the middle and lower reaches classified as moderate to high. Between 2008 and 2023, eroded sediment doubled, and deposited sediment increased 1.4-fold, linked to higher river discharge during intense rainfall. This integrated GIS, remote sensing, and geomorphic analysis provides crucial insights for hazard mitigation and land management in the Mae Chan River watershed.

Keywords: Mae Chan Fault, Mae Chan River watershed, active tectonics, landslide susceptibility, streambank erosion

References:

Journal of Asian Earth Science, 278 (2025), 106412
Quaternary Science Advances, 17 (2025), 100263

Funding Source(s): Chiang Mai University (CMU) Junior Research Fellowship Program (R66IN00513)



PM2.5 Exposure During Pregnancy and Adverse Birth Outcomes in Northern Thailand (2016-2022)

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Objectives: This study investigates the effects of PM2.5 exposure during pregnancy on adverse outcomes, specifically preterm birth and low birth weight (LBW), among pregnant women in northern Thailand.
Research Problem: Air pollution, particularly PM2.5, has been linked to negative pregnancy outcomes, but the specific risks posed by varying exposure levels throughout gestation and among high-risk populations remain underexplored.
Methods: We analyzed a cohort of 16,965 pregnant women from 2016-2022. PM2.5 data from two air quality monitoring stations were used to determine daily exposure levels. Logistic regression models were employed to assess the association between PM2.5 exposure and pregnancy outcomes. Subgroup analyses were also conducted for high-risk women.
Major Findings: PM2.5 exposure exceeding 37.5 µg/m³ throughout pregnancy significantly increased the risk of preterm birth (aOR = 2.19, $p < 0.001$) and LBW (aOR = 1.99, $p < 0.001$). Subgroup analysis revealed higher risks for high-risk women (aged >35, pre-pregnancy BMI <18.5, pregnancy-induced hypertension).
Conclusion: This study highlights a significant association between PM2.5 exposure and adverse pregnancy outcomes, emphasizing the urgent need for targeted interventions to protect maternal and child health.

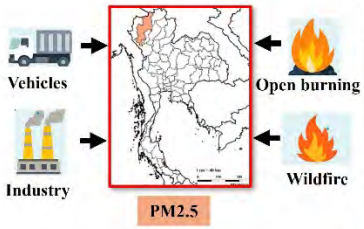
Keywords: particular matter2.5 exposure, preterm birth, low birth weight, maternal risk factors, health risk.

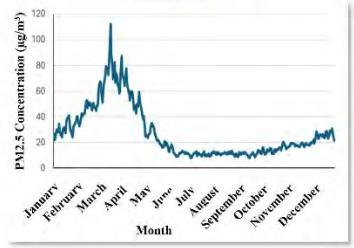
References:
Aerosol Air Qual. Res. 2024, 24, 230269.
Toxics 2024, 12, 446.

Funding Source(s): This research was funded by Chiang Mai University (R66IN00641).

PM2.5 Exposure During Pregnancy and Adverse Birth Outcomes in Northern Thailand (2016-2022)

Sources and Characteristics of PM2.5Exposure in Chiang Mai





The association between daily PM2.5 exposure > 37.5 µg/m³ during entire pregnancy and adverse outcomes



16965 pregnant women and their infant from Maharaj Nakron Chiang Mai Hospital and Regional Health Promotion Center1 Hospital Chiang Mai (2016-2022)

Adverse outcomes

- Preterm birth — aOR = 2.19, $p<0.001$
- Low birth weight — aOR = 1.99, $p<0.001$

Subgroup analysis of high-risk pregnant women	Preterm birth	LBW
Maternal age >35 years old	aOR 1.17 p=0.069	aOR 1.35 p=0.001
Pre-pregnancy BMI <18.5	aOR 1.26 p=0.016	aOR 1.14 p=0.122
Pregnancy induced hypertension	aOR 1.09 p=0.030	aOR 1.11 p=0.012

Chiang Mai CCS as Thailand's National Research Center Advancing the CCS Technology Roadmap Toward Carbon Neutrality and Net-Zero Emissions

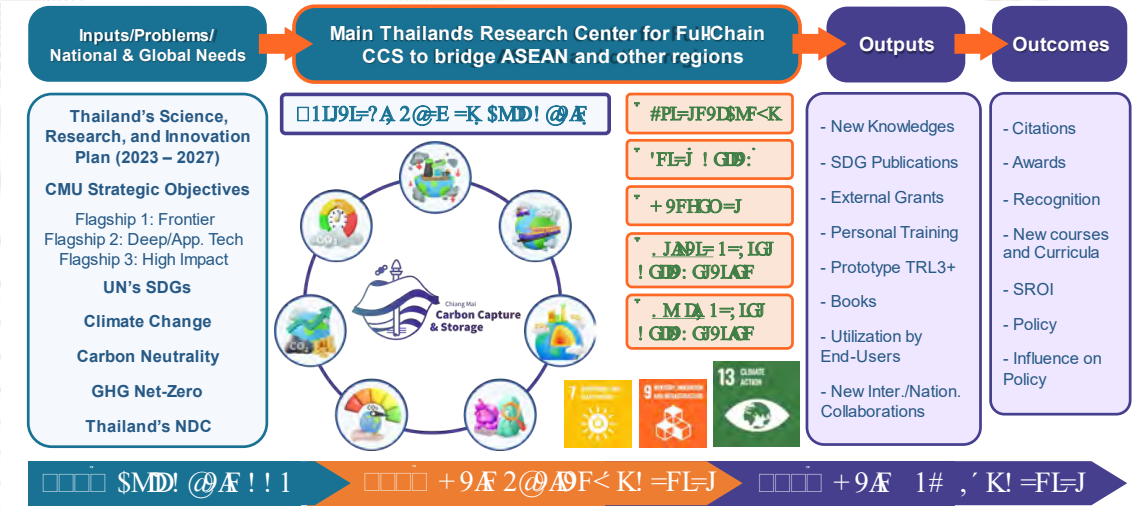
Suparit Tangparitkul[1,*], Nakorn Tippayawong[1], Chatchawan Chaichana[1], Natthanan Promsuk[1], Santi Phithakkitnukoon[1], Pisanu Wongpornchai[1], Kedsarin Pimraksa[1], Cheowchan Leelasukseree[1], Pawarut Jongchansitto[1], Yothin Chimupala[1], Tinnakorn Phongthiya[1], Jirakom Sirisrisakulchai[1], Tadsuda Taksavasu[1], Mingkwan Kruachanta[1], Ramnarong Wanison[1], Sirasit Srinuanpan[1], Komsoon Somprasong[1], Chakkapong Chamroon[1], Saranphong Yimklan[1], Kanya Rattanamongkhonkun[1], Kunanon Jongchansitto[1], Teerapat Tosuai[1], Nopparuj Suetrong[1], Chanapol Charoentanaworakun[1]

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Established in 2022, Chiang Mai CCS serves as Thailand's national research center dedicated to advancing carbon capture and storage (CCS) technologies in support of the country's targets for carbon neutrality by 2050 and net-zero emissions by 2065. The center played a lead role in developing Thailand's CCS Technology Roadmap and is now coordinating its implementation. Through extensive collaboration with other universities, government agencies, and major industrial players—including EGAT, PTT Group, and SCG—the center supports flagship CCS projects in the energy and IPPU sectors. As the founding lead of the Thailand CCUS Alliance (TCCA), Chiang Mai CCS provides a national platform for coordinated technical, regulatory, and policy action. Internationally, the center partners with leading universities and is supported by external grants including the UK International Science Partnerships Fund (ISPF). To date, Chiang Mai CCS has secured over 50 million THB in external funding and contributed directly to the identification of more than three storage sites in onshore saline aquifers. With a strong focus on social return on investment (SROI) and SDG 13, ongoing efforts include the development of new CO_2 capture technologies, reservoir simulation, and trapping efficiency enhancement—strengthening Thailand's CCS readiness and regional leadership in carbon management.

Keywords: CCS, CCUS, carbon neutrality, net-zero emissions

Funding Sources: NSRF, PMU-B, EGAT, British Council, and CMU.



Community-Driven Citizen Science for Air Quality Monitoring and Health Risk Assessment on the Thai-Lao Frontier Border Area of Northern Thailand

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This study implements a community-driven citizen science framework to address transboundary air pollution and conduct local health risk assessments on the Thai-Lao frontier. Countering traditional top-down monitoring, our approach empowers residents as active partners by deploying a network of solar-powered, low-cost "DustBoy" PM2.5 sensors and training citizens through dedicated workshops. Recognizing the need for accessible and user-friendly air quality information, we integrated the Chiang Mai University (CMU) LINE Official account as a digital engagement tool for personal health protection. This project includes monitoring to assess health risks from hazardous components of particulate matter, including carcinogens like Polycyclic Aromatic Hydrocarbons (PAHs) and the particles' overall Oxidative Potential (OP). This citizen-led monitoring has confirmed severe seasonal pollution, with PM 2.5 and health risk levels peaking between February and April due to transboundary smoke from biomass burning, with data showing significantly higher concentrations at monitoring sites in border Laos compared in Thailand during this period. By placing data directly into community hands, this framework fosters environmental literacy and enables evidence-based, local decision-making. The project establishes a successful, collaborative model for air quality management that builds local capacity for health risk assessment, creating a pathway for improved public health and equitable environmental governance.

Keywords: $PM_{2.5}$, smoke haze, low-cost sensors, air quality monitoring, citizen science

References:

Urban Climate Volume 60 (2025) page 1 - page 16
Air Quality, Atmosphere & Health Volume 15 (2022) page 1963– page 1979

Funding Source(s): Development fund for Research Groups, Research Centers, Centers of Excellence

Dry-mixed plastic-modified asphalt mixtures: A pathway toward sustainable road surfacing with microplastic emission awareness

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[2]*Department of Environmental Engineering, Faculty of Engineering, Chiang Mai University, Huay Kaew Road, Muang, Chiang Mai, 50200, Thailand*

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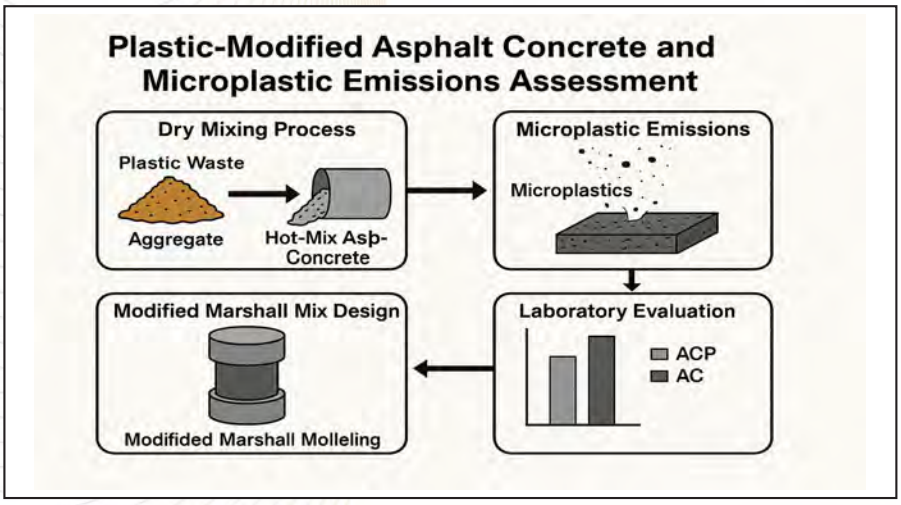
This study offers a comprehensive evaluation of dry-mixed, plastic-modified asphalt mixtures, focusing on both engineering performance and environmental safety. Using recycled low-density polyethylene (LDPE), the plastic waste was dry-blended into hot mix asphalt (HMA) without pre-melting, aiming for practical scalability. Laboratory tests, including wheel tracking and indirect tensile strength, demonstrated that the addition of LDPE enhanced the rutting resistance and moisture susceptibility of HMA, with optimal results achieved at a 6% LDPE content by weight of bitumen. A thorough airborne microplastic monitoring protocol was developed and validated in a simulated mixing chamber. Analytical techniques, especially Fourier-transform infrared spectroscopy (FTIR) and scanning electron microscopy (SEM), were used to detect and verify microplastic particles during the dry-mixing process. These results highlight the dual benefits of dry-mixed plastics in increasing road durability with no risk of airborne emissions. This work advocates for balanced development of sustainable infrastructure technologies that include environmental impact monitoring frameworks.

Keywords: Plastic-modified asphalt, Dry mixing, Recycled LDPE, Microplastic emissions, Sustainable road

References :

Construction and Building Materials, Volume 404(2023), 133127
Results in Engineering, Volume 25(2025), 104464

Funding Source(s): Alliance to End Plastic Waste (AEPW) and CMU strategic funds (A2)



Turning Waste into Value Product: Biochar from Coffee Grounds and Cyanobacteria for Green Applications

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[1]*Office of Research Administration, Chiang Mai University, Thailand, 50200*
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This study investigated the production of biochar through co-pyrolysis of spent coffee grounds (SCG) with the cyanobacterium *Leptolyngbya* sp. KC 45, using either its whole biomass (LT) or its residual biomass (LTR) in various mixing ratios. The blended feedstocks were subjected to pyrolysis in a fixed-bed reactor under high-temperature, oxygen-free conditions. Results showed that increasing the proportion of LT or LTR led to higher biochar yields. In terms of energy content, biochar produced solely from SCG exhibited the highest heating value, indicating its strong potential as a fuel. All co-pyrolyzed biochars displayed mesoporous structures. As the proportion of LT or LTR increased, the surface morphology of the SCG-derived biochar showed an increasing presence of fine flake-like structures, attributed to the influence of LT or LTR biochar. Regarding chemical and physical properties—such as pH, electrical conductivity, carbon-to-nitrogen ratio, and moisture content—the co-pyrolyzed biochars met the standard criteria for soil conditioners. These findings suggest that such biochars hold promise for use as soil amendments.

Keywords: Coffee Grounds, Leptolyngbya sp. KC 45 (LT), Value Product, Waste-to-product, **soil amendments**

Reference: *Energy Nexus*, 18, 2025, 100454.

Funding Source: FF66 R65EX00065 / FF67: R66EX01090 / Thailand Science Research and Innovation (TSRI) / Chiang Mai University (CMU) that support the reported work

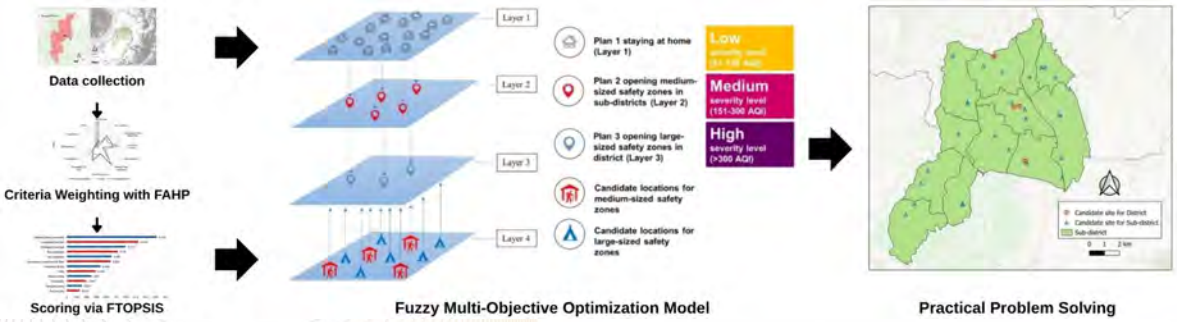
Multi-Objective Fuzzy Mathematical Programming Model for Temporary Shelter Site Selection during PM 2.5 crisis

Chawis Boonmee[1,*], Chompoonoot Kasemset[1], Mikiharu Arimura[2]
[1]*Department of Industrial Engineering, Faculty of Engineering, Chiang Mai University, Thailand*
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This study presents a fuzzy multi-objective optimization model for selecting temporary shelter sites during PM2.5 air pollution crises in Northern Thailand. Focused on high-risk areas like Saraphi District, Chiang Mai, the model supports urgent public health responses by integrating Multi-Criteria Decision Making (MCDM) with fuzzy Mixed-Integer Linear Programming (MILP). Key criteria—such as air filtration, safety, accessibility, early warning systems, and installation cost—were identified through literature review, field surveys, and expert input. Fuzzy AHP determined the weights of these criteria, while Fuzzy TOPSIS evaluated 31 candidate sites. The results were applied in a fuzzy MILP framework to identify optimal shelter locations under capacity, budget, and risk constraints. The model recommended 18 suitable sites with a combined capacity of 5,806 people. Stakeholder evaluations affirmed the model's practicality. This research contributes to Sustainable Development Goal 13 (Climate Action) by enhancing readiness for environmental health emergencies.

Keywords: PM2.5 crisis, temporary shelter, fuzzy MILP, FAHP, FTOPSIS

Funding Source(s): This research work was supported by CMU Junior Research Fellowship Program, Chiang Mai University, Thailand and partially supported Chiang Mai University.



Performance analysis of precooling systems for cryogenic carbon capture: A comparative study of theoretical, numerical, and experimental methods

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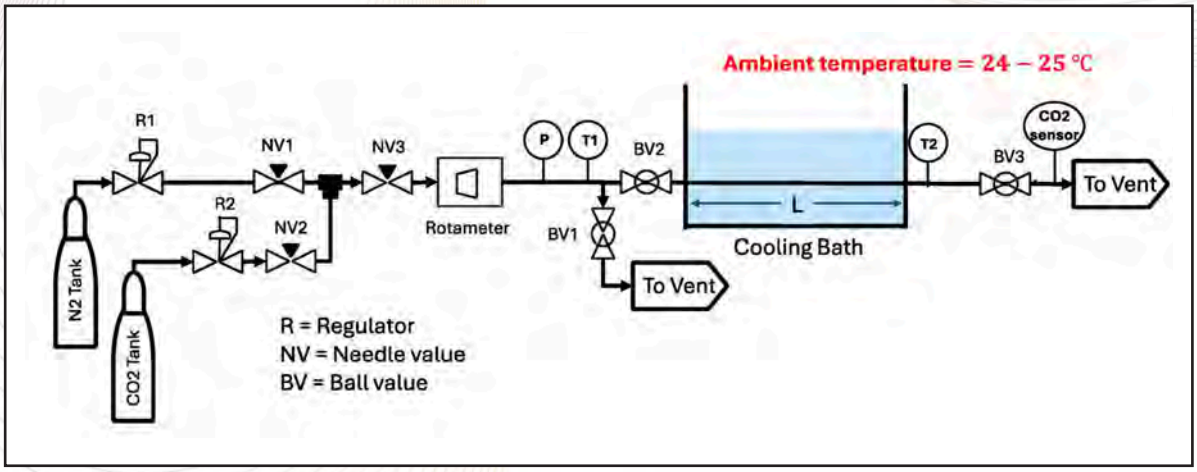
Addressing climate change requires innovative methods to reduce greenhouse gas emissions. Cryogenic Carbon Capture (CCC) is a promising technology for capturing CO_2 from industrial sources. This study presents a simplified precooling system design within CCC, aiming to optimize efficiency and reliability while minimizing energy use. The effects of CO_2 concentration (in simulated flue gas), cooling bath temperature, and gas mixture flow rate on heat exchanger performance were investigated through theoretical, numerical, and experimental analyses. Liquid nitrogen at −196 °C caused CO_2 freezing and pipe blockages, making it unsuitable. A dry ice–isopropyl alcohol bath at −78.5 °C provided stable cooling without CO_2 solidification. Numerical simulations showed that a 140 cm pipe length offers an optimal balance between temperature reduction and pressure control. Experiments confirmed that longer pipes enhance cooling due to increased surface area, while higher CO_2 concentrations and flow rates lead to higher outlet temperatures and pressures. The findings underscore the importance of optimized heat exchanger design to improve CCC performance. Further research is recommended to refine the system for industrial-scale applications, ensuring efficient and reliable CO_2 capture.

Keywords: k Climate change; CO2 concentration; CO2 freezing prevention; Cryogenic carbon capture (CCC); Greenhouse gas; Low-temperature heat exchanger performance; Numerical analysis; Pre-cooling system

References:

Thermal Science and Engineering Progress, p. 103562, 2025.
E3S Web of Conferences, 2021, vol. 233: EDP Sciences, p. 01068.

Funding Source(s): CMU Junior Research Fellowship Program 2023



CMU
Annual Research Summit 2025

Oral Presentation

Agriculture, Biodiversity

Invited Speakers

ดร.ศิรสิทธิ์ ศรีนวลปาน สำนักงานบริหารงานวิจัย มหาวิทยาลัยเชียงใหม่	Production and Utilization of Algal and Cyanobacterial Biomass for the SDGs and the BCG Industry
ดร.สยาม ลววิโรจน์วงศ์ ผู้อำนวยการสำนักประยุกต์และ บริหารภูมิสารสนเทศ สำนักงานพัฒนาเทคโนโลยีอวกาศ และภูมิสารสนเทศ (องค์การมหาชน)	Satellite-Powered Sustainability: Agricultures, Environemnts, Natural Resources, and Disaster Resilience

Microbial Diversity in Northern Thailand for Human Utilization and Sustainability

Center of Excellence in Microbial Diversity and Sustainable Utilization
Faculty of Science, Chiang Mai University, Chiang Mai 50200, Thailand
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The Center of Excellence in Microbial Diversity and Sustainable Utilization has been established to integrate research at Chiang Mai University, driving high-impact research on microorganisms from fundamental studies to sustainable applications. Additionally, the center has been developing innovative microbial technologies aligned with the Sustainable Development Goals (SDGs) and the Bio-Circular-Green (BCG) model. Researchers have produced outstanding achievements in microbial applications across diverse fields, including agricultural microbiology, high-value food production, medical and health application, and microbial innovations for energy. Based on microbial diversity research, several new microbial species were discovered in northern Thailand, and their database has been developed. In agricultural applications, the discovery of plant growth promoting microorganisms can enhance plant development and can be further developed into biofertilizers. Several emerging plant diseases have been detected, and antagonistic microorganisms have been employed as a biological control strategy to manage and prevent these diseases. In addition, edible wild mushrooms and their bioactive compounds have been identified for use in food and functional foods. Research has been conducted on microalgae as a potential source of biodiesel for alternative energy production. Finally, the research center has developed a highly competent workforce in microbiology, including master's and doctoral students, postdoctoral researchers, researchers, as well as researchers from government, private sectors, and local communities.

Keywords: Microbial application, Microbial diversity, Microbial research and innovation, Tropical area

References:

Frontiers in Cellular and Infection Microbiology 15 (2025) e1610403
Food 14 (2025) e808

Funding Source: Research Group Development (R68IN00007), Chiang Mai University, Thailand.



Carbon Sequestration and the Recovery of Forest Structure and Biodiversity by the Framework Species Method of Forest-Ecosystem Restoration

Stephen Elliott[1,*], Dia Shannon[1], Prasit Wangpakapattanawong[1], Pimonrat Tiansawat[1], Watit Khokthong[1], Pornpawee Laohasom[1], Worayut Takaew[1], Khuanphirom Naruangsri[1], Nay Tun Lin[1], Phyo Thet Naing[1], Htet Aung Khant[1], Tun Pyae Shan[1,2], Waiprach Suwannarat[1], Sutthathorn Chairuangsri[1]

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For more than 30 years, Chiang Mai University's Forest Restoration Research Unit (FORRU-CMU) (https://www.forru.org/) has been conducting research to adapt the framework species method (Elliott et al., 2022) to restore upland evergreen forest to the hills of northern Thailand. The method relies on selecting tree species from the reference forest ecosystem, which survive well and grow rapidly, when planted on degraded sites to complement natural regeneration. They are also selected for their ability to suppress weed growth and attract seed-dispersing animals (to enhance biodiversity recovery). We present the latest evidence to show that the method exceeds the carbon sequestration rate of natural forest regeneration and tree plantations, accelerates forest structural development and supports biodiversity recovery. Tree carbon accumulates to approximately half the reference-forest value within 10-12 years and achieves 80%+ recovery within 24 years. Soil carbon also increases, but is less clearly associated with forest age, due to land-use legacy. Forest structure rapidly approaches that of reference forest within 11 years. However, after canopy closure instrument-based method fail to reflect further increases in biomass and structural development. The species richness of both birds and mammals increases markedly, but fail to attain reference-forest levels within 24 years.

Keywords: Forest ecosystem restoration, framework species method, biodiversity recovery, carbon sequestration, forest structure

Reference:

Phil. Trans. R. Soc. B. 378 (2023) 20210073

Funding Source(s): The Next Forest, Bangkok Bank, Thailand. and Research Group Development (R68IN00045), Chiang Mai University, Thailand.



Genomic Charaterization of a Novel Thermophilic Bacillus Species from Thai Hot Springs: Biotechnological Potential for Aquaculture Applications

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[2]*Department of Fisheries and Marine Bioscience, Faculty of Biological Science and Technology, Jashore University of Science and Technology, Bangladesh*
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We aimed to isolate and characterize a novel *Bacillus* strain from Thailand's hot springs to evaluate its potential as a probiotic candidate for aquaculture applications. Finding robust probiotic bacteria that can survive extreme conditions while providing beneficial effects like biofilm inhibition and antimicrobial activity remains challenging for sustainable aquaculture practices. We isolated strain THPS1 from hot spring sediments (70°C, pH 7.9), conducted whole genome sequencing using DNBseq technology, performed phylogenetic analysis, and tested probiotic properties including spore formation, acid/bile tolerance, antibiofilm activity, and storage stability. As a result, THPS1 represents a novel thermophilic *Bacillus* species with a 5.38 Mbp genome containing 5,606 genes. The strain showed exceptional sporulation efficiency (92.21%), strong antibiofilm activity against major aquaculture pathogens (70.78% inhibition of *Vibrio parahaemolyticus*), and excellent survival under acidic conditions and bile salts. Genomic analysis revealed 12 biosynthetic gene clusters, extensive CRISPR-Cas defense systems, and unique adaptations for extreme environments. In conclusion, *Bacillus* sp. THPS1 demonstrates significant potential as a heat-stable probiotic for aquaculture, offering natural biofilm control and pathogen resistance while maintaining viability under storage conditions typical of commercial applications.

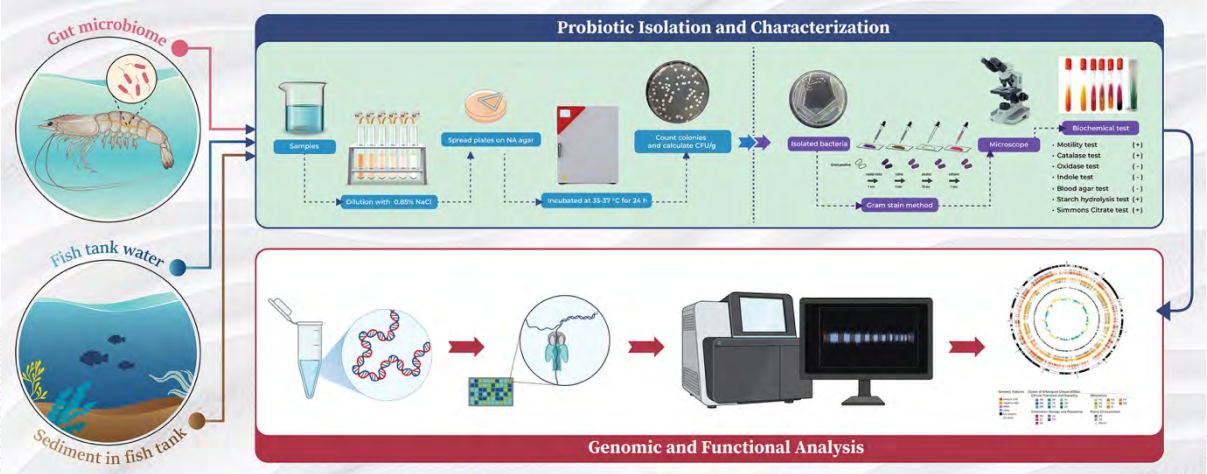
Keywords: antibiofilm activity, aquaculture probiotic, genome sequencing, hot spring bacteria, thermophilic *Bacillus*

References:

Microorganisms 12 (2024) 2476.
Journal of Fish Diseases 47 (2024) e13941

Funding Source(s): Targeted Research Fund

Graphical Abstract



Center of Excellence in Agro Bio-Circular-Green Industry (Agro-BCG)

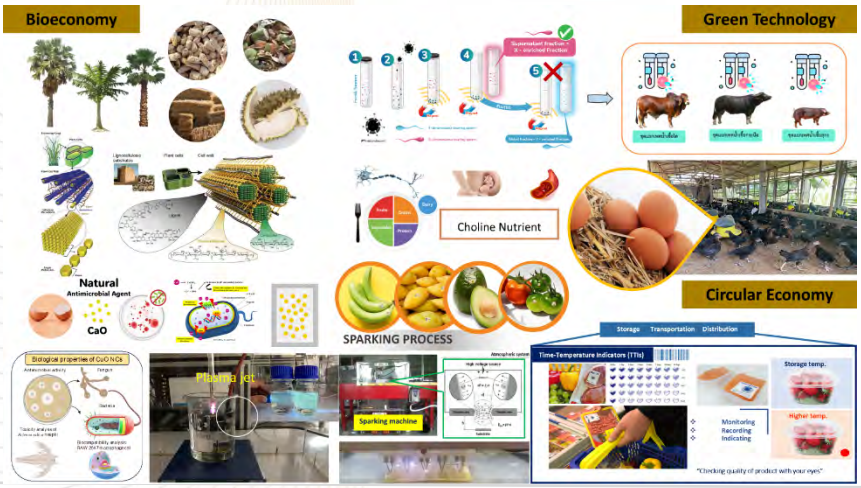
Pornchai Rachtanapun[1], Kittisak Jantanasakulwong, Noppol Leksawasdi, Yuthana Phimolsiripol, Phisit Seesuriyachan, Thanongsak Chaiyaso, Warintorn Ruksiriwanich, Pensak Jantrawut, Korawan Sringarm, Sarana Rose Sommano, Sutee Wangtueai, Julaluk Khemacheewakul, Suwit Chotinan, Siraphat Taesuwan, Suphat Phongthai, Chayatip Insomphun, Sarinthip Thanakkasaranee, Warinporn Klunklin, Pipat Tangjaidee, Niphawan Panti, Phatthanaphong Therdtatha

Center of Excellence in Agro Bio-Circular-Green Industry (Agro BCG), Chiang Mai University, Chiang Mai 50100, Thailand.
**E-mail: pornchai.r@cmu.ac.th*

Agro-Industrial BCG Research Group (Agro BCG) was established in 2020 by Prof. Dr. Pornchai Rachtanapun. He brought together faculty members from various disciplines within the Faculty of Agro-Industry and other faculties at Chiang Mai University. In 2023, this research group was elevated to become the " Center of Excellence in Agro-Bio-Circular Green Industry". Currently, it comprises 21 researchers from various faculties and collaborates with 59 institutions, including universities in Thailand and abroad, and private companies. The center plans to support research to create international-level work through the integration of cross-disciplinary knowledge. It aims to drive research into practical applications, including the establishment of start-up companies. With a robust ecosystem and mentorship system, group members rapidly advance their academic careers. Six professors, five associate professors, and five assistant professors have been promoted. Additionally, 10 researchers from the team are ranked among the top 100 at Chiang Mai University. The center has also produced 85 graduate students (Master's and Ph.D. levels). Due to his outstanding research contributions, Prof. Dr. Pornchai Rachtanapun was invited by the National Research Council to receive the "Senior Research Scholar" grant in 2024.

Keywords: Agricultural Waste, value added, Biorefinery, Agro, BCG.

Funding Source(s): Name of funding source(s)/grant(s) that support the reported work



Development of Sustainable Protein Alternatives from Local Resources: An Integrated Approach to Food Security

Sarana Sommano[1*], Yuthana Phimolsiripol[2], Bajaree Chuttong[3], Sasithorn Sirilun[4], Jomkhwan Meerak[5], Malaiporn Wongkaew[6], Nuttapon Khongdee[7], Linh Nguyen [8], Tibet Tangpao[1], Piyachat Sunanta[9], Toungporn Uttarotai[7], Nipon Mawan[7], Netnapa Makhamrueang[4], Jiraporn Sangta[10], David R. George[11], William G. Tycho Willats[12], Vassilis Kontogiorgos[13]

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Food security challenges in resource-constrained regions demand innovative protein production strategies that utilise locally available materials and reduce dependence on imported sources. This study presents a comprehensive framework for developing sustainable protein alternatives by systematically exploring underutilised indigenous resources. An extensive ethnobotanical survey was conducted to identify and evaluate local protein and polysaccharide sources, including native legumes (*Vigna* spp.), aquatic plants, freshwater algae, and biomass waste from food processing. The research focused on the extraction and characterisation of functional ingredients suitable for meat-analogue formulations. High-throughput glycoarray profiling with standardised glycans was employed to assess the functional potential of polysaccharides rapidly. Protein isolates from *Vigna* species exhibited excellent solubility, emulsifying capacity, and structural properties, making them strong candidates for integration into alternative protein matrices. The study established multiple pathways for transforming abundant yet underutilised local materials into high-value protein ingredients, supporting circular economy principles within regional food systems. Collaborative partnerships with research institutions in China, Germany, and the UK enabled access to advanced analytical techniques and accelerated method development. The findings offer viable, scalable models for local protein production that enhance food security, reduce import dependency, and promote economic growth, providing a replicable framework for diverse geographical and socio-economic contexts.

Keywords: sustainable protein alternatives, ethnobotanical survey, *vigna spp.*, glycoarray profiling, food security

Funding Source(s): Targeted Research

Sustainable Protein Alternatives from Local Resources



Food insecurity in resource-constrained regions



Ethnobotanical survey of local, underutilised resources



Extraction and profiling of functional proteins and polysaccharides



Sustainable protein ingredients for scalable, local food systems

Preparation, Characterization, and Bioactivities of Low-Molecular-Weight Protein Hydrolysates from White Jellyfish (*Lobonema smithii*)

Pysethsisoda Sang[1], Maytamart Upata[1, 2], Yuthana Phimolsiripol[1], Narongchai Autsavapromporn[3], Ruttiros Khonkarn[4], Jirawan Maneerote[5], and Sutee Wangtueai[1, 6, *]

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[4]*Pharmaceutical Sciences. Faculty of Pharmacy Chiang Mai University*
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This research aimed to prepare low-molecular-weight bioactive protein hydrolysates from white jellyfish (*Lobonema smithii*) (LMW-PHJ) through mixed enzymatic hydrolysis. Three commercial proteases—alcalase, papain, and flavourzyme—were used individually and in combinations to hydrolyze fresh jellyfish proteins. The study characterized the resulting hydrolysates and evaluated their antioxidant activities (DPPH, ABTS, hydroxyl, and hydrogen peroxide radical scavenging) as well as anti-tyrosinase activity. Hydrolysis was performed under optimized conditions using different enzyme mixtures: alcalase + flavourzyme (JFAF), alcalase + papain (JFAP), flavourzyme + papain (JFPF), and all three enzymes combined (JFAPF) at 3.0% enzyme concentration for 360 min. The degree of hydrolysis (DH), hydrolysate yield, and IC_{50} values for antioxidant and tyrosinase inhibitory activities were determined. Among all treatments, JFPF exhibited the highest antioxidant and tyrosinase inhibitory activity, with an IC_{50} value of 2.76 mg/mL for tyrosinase inhibition and the highest DH (12.70%). FTIR analysis confirmed the presence of amide A, I, II, and III functional groups, while SEM images showed a rougher surface microstructure of hydrolysate powder. Further ultrafiltration fractionation of JFPF into molecular weight ranges (10, 3, and 1 kDa) showed that Fraction IV (<1 kDa) exhibited the strongest antioxidant and tyrosinase inhibitory activities, suggesting that small peptides were primarily responsible for the bioactivities.

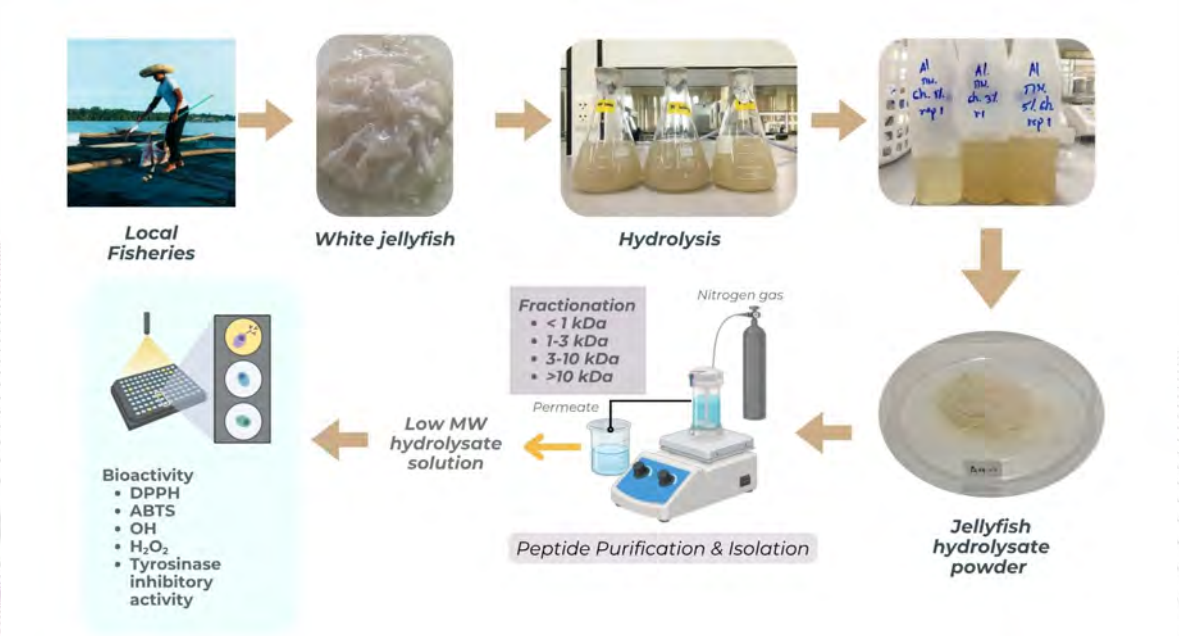
Keywords: Antioxidant activity, Anti-tyrosinase activity, Low-Molecular-Weight Protein Hydrolysates, White Jellyfish

References:

Foods 11(4) (2022) 615.
Foods 13(21) (2024) 3350.

Funding Source(s): CMU Mid-Career Research Fellowship program, Chiang Mai University

Graphical Abstract



Integrated Innovative Approaches for the Production of Premium Thai Barley Malt, Non-Alcoholic Beer, and High-Value Health-Promoting Ingredients

Wannaporn Klangpetch[1], Pipat Tangjaidee[1], Tabkrich Khumsap[1], Kridsada Unban[1], Sippawit Punyatuy[2], Suphat Phongthai[1,*]

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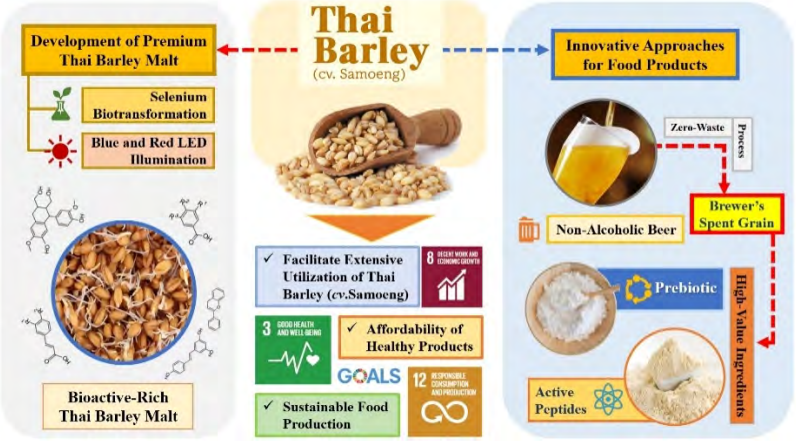
With imports projected at $226 million in 2024, Thailand's brewing industry is highly dependent on imported barley. Despite ongoing efforts to create high-quality and disease-resistant local barley varieties, research focused on improving malt quality and optimizing comprehensive grain utilization is still insufficient. This research aims to fill the existing gap by employing integrated novel approaches to produce high-quality Thai barley malt and enhance comprehensive barley utilization. This study employed three strategies: (1) selenium bio-transformation and light emitting diode illumination, (2) non-alcoholic brewing technology, and (3) emerging techniques-assisted enzymatic hydrolysis, aimed at improving malt quality, advancing beer development, and fully valorizing by-products. The methods effectively enhanced the levels of bioactive compounds, particularly seleno-polysaccharides and total phenolics, in treated barley malts. Furthermore, non-alcoholic beer with improved functional properties was successfully produced from Thai barley (*cv.* Samoeng). The derived brewer's spent grain was selectively converted into bioactive peptides (GDRLL), which exhibited significant inhibitory effects on enzymes that regulate hypertension. The xylo-oligosaccharides produced were identified as promising prebiotics, significantly promoting the growth of the examined probiotics. This study offers potential pathways for creating innovative products designed for health-conscious and alcohol-restricted consumers, while also enhancing the value of agro-industrial by-products throughout the Thai's brewing industry.

Keywords: Thai Barley Malt, Non-Alcoholic Beer, Bioactive Compounds, Peptides, Prebiotic

References:

Food Bioscience 69 (2025) 106962
Foods 14 (2025) 1515

Funding Source(s): Targeted Research Fund (R66IN00431), Chiang Mai University, Thailand.



Valorising Coffee Pulp through Biorefinery for Sustainable Applications

Sarana Rose Sommano[1,*], Sasithorn Sirilun, Chompunut Lumsangkul[3], Korawan Sringarm[4], Pipat Tangjaidee[5], Malaiporn Wongkaew[6], Pornchai Rachtanapun[5], Warintorn Ruksiriwanich[2], Phisit Seesuriyachan[5], Yuthana Phimolsiripol[5], Jiraporn Sangta[7]

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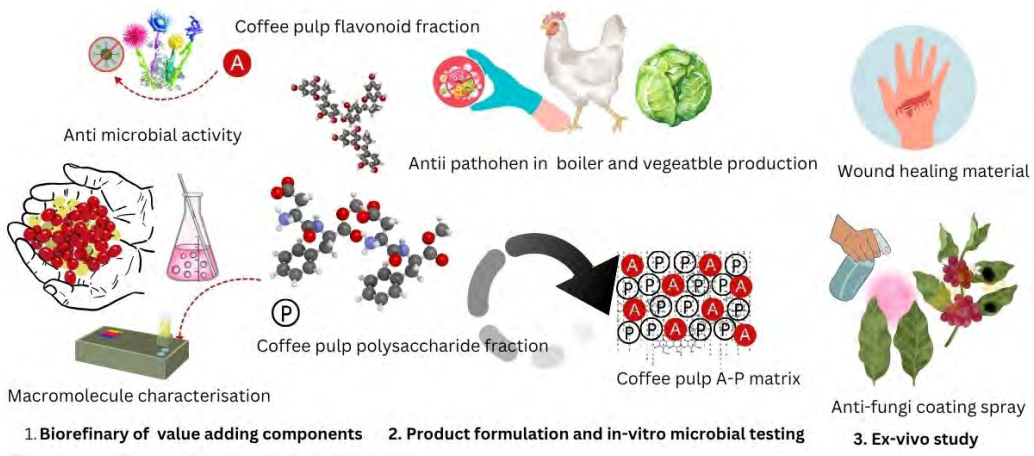
Coffee pulp, a significant byproduct representing over 50% of coffee processing waste, poses an environmental and economic challenge for both Arabica and Robusta varieties. This research presents a biorefinery approach to extract and valorise valuable phenolic and polysaccharide fractions from this underutilised resource. Utilising high-throughput glycoarray profiling, we initially screened and assessed the diverse polysaccharide compositions present in the pulp using various glycan-affinity solvents. The alcoholic extracts were particularly rich in key coffee flavonoids, including chlorogenic acid, caffeic acid, ferulic acid, epigallocatechin gallate, coumaric acid, and caffeine, which exhibit promising potential as antimicrobial agents for food and agricultural applications. Further characterisation of the isolated polysaccharides revealed a composition of 15% soluble forms and 85% lignin and cellulose. These fractions are currently being formulated into innovative products, such as cellulosic materials for wound healing applications and encapsulating agents for plant disease control. Our presentation will detail these product formulations, demonstrating a practical and impactful closed-loop, circular production model that significantly contributes to sustainability within the coffee industry.

Keywords: Biorefinery, Coffee Processing Closed- loop modelling, Pathogens, Polysaccharides

References:

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Funding Source(s): Fundamental fund 2566



Emerging fungal pathogens of highland fruit crops in Chiang Mai: First reports and molecular insights

Ratchadawan Cheewangkoon[1,*], Sukanya Haituk[1], Thitima Wongwan[1], Milan C. Samarakoon[1], Anuruddha Karunarathna[1], Tipprapa Promthep[1], Sirikanlaya Sittihan[1]

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This study investigates fungal plant diseases, including emergent pathogens, affecting economically important crops in the highland agricultural zones of Chiang Mai, northern Thailand. Through extensive field surveys and integrative morphological and multi-locus phylogenetic analyses (ITS, LSU, tef1α, and tub 2), fungal isolates were identified from 83 symptomatic plant samples across 24 families and 44 genera. Among the most notable findings, *Pseudoplagiostoma perseae* was identified as the causal agent of necrotic and discolored leaf spots on avocado (*Persea americana*), and *Pseudoplagiostoma mangiferae* was associated with leaf blotch on mango (*Mangifera indica*). These findings represent the first documented reports of these species in Thailand. Pathogenicity assays confirmed their host specificity, showing no cross-infection between hosts. In vitro fungicide sensitivity tests demonstrated 100% inhibition of mycelial growth for both pathogens when treated with carbendazim, trifloxystrobin, mancozeb, and prochloraz. Additionally, *Leptoxyphuim fumago* was recorded for the first time globally as a causal agent of coffee fruit rot. This research provides crucial molecular and geographic data that supports early detection systems and sustainable disease management strategies, especially under changing climatic conditions. The outcomes contribute to protecting high-value crops and reducing unnecessary fungicide use, aligning with the goals of long-term agricultural sustainability and biosecurity.

Keywords: Highland agriculture, Emerging plant diseases, Molecular diagnostics, Fungal taxonomy

Funding Source(s): The Presided Monitoring of Emerging Fungal Plant Diseases in the Highland Agricultural Areas of Chiang Mai Province Using Molecular Technique and the Development of Geographic Information System for Supporting the Coffee Disease Surveillance M67IN00041 and Fundamental Fund (M67IN0004), Chiang Mai University, Thailand.



Influence of Silicon Fertilizer Management and Climate Change on Grain Yield and Yield Components in a Thai Aromatic Highland Rice Variety "Buer Ner Moo"

Srirluk Toosang[1], Phukjira Chan-in[1], Benjamapohn Wangkaew[1] and Tonapha Pusadee[1,2,3*]

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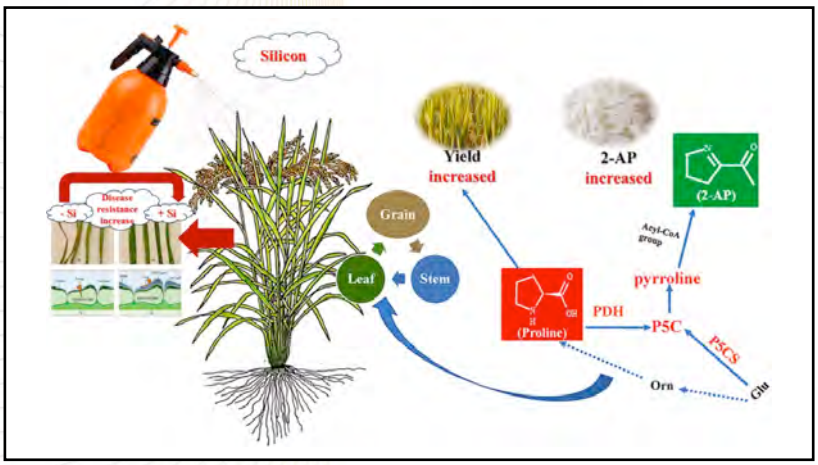
Buer Ner Moo is a Thai aromatic highland rice variety traditionally cultivated in terraced fields by local hilltribe communities under rainfed conditions. However, the productivity of this rice is increasingly threatened by rising temperatures driven by climate change, which negatively affect both grain yield and grain filling. This study aimed to assess the impacts of silicon (SiO_2) fertilizer management and elevated temperatures on grain yield and its components over two consecutive growing seasons (2023–2024). The field experiment was conducted in Ban Mae Klang Luang, Ban Luang Subdistrict, Chom Thong District, Chiang Mai Province, at an elevation of 1,200 meters above sea level. A foliar application of 225 ppm SiO_2 was administered at the booting stage. The results showed a significant increase in grain yield following SiO_2 application in both 2023 and 2024. However, despite the positive effects of silicon, the overall grain yield in 2024 decreased by 26.52% compared to 2023, while the grain filling percentage declined by 4.08%. Temperature monitoring from June to November revealed higher average temperatures in 2024, which likely contributed to these reductions. The findings suggest that increasing temperatures remain a major challenge for highland rice production, while silicon fertilization can enhance resilience and help sustain highland rice productivity under climate change.

Keywords: Climate Change, High temperatures, Silicon fertilizer, highland rice, Grain yield

References:

Crop Science 61 no. 2 (2021) 936-946.
Journal of the Science of Food and Agriculture 101 no. 1 (2021) 220-228.

Funding Source(s): Chiang Mai University



Why, How and So What!! What did SMART BEE SGDs research center do for community?

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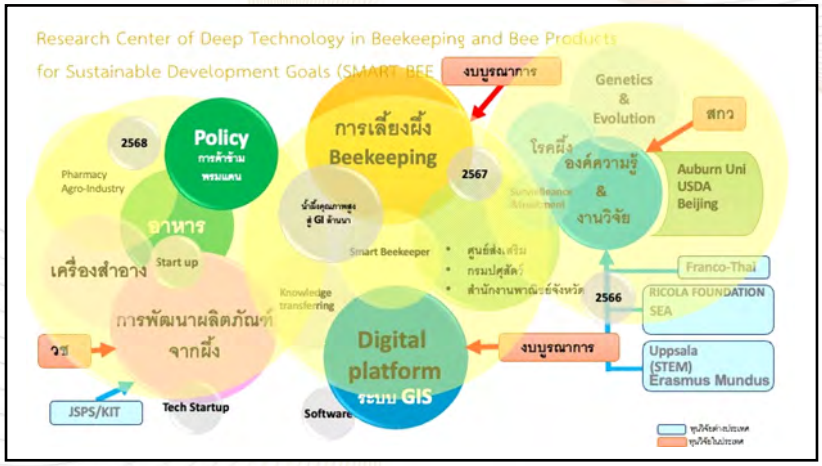
SMART BEE SDGs Research Center is dedicated to integrating diverse fields of knowledge to improve the quality of beekeeping in Thailand and around the world. Our multidisciplinary approach spans from basic science to applied innovation. In our foundational research, we discovered a new species of stingless bee. We also study the role of microbial associations in bee health, having identified both beneficial bacteria and fungi in various bee species, as well as pathogenic viruses that contribute to population decline. Product development is a key objective of our center. We have explored applications in cosmetics, food, and medicine—leading to the creation of prototypes and the publication of research findings. Additionally, we incorporate Artificial Intelligence (AI) into our research. For instance, one of our technologies, focusing on pollen image processing, has reached Technology Readiness Level (TRL) 3. We have also published work on using hive imagery for estimating bee population sizes.
Beyond laboratory research, our center is actively involved in community and policy engagement. We have organized two meetings and one symposium on bees in the Mekong region and have published policy recommendations for beekeeping in six Mekong countries.

Keywords: Bee, Multimilitary, Beekeeping, AI, Policy

References:

Frontiers in Sustainable Food Systems 8 (2024) 1420836.

Funding Source(s): Research Center supporting grant, Chiang Mai University



Research Center of Plasma Innovation for Sustainable Quality of Life

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The Research Center of Plasma Innovation for Sustainable Quality of Life (CISPlas) aims to advance the development and application of plasma technology in agriculture, healthcare, food, and materials science. In response to the pressing societal demand for reduced chemical use and environmentally friendly solutions, CISPlas brings together expertise from six faculties at Chiang Mai University and collaborates with both national and international institutions. Its core missions include the development of plasma-based prototypes, the cultivation of highly skilled human resources, and the reinforcement of academia-industry collaboration. Key activities encompass integrated research initiatives—such as cold plasma innovation for Vanda orchid cultivation and postharvest management—as well as the industrial-scale development of plasma systems for washing fruits and vegetables. CISPlas also supports capacity building through postdoctoral and post-master fellowships, while promoting the practical application and utilization of plasma technologies. Within two years, CISPlas has successfully delivered four industrial-grade prototypes, published 16 peer-reviewed articles, filed two petty patents, trained 10 researchers, and implemented two plasma-based technologies in real-world settings. In summary, CISPlas serves as a strategic driver of deep-tech plasma innovation, contributing significantly to the achievement of the United Nations Sustainable Development Goals (SDGs) through improved quality of life and sustainable national advancement.

Keywords: Plasma Technology, Cold Plasma, Agriculture Innovation, Deep Tech

References:

Horticulturae 11 (2025) 669–669.

Funding Source(s): Research Group, Research Center, and Center of Excellence Development Grants

Tannin-Tolerant *Saccharomyces cerevisiae* Isolated from Traditional Fermented Tea (Miang) of Northern Thailand and Its Feasible Applications

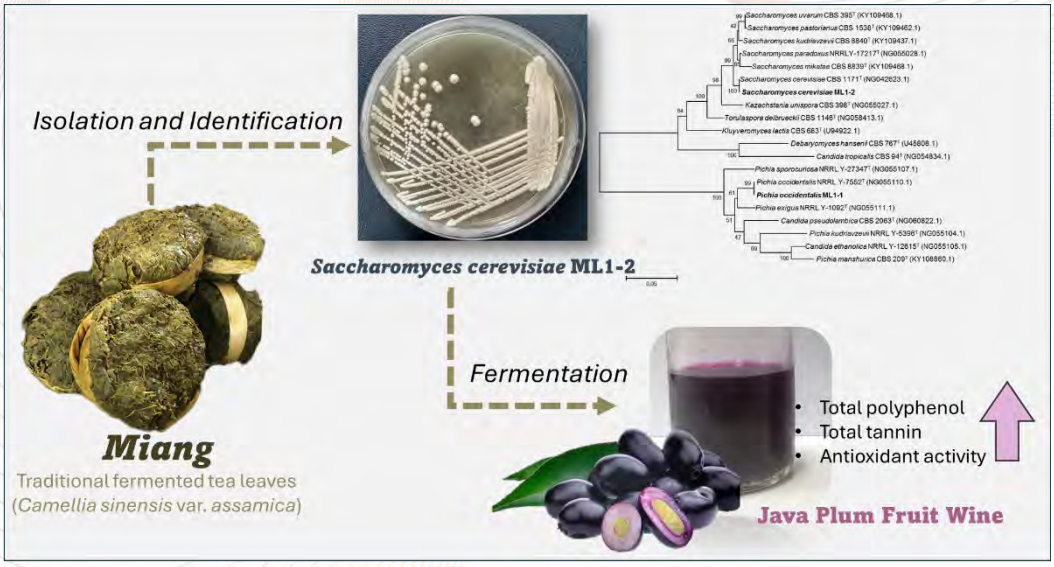
Kridsada Unban[1*], Chartchai Khanongnuch[2]
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[*]*E-mail: kridsada.u@cmu.ac.th*

This study evaluated the ability of a yeast strain isolated from traditional fermented tea leaves (*Camellia sinensis* var. *assamica*), Miang from northern Thailand. Among 43 Miang samples, 25 yeast isolates displayed gas-forming character in the presence of 1% (*w*/*v*) tannin. Only ML1-1 and ML1-2 isolates were confirmed as ethanol-producing yeast capable of tannin tolerance. These isolates were further identified to be *Pichia occidentalis* and *Saccharomyces cerevisiae*, respectively, based on D1/D2 domain sequence analysis. *S. cerevisiae* ML1-2 was selected for further studies and exhibited growth at 20–35 °C, pH 4–7, and tolerance to high sugar concentrations of up to 350 g/L. Supplementation of 1% (*w*/*v*) tannin had no effect on sugar utilization and ethanol production, while delayed sugar consumption and ethanol production were observed in the reference strain *S. cerevisiae* TISTR 5088. However, 5 and 10% (*w*/*v*) tannin showed inhibitory effects on the growth and ethanol production of the selected isolate. During the fermentation under high tannin conditions derived by mixing Java plum fruit with ground seed, *S. cerevisiae* ML1-2 showed significant advantages in growth and enhanced the content of ethanol, polyphenols, tannin, and flavonoids compared to *S. cerevisiae* TISTR 5088.

Keywords: tannin-tolerant, *Saccharomyces* sp., fermented tea, Miang, alcoholic beverage

References:
Microbiology Research 14 (2023) 1969-1983.

Funding Source(s): Junior Research Fellowship 2023, Chiang Mai University



Isolation and Identification of Antioxidant Peptides Derived from Cricket (*Gryllus bimaculatus*) Protein Fractions

Olumide Oluwatoyosi Fashakin [1], Pipat Tangjaidee [1], Kridsada Unban [1], Wannaporn Klangpetch [1], Tabkrich Khumsap [1], Korawan Sringarm [2], Saroat Rawdkuen [3], and Suphat Phongthai [1,*]

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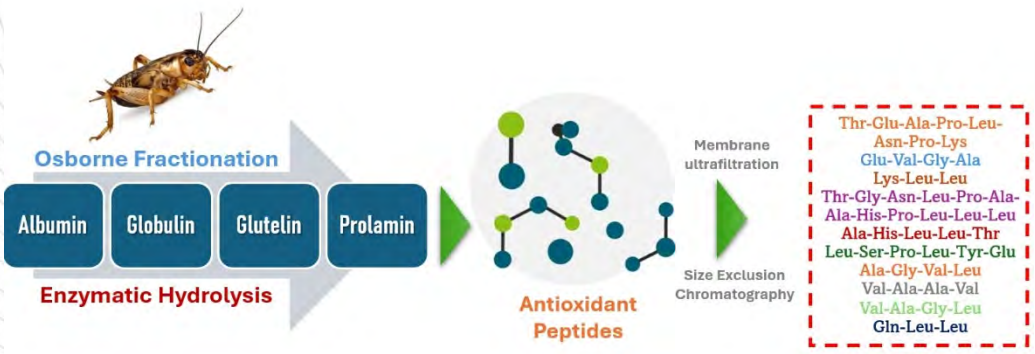
Crickets contain high protein content that can be used to improve nutrition but are less exploited. This study was conducted to isolate different cricket protein fractions using Osborne fractionation. All fractions were enzymatically hydrolyzed and characterized. The result shows that the glutelin fractions have the highest extraction yield with 53.9 ± 2.12% (p<0.05). Moreover, glutelin hydrolysate fractions prepared by Alcalase with 16.35 ± 0.29% hydrolysis degree were selected for further purification because of their high antioxidant activities, including ABTS radical scavenging activity (0.44-0.55 µmoL Trolox eq./g) and metal chelating activity (1721.99-1751.71 µmoL EDTA eq./g). Two active fractions (GA-1 (<3kDa) and GA-2 (<3kDa) were collected from the consecutive purification of glutelin hydrolysates, including membrane ultrafiltration and gel filtration. The derived fractions were analyzed by LC-MS/MS to obtain 10 peptides including TEAPLNPK, EVGA, KLL, TGNLPGAAHPLLL, AHLLT, LSPLYE, AGVL, VAAV, VAGL, QLL with a molecular weight range of 359.23-721.37 Da. The amino acid sequence shows the prevalence of hydrophobic amino acids (50-100%) such as valine and leucine in the peptide chains accounting for its high antioxidant activity. In conclusion, cricket glutelin hydrolysate prepared by Alcalase can serve as an alternative source of potent edible bioactive peptides in functional food products.

Keywords: Cricket Protein, Antioxidant Peptides, Fractionation, Bioactive peptide

References:

Insects, 14 (2023) 674.

Funding Source(s): New Researcher 2023, Chiang Mai University



Development of Fish Blood Protein Hydrolysate as a Functional ingredient and Cryoprotectant for improving the Quality of Frozen Surimi

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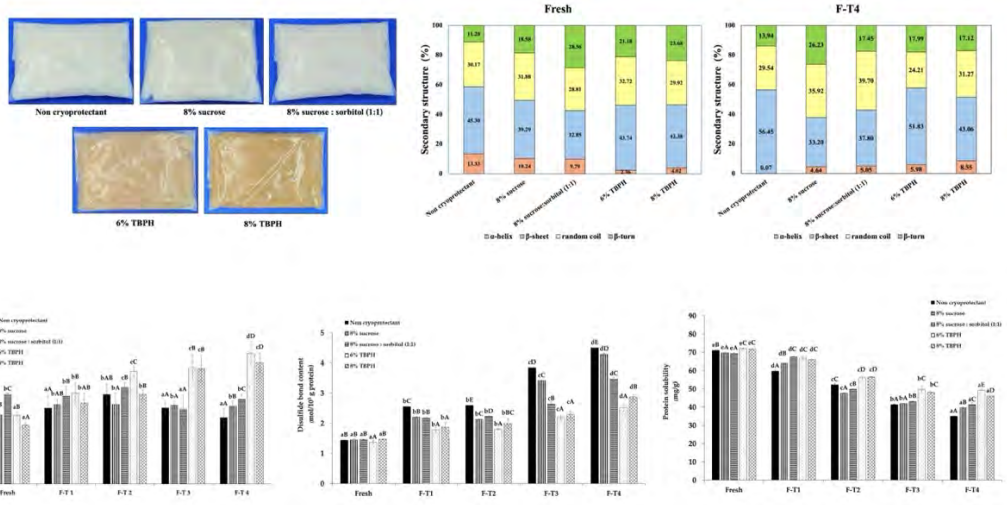
This study explored how different cryoprotectants impact protein structure in threadfin bream surimi after four freeze-thaw cycles. Researchers tested sucrose (8%), a 1:1 sucrose:sorbitol blend (8%), and tuna blood protein hydrolysates (TBPH) at 6% and 8%. Protein structural changes were evaluated by measuring salt solubility, total sulfhydryl content, disulfide bond content, and protein secondary structure. Results showed that with more freeze-thaw cycles, protein solubility and total sulfhydryl content decreased, while disulfide bond content increased across all samples. Natural actomyosin (NAM) from surimi without cryoprotectants exhibited a significant drop in protein solubility, indicating denaturation from freezing and thawing. Notably, 6% TBPH was most effective at preserving surimi protein solubility. Furthermore, NAM without cryoprotectants had the highest disulfide bond content after freeze-thaw cycles, whereas NAM with TBPH and the sucrose:sorbitol blend had the lowest. TBPH particularly excelled at inhibiting disulfide bond formation in NAM, which correlated with improved water-holding capacity. TBPH also transformed α-helix structures into β-sheet and β-turn structures, fostering a robust protein network in surimi. Additionally, TBPH demonstrated antimicrobial activity. Therefore, TBPH, especially at 6%, effectively mitigated protein degradation caused by freezing and thawing, highlighting its potential as a natural cryoprotectant and antimicrobial agent for frozen surimi products.

Keywords: Fish blood Protein hydrolysate, Cryoprotectant, Myofibrillar protein, Protein secondary structure, Freeze-thaw cycles

References:

Food and Bioprocess Technology (2025) 1-15.

Funding Source(s): CMU Junior Research Fellowship Program, Chiang Mai University.



Genetic Diversity and Population Structure of Leatherback Sea Turtles (*Dermochelys coriacea*) in Thailand Compared to Global Populations for Conservation Applications

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This study investigates the genetic diversity and population structure of leatherback sea turtles (*Dermochelys coriacea*) in Thailand and compares them with global populations to inform conservation strategies. Using 8 microsatellite loci and mitochondrial DNA (mtDNA) control region sequences from 149 hatchlings across five nesting sites in the Andaman Sea, moderate nuclear genetic diversity and low maternal haplotype diversity were observed. Three mtDNA haplotypes were identified (Dc1.1, Dc1.4, Dc13.1), all previously recorded in the Indo-Pacific, indicating Thailand's role in this lineage. Bayesian clustering revealed two genetic groups, suggesting potential cryptic population structure within Thailand. Globally, mtDNA analyses showed extremely low haplotype and nucleotide diversity, with recent radiation from the Indo-Pacific region. Despite low diversity, significant population structuring was detected, highlighting restricted gene flow and strong natal homing behavior. These findings underscore the importance of protecting localized nesting habitats and maintaining connectivity among global populations. The Thai leatherback population, although small, holds distinct genetic signatures valuable for global conservation and recovery planning of this endangered species.

Keywords: conservation genetics, Leatherback turtle, population genetics, sea turtle

References:

Diversity 14 (2022) 764.
Ecology and Evolution 15 (2025) e71014.

Funding Source(s): Targeted Research (TG R000031693), Chiang Mai University, Thailand

Fungal Pathogens Causing Postharvest Diseases in Muskmelon and Culinary Melon from Northern Thailand and Their Fungicide Sensitivity Profiles

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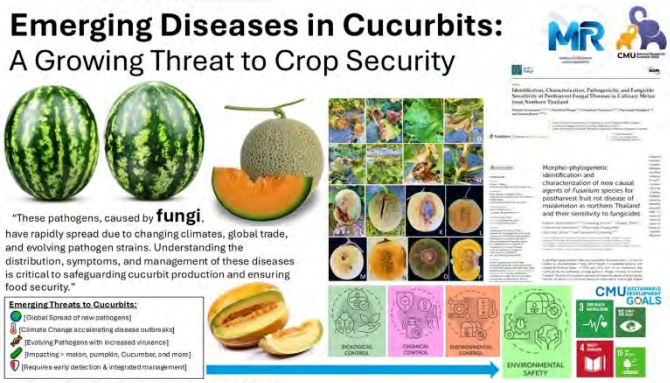
A significant global problem affecting muskmelon and culinary melon postharvest anthracnose and fruit rot are caused by phytopathogenic fungi, which results in unsaleable products and substantial financial losses. In 2022 and 2025, fungal diseases in muskmelon and culinary melon were found during the postharvest storage period in northern Thailand. The aim of this study was to isolate the species of fungi causing these diseases. All isolates of fungi were identified through a combination of morphological characteristics and molecular analyses. *Fusarium compactum*, *F. jinanense*, *F. mianyangense* and *F. sulawesiense* were identified as the causal agent of fruit rot in muskmelon. Additionally, *Colletotrichum chlorophyti* and *C. siamense* were identified as the causal agents of anthracnose, *F. sulawesiense* caused fruit rot, and *Macrophomina phaseolina* was responsible for charcoal rot in culinary melon. Pathogenicity tests were conducted, and the fungi were successfully re-isolated from the symptomatic lesions. Moreover, sensitivity tests for fungicides of each fungal species were investigated. The results indicated that sensitivity profiles varied based on the fungicides used, fungal species, and strains. This study can be beneficial in developing potential management strategies against postharvest disease of muskmelon and culinary melon caused by pathogenic fungi.

Keywords: Agricultural crops, Food Security, Fungal disease, Fungicide sensitivity, Tropical area

References:

Frontiers in Plant Science 15 (2024) e1459759
Journal of Fungi 11 (2025) e540

Funding Source(s): CMU Mid-Career Research Fellowship Program (MRCMU2566R_030 and MRCMUR2567-2_030), Chiang Mai University, Thailand.



Diversity of Macrofungi in Chiang Mai University and Their Applications

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Northern Thailand has been recognized by numerous mycologists as a hotspot for macrofungi discovery. In this study, the diversity of macrofungi in the Chiang Mai University campus was investigated during the rainy seasons from 2022 to 2024. A total of 98 specimens were collected and classified into 30 genera by using morphological characteristics and molecular data. The most frequent genus was *Agaricus*, with 18 specimens. This was followed by *Xanthagaricus* (8 specimens), *Collybiopsis* (7 specimens), *Marasmius* (6 specimens), *Micropsaliota* (6 specimens), *Russula* (5 specimens), and *Chlorophyllum* (4 specimens). Ten species were identified as edible and demonstrated antioxidant activity. Interestingly, three new species, *Crinipellis siamensis*, *Lentinus saisamorniae* and *Hymenagaricus siamensis*, were introduced. However, the other 30 specimens potentially represent new species, which require further identification. Furthermore, pure culture of *L. saisamorniae* was isolated and showed potential for commercial cultivation in the future.

Keywords: Identification, Macrofungal diversity, New taxa, Tropical area

References:
Phytotaxa 666 (2024) 135–145
Phytotaxa 705 (2025) 149–161

Funding Source(s): CMU Junior Research Fellowship Program (JRCMU2566R_089), Chiang Mai University, Thailand.



***Crinipellis siamensis* sp. nov**



***Lentinus saisamorniae* sp. nov.**



***Hymenagaricus siamensis* sp. nov.**

Role of novel prebiotics from agricultural by-products on immune and gut microbiota of zebrafish (*Danio rerio*)

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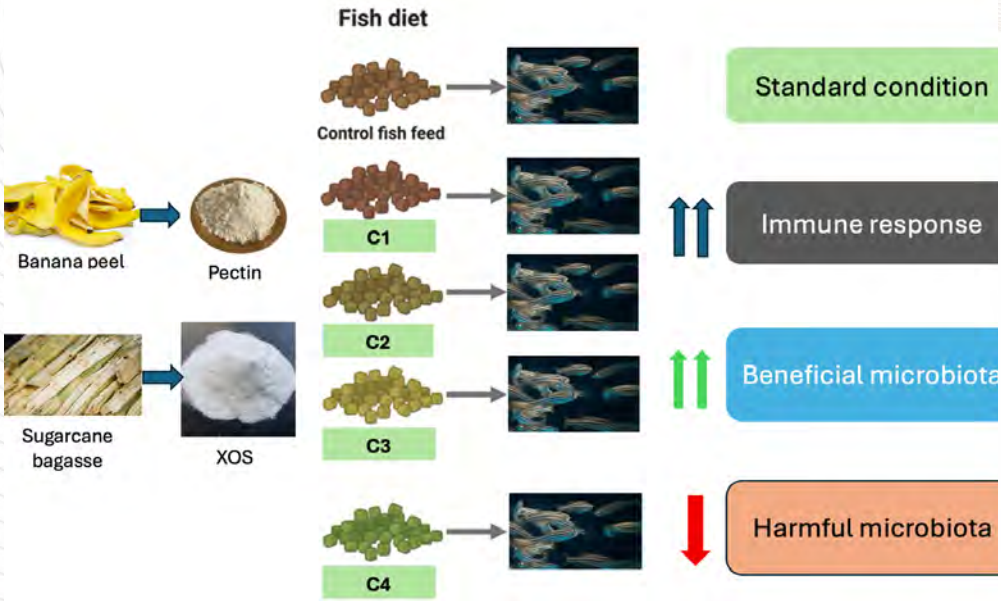
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This study evaluated the potential of pectin oligosaccharide (POS) derived from banana peel and xylooligosaccharide (XOS) from sugarcane bagasse as prebiotic feed additives to improve growth, immunity, and gut microbiota in zebrafish (*Danio rerio*). POS and XOS were extracted, characterized through proximate analysis, glycoarray profiling, antioxidant assays, and *in vitro* prebiotic activity tests. Zebrafish diets were supplemented with varying concentrations of POS or XOS for eight weeks, followed by immune-related gene expression analysis via RT-qPCR and gut microbiota profiling using metagenomic sequencing. Results showed significant upregulation of immune genes (*nfkb2, tlr4al, mpx, tfa, tgfβ1*), particularly at supplementation levels of 8–32 mg/g POS. Gut microbiota analyses revealed increased populations of beneficial bacteria (*Lacticaseibacillus paracasei*, *Bifidobacterium longum*) and reduced levels of harmful bacteria (*Escherichia coli*, *Clostridium perfringens*), yielding prebiotic index values comparable to commercial inulin. These findings demonstrate that dietary POS and XOS effectively enhance immune responses and beneficially modify the gut microbiome of zebrafish. Consequently, POS and XOS derived from agricultural by-products represent promising sustainable functional feed additives for aquaculture, promoting fish health while contributing to the sustainability and circular economy of aquaculture production.

Keywords: Prebiotics, Zebrafish, Agricultural by-products, Gene expression, Gut microbiota

Funding Source(s): Fundamental Fund; FF66



Inhibition of mastitis pathogens by microbiome in ecological mammary gland niches: development of live bacteria intra-mammary infusion in biotechnology innovation for mastitis treatment

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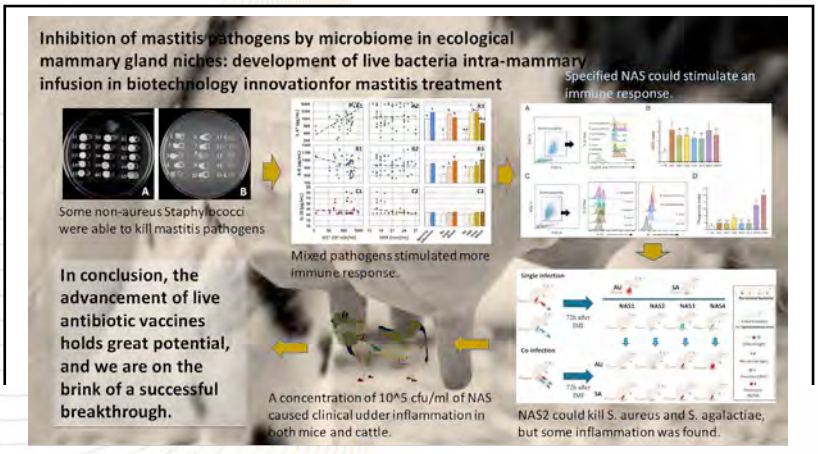
Mastitis is the most economically costly disease in the dairy industry, especially the discard of milk contaminated with antibiotics after treatment. The project aimed to develop a non-specific live bacteria vaccine that could kill mastitis pathogens and enhance udder immune responses. Firstly, various minor pathogens in the microbiome were found to possess antibiotic properties, and our study demonstrated that some non-aureus staphylococci (NAS) were capable of killing major mastitis pathogens. The specified NAS were tested for their ability to stimulate an immune response and were found to be effective in doing so, especially when combined with major pathogens. The specified strains of non-aureus staphylococci (NAS), along with Streptococcus agalactiae and Staphylococcus aureus, were experimentally introduced into mice. Certain NAS strains were found to enhance immune function and combat major pathogens. In dairy cattle, treatment of mastitis with the specified NAS was successful in some cases, but a concentration of 10^5 cfu/ml of NAS caused clinical udder inflammation in both mice and cattle. Researchers adjusted the NAS concentration to reduce symptoms, finding that 10^3 cfu/ml was effective for mouse udders, though its efficacy against major bacterial pathogens remains uncertain. In conclusion, the advancement of live antibiotic vaccines holds great potential, and we are on the brink of a successful breakthrough.

Keywords: mastitis, non-aureus staphylococci, live-bacteria vaccine

References:

Antibiotics. 12 (2023) 600.
Vet Sci. 11 (2024) 350.

Funding Source(s): Fundamental Fund, 2566-2567, Chiang Mai University (R65EX00140)



Effect of Fine Particulate Matter Exposure on Respiratory Microbiota and Disease Risk in Dairy Heifers in Chiang Mai, Thailand

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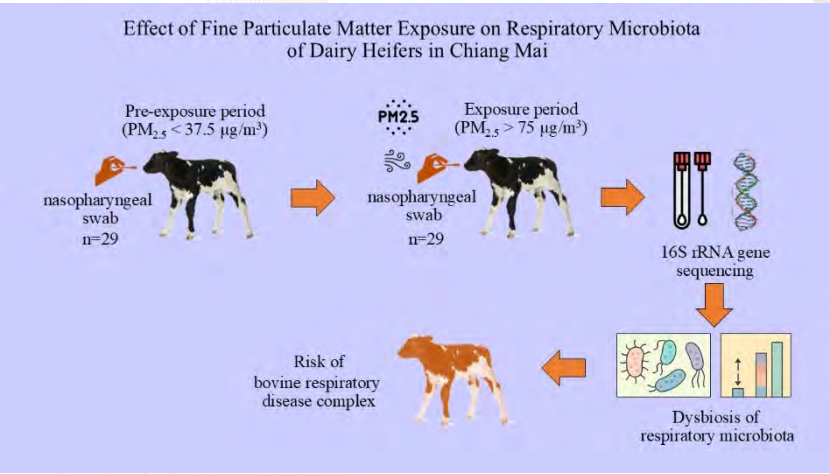
Fine particulate matter (PM2.5) contains microbiological and toxic substances that can disrupt respiratory microbiota and induce inflammation. In cattle, such disruption may impair mucosal immunity and contribute to bovine respiratory disease complex (BRDC). However, the effects of PM2.5 on the respiratory microbiota of dairy cattle remain unclear. This study investigated the impact of PM2.5 on the nasopharyngeal microbiota of dairy heifers in Chiang Mai. Nasopharyngeal swabs were collected twice from the same 29 heifers: during a period of normal air quality (PRE group) and during high PM2.5 exposure (POS group, 75 µg/m³). Microbiota profiling was performed using 16S rRNA gene sequencing targeting the V4 region. The results showed that PM2.5 exposure significantly altered microbiota composition. Alpha diversity indices indicated increased richness and evenness in the POS group ($p < 0.05$). Beta diversity analysis also revealed significant differences between the groups ($p < 0.05$). Dominant phyla included *Actinobacteriota*, *Proteobacteria*, and *Firmicutes*. In the POS group, *Mycoplasma*, *Prevotella*, and *Pasteurella* increased, while *Moraxella* and *Fusobacterium* decreased. *Pasteurella* and *Lawsonella* were the most abundant in PRE and POS groups, respectively. In conclusion, PM2.5 exposure induced nasopharyngeal microbiota dysbiosis in dairy heifers, potentially increasing susceptibility to BRDC.

Keywords: fine particulate matter, respiratory microbiome, dairy cattle, bovine respiratory disease complex

References:

Veterinary Research 53:4 (2022) 1-15.

Funding Source(s): Supported by CMU Mid-Career Research Fellowship program (Grant No. MRCMU2566R_026)



Avian Metapneumovirus (aMPV) Seroprevalence in Layer Farms in Chiang Mai Province, Thailand

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Avian metapneumovirus (aMPV) is a significant viral pathogen affecting chickens and turkeys, responsible for causing acute upper respiratory tract infections and swollen head syndrome. This disease is highly contagious and can lead to substantial economic losses in poultry flocks around the world, particularly in Asia, due to its impact on flock health and productivity, especially when compounded by secondary infections. In this study, we conducted a serological survey of chicken sera from layer farms in Chiang Mai province, Thailand, using indirect ELISA. We collected a total of 87 serum samples from pre and post-layer (15-21 and 40-56 weeks old) aMPV non-vaccinated flocks between December 2023 to February 2024, located in high-density poultry farming areas of Chiang Mai. Out of these samples, 65.52% and 67.97% tested positive for aMPV antibodies. The results suggest that commercial poultry in Chiang Mai are exposed to aMPV or that the virus has infected layer chickens. Implementing biosecurity measures and maintaining excellent ventilation practices can help reduce infections among chickens. This study provides the first serological evidence of aMPV presence in Chiang Mai, Thailand, highlighting the need for ongoing surveillance and improved management practices to protect poultry health and industry profitability.

Keywords: Avian metapneumovirus, Chickens, Layer, Seroprevalence, Indirect ELISA

References:

Avian Diseases 58(4) (2014) 623-627
World's Poultry Science Journal (2016) 72(4) 833-846

Funding Source(s): Junior Research Fellowship Program (JRCMU2566R_069), Chiang Mai University, Thailand.

Role of β-glucan on finfish and shellfish health and well-being: A systematic review and meta-analysis

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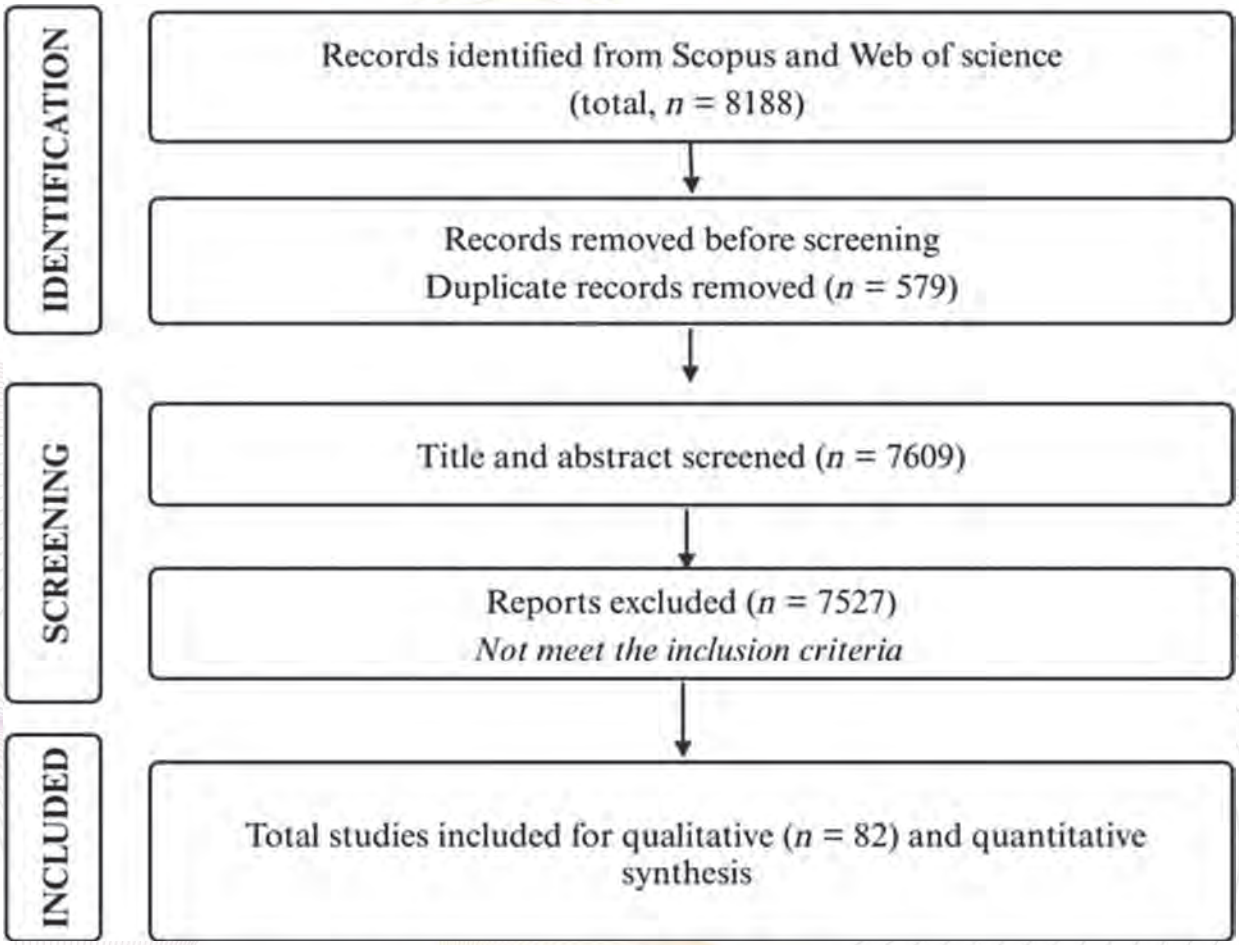
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This study aimed to conduct a systematic review and meta-analysis evaluating the inclusion of β-glucan in aquaculture animal diets and its impact on their health outcomes. Relevant studies were identified from Scopus and Web of Science databases. A total of 82 primary studies published between 1996 and 2024 were reviewed, of which 70 were included in the meta-analysis. The results revealed that the application of β-glucan to aquaculture animal's diets significantly enhanced specific growth rate (SGR; mean effect, $g = 2.71$; $p < 0.001$), feed conversion ratio (FCR; $g = -3.88$; $p < 0.0001$) and lowered mortality after exposure to pathogens. Likewise, β-glucan had a positive influence ($p < 0.0001$) on innate immune parameters (lysozyme and phagocyte activity, NBT, ACH50, and IgM). The study found that the effects of β-glucans varied among marine and freshwater fish where freshwater fishes ($g = 2.05–6.57$) exhibit better performance. This study also found a negative correlation between fish's innate immune response and trophic level, suggesting that fish with higher trophic levels may be less efficient at absorbing this bio-stimulant. Even though there were high heterogeneity ($I2 = 73\%–97\%$, $p < 0.05$) due to the diversity of tested organisms and publication bias, our model and findings are valid. The findings suggest that the dietary application of β-glucans can have beneficial effects on growth and immune responses especially for freshwater species. The validity of these observations needs to be confirmed by further prospective studies.

Keywords: Aquatic Animal, Growth Performance, Immune Response, Immunostimulants, Meta-analysis, β-glucan

Funding Source(s): Chiang Mai University, Thailand


IDENTIFICATION
Records identified from Scopus and Web of science
(total, n = 8188)
Records removed before screening
Duplicate records removed (n = 579)
SCREENING
Title and abstract screened (n = 7609)
Reports excluded (n = 7527)
Not meet the inclusion criteria
INCLUDED
Total studies included for qualitative (n = 82) and quantitative synthesis

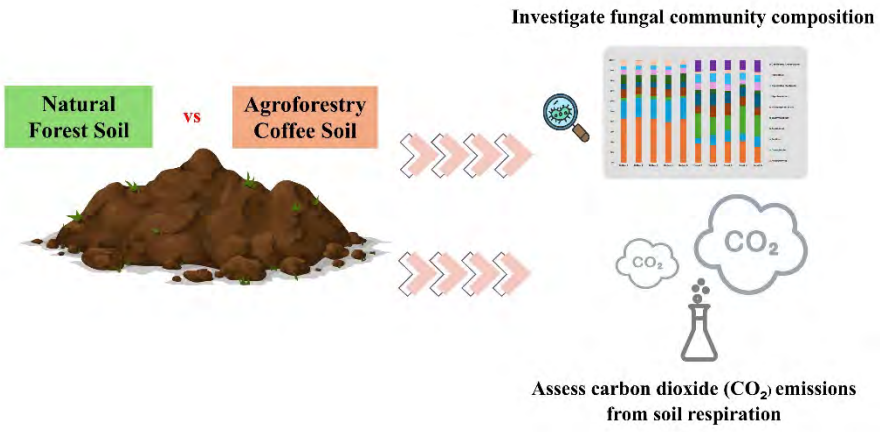
Comparative Assessment of Soil CO_2 Emissions and Fungal Diversity between Natural Forest and Coffee Agroforestry Systems

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Environmental issues, especially global warming driven by greenhouse gas emissions, significantly impact ecosystems and natural resources. This study aimed to assess carbon dioxide (CO_2) emissions from soil respiration in coffee-based agroforestry systems and to investigate fungal community composition in coffee plantations in Chiang Mai Province, Thailand. Soil respiration was measured using a closed incubation system with NaOH traps over a 25-day period to determine cumulative CO_2 emissions. Results showed that natural forest soil released more CO_2 from microbial respiration than agroforestry coffee soil. The cumulative CO_2 emission was 125.23 mg CO_2 g^{-1} dry soil in the natural forest, compared to 78.63 mg CO_2 g^{-1} dry soil in the agroforestry system. Fungal diversity at the genus level revealed distinct ecological responses. Animal parasites, mycoparasites, and plant pathogenic fungi were more abundant in agroforestry coffee plots than in adjacent natural forests, suggesting that land-use practices shape fungal community composition. These differences may affect nutrient cycling and soil health. The findings highlight the importance of appropriate land management to maintain ecosystem balance and soil fertility. This research provides valuable insights for sustainable agriculture and land use planning while supporting environmental objectives such as achieving carbon net zero.

Keywords: Coffee Agroforestry, Fungal diversity, Carbon dioxide emission, Soil respiration

Funding Source(s): CMU Junior Research Fellowship Program (No. JRCMU2566R_003), Chiang Mai University, Thailand.



2024 Report on the research relating to the 5 product developments of animal health: titanium dioxide nano-formulation, *Caesalpinia sappan*, canine platelet-rich fibrin, *Cymbopogon citratus* essential oil, and eugenol and 1,8-cineole

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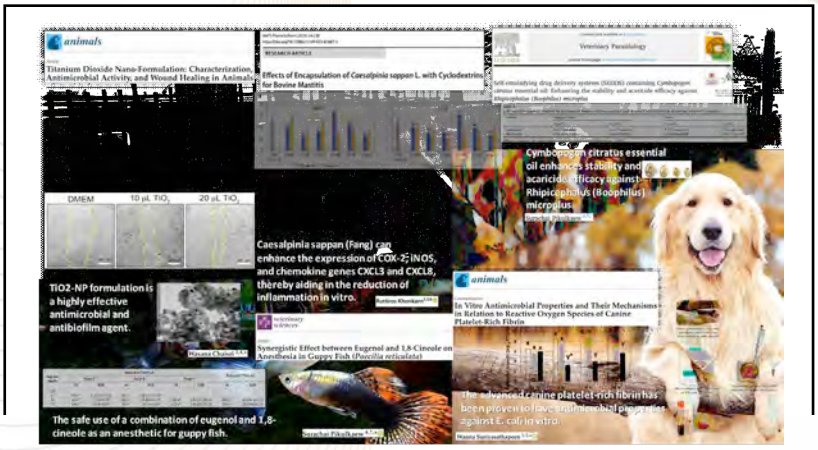
One of the objectives of the Research Center for the Production and Development of Products and Innovations for Animal Health and Production (RC-PI-AH) is to research product development aimed at enhancing animal health. In 2023-2024, 5 out of 9 studies of RC-PI-AH were involved in animal health product development, and all were approved for publication in high-ranking scientific journals in veterinary medicine. The first study found that titanium dioxide nano-formulation has the potential for use as an animal wound treatment due to its ability to suppress bacterial growth and biofilm formation, enhancing wound healing. Caesalpinia sappan (Fang) can enhance the expression of COX-2, iNOS, and chemokine genes CXCL3 and CXCL8, thereby aiding in the reduction of inflammation in vitro. The advanced canine platelet-rich fibrin has been proven to have antimicrobial properties against *E. coli* in vitro. Cymbopogon citratus essential oil enhances stability and acaricide efficacy against Rhipicephalus (Boophilus) microplus, showing promise in controlling tick populations in dairy cattle. The last study demonstrates the safe use of a combination of eugenol and 1,8-cineole as an anesthetic for guppy fish. The RC-PI-AH continues to research product development for animal health and further provides support to create commercially innovative products.

Keywords: titanium dioxide nano-formulation, Caesalpinia sappan, canine platelet-rich fibrin, Cymbopogon citratus essential oil, and eugenol and 1,8-cineole

References:

Animals 13 (2023) 2688.
AAPS PharmSciTech. 24(8) (2023) 230.

Funding Source(s): Research Groups, Research Centers, and the Research Excellence Center Fund, Chiang Mai University



Inactivation of Cattle Mastitis Related Pathogens Using Pinhole Plasma Jet Activated Water

Norrapon Vichiansan[1], Takron Opassuwan[1,2], Malinee Intanoo[2], Punnawut Yama[2], Komgrit Leksakul[1], Choncharoen Sawangrat[1,2], Tossapol Moonmanee[3], Dheerawan Boonyawan[4], Witaya Suriyasathaporn[5], Phanumas Sojithamporn[1], Tinnakorn Phongthiya[1,2,*]

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Staphylococcus aureus, Streptococcus agalactiae, Streptococcus dysgalactiae, and *Streptococcus uberis* are the main pathogens associated with cattle mastitis which is a significant disease in cattle herds. This study investigates the efficiency of pinhole plasma jet activated water on inactivation of *in-vitro* pathogens associated with cattle mastitis. The physicochemical properties of PAW and hydrogen peroxide concentration were measured. The highest concentration of hydrogen peroxide (i.e., 42.52 ± 2.83 mg/L) can be achieved with pinhole plasma jet discharge for 180 min and air flow rate of 5 L/min. According to this condition, 2.35 Log CFU/mL of *staphylococcus aureus* was inhibited, while others were completely inactivated. Scanning electron microscope was adopted to investigate the changes in morphology of pathogens. The results show damage appearances which possibly responsible by generated hydrogen peroxide in PAW. Additionally, pinhole plasma jet was then up-scale by increase the module to 12 modules for mass production of plasma activated water (PAW). Hydrogen concentration of 7.76 ± 0.17 ppm was achieved with up-scaled PAW prototype which has equal inactivation potential as chlorine (i.e., a conventional sterilization agent) to inactivate in-vitro mastitis pathogens. Therefore, this study confirms the potential of applying PAW in dairy industry as a sustainable technology.

Keywords: Cattle mastitis, Plasma activated water, Reactive oxygen species, sustainable technology, patho-gens inactivation

References:

Food Bioscience 49 (2022) 101857 - 101872.
Food Control 98 (2019) 501-509.

Funding Source: This research was partially supported by Chiang Mai University (TGCMU2566P044/ 2566).

Transcriptome analysis of porcine reproductive and respiratory syndrome virus stimulated porcine peripheral blood monocytes along with *Caesalpinia sappan* extract

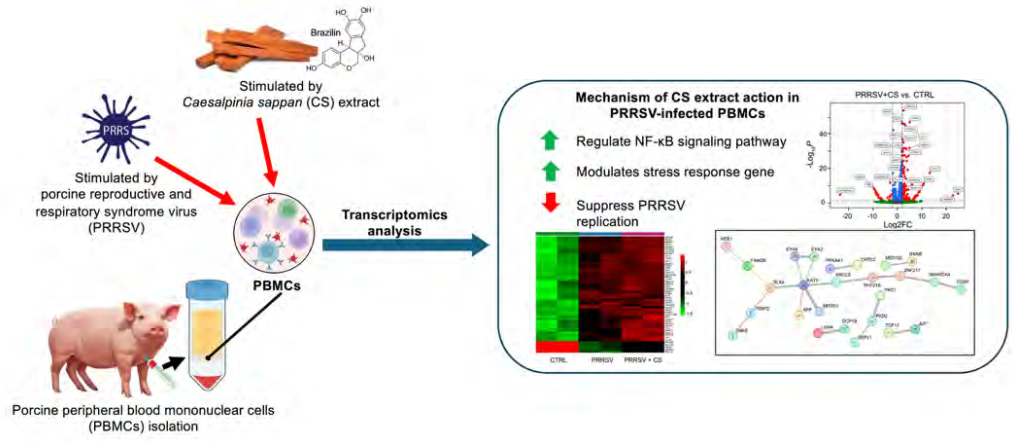
Chaiwat Arjin [1], Patipan Hnokaew [2], Patchara Tasuksai [1], Marninphan Thongkham [1], Kidsadagon Pringproa [3], Jirapat Arunorat [3], Terdsak Yano [3], Mintra Seel-audom [1], Pornchai Rachtanapun [4], Korawan Sringarm [1,*] and Phongsakorn Chuammitri [3,*]

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The objective of this study was to identify significant genes and pathways that are involved in the responsiveness of peripheral blood monocytes (PBMCs) to *Caesalpinia sappan* (CS) extract supplementation following PRRSV infection. PBMCs were isolated from six weaned piglets, and RNA sequencing was performed. The transcriptional responses that resulted were analyzed using mRNA sequencing. The PRRSV and CTRL groups, as well as the PRRSV+CS and CTRL groups, were identified as having 263 and 274 differentially expressed genes (DEGs), respectively, through differential expression analysis. The most promising candidate genes among these were ZNF646 and KAT5, which have the potential to influence the interaction between PRRSV-infected PBMCs and CS extract supplementation by regulating gene networks and cellular homeostasis during stress. The cellular response to stress pathway and the NF-kB signaling pathway were identified as two pathways that are associated with the responsiveness to CS extract supplementation. Our findings show that CS extract may activate the NF-κB signaling pathway and uncover a new mechanism for stress response in PRRSV-infected PBMCs. In conclusion, the NF-κB signaling pathway controls cellular stress caused by CS extract and influences PRRSV infection in PBMC cells. Our findings suggest that CS extract may modulate PRRSV infection.

Keywords: Transcriptomic, Porcine reproductive and respiratory syndrome virus, peripheral blood monocytes, *Caesalpinia sappan*, Pig

Funding Source(s): CMU Junior Research Fellowship Program, Chiang Mai University



CMU Annual Research Summit 2025

Oral Presentation



Herbs, Cosmetic, Supplements, Drugs, High Valued Food

Invited Speakers

ดร.พัชราภรณ์ วงษา
ผู้อำนวยการโปรแกรมบริหาร
โภชนเภสัชภัณฑ์และเวชสำอาง
ศูนย์ความเป็นเลิศ
ด้านชีววิทยาศาสตร์

ภาพรวมการพัฒนาอุตสาหกรรมสมุนไพรไทย: จากนโยบายสู่โอกาสทางธุรกิจและการเข้าถึงแหล่งทุน

ศ.ดร.ประสาท กิตตะคุปต์
สถาบันบัณฑิตศึกษาจุฬาภรณ์

การคิดหัวข้องานวิจัย เพื่อนำไปสู่การค้นพบที่สามารถตีพิมพ์ได้ในวารสารที่ดีและนำไปสู่การใช้ประโยชน์

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Biological Activities of *Oroxylum indicum* Bark Extract Associated with Degenerative Disease Prevention

Soraya Rodwattanagul[1], Pathomwat Wongrattanakamon[1,2], Siripat Chaichit[1,2], Chuda Chittasupho[1,2], Wutigri Nimlamool[2,3], Wim E. Hennink[4], Siriporn Okonogi[1,2,*]

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[2]*Center of Excellence in Pharmaceutical Nanotechnology, Faculty of Pharmacy, Chiang Mai University, Chiang Mai, Thailand.*
[3]*Department of Pharmacology, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand*
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Degenerative diseases are closely associated with oxidative stress, glycation, and chronic inflammation. This study investigates the antioxidant, antiglycation, and anti-inflammatory activities of *Oroxylum indicum* stem bark extracts, a medicinal plant widely used in traditional Asian remedies. Extracts were prepared using hexane, ethyl acetate, and ethanol, and analyzed by high-performance liquid chromatography (HPLC), which revealed key phytochemicals including baicalein, chrysin, oroxylin A, and p-coumaric acid. Among the extracts, the ethyl acetate fractionated extract (EAFE) exhibited the highest total phenolic content (172±8 mg/g) and total flavonoid content (147±1 mg/g). Correspondingly, EAFE demonstrated the strongest antioxidant activity, with Trolox equivalent antioxidant capacity of 9.7±0.1 mM/mg and β-carotene bleaching inhibition of 79.5±1.1%, compared to 3.1±0.1 mM/mg and 88.7±0.1% for quercetin. EAFE also showed the greatest antiglycation activity (89.1±0.7% inhibition in BSA-methylglyoxal assay). The data suggests a strong correlation between phenolic/flavonoid content and bioactivity. Additionally, in silico analysis indicated that anti-inflammatory potential may be due to direct interactions of bioactive compounds with the toll-like receptor 4 (TLR4). These findings scientifically support the traditional use of *O. indicum* and highlight EAFE as a promising candidate for mitigating oxidative stress, glycation, and inflammation—key factors in degenerative disease progression

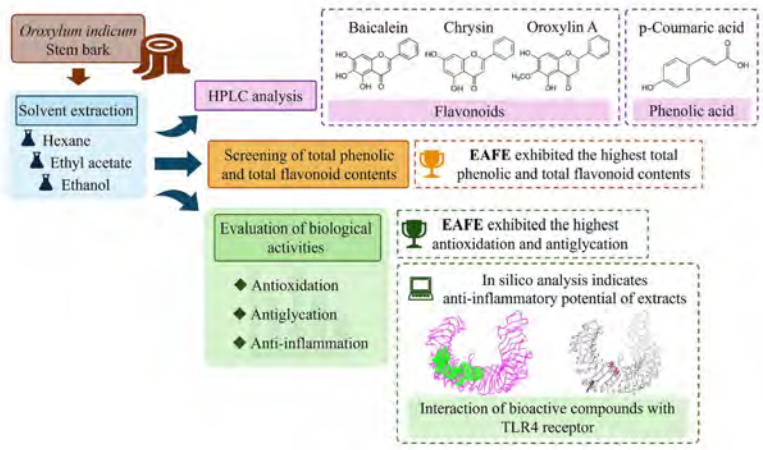
Keywords: plant extract, baicalein; chrysin, oroxylin A, quercetin, flavonoids, in silico

References:

PLOS One 20(6) (2025).

Funding Source(s):

Research group (RG) fund from Chiang Mai University, Chiang Mai, Thailand
Visiting researcher (VR) fund from Chiang Mai University, Chiang Mai, Thailand



Preventive Effects of Naturally Thai Fermented Soybean on Age-Related Diseases: Insights from Metabolome, Microbiome, and Experimental Models

Teera Chewonarin[1, *], Sivamoke Dissuk[1], Jetsada Roungsuriya[1], Patcharawadee Thongkumkoon[2], Kongsak Boonyapranai[3], Arisa Bonness[1], Pornsiri Pitchakarn[1], Ariyaphong Wongnoppavich[1], Jirarat Karinchai[1], Sirinya Taya[4], Rawiwan Wongpoomchai[1], Peraphan Pothacharoen, [1], Thanyaluck Phitak[1], Supachai Yodkeree[1],

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[2]*Center of Multidisciplinary Technology for Advanced Medicine, Faculty of Medicine, Chiangmai University Chiang Mai 50200, Thailand*
[3]*Research institute of Health Science, Multidisciplinary Research Institute, Chiang Mai University, Chiang Mai 50200, Thailand*
[4]*Functional Food Research Unit, Multidisciplinary Research Institute, Chiang Mai University, Chiang Mai 50200, Thailand*

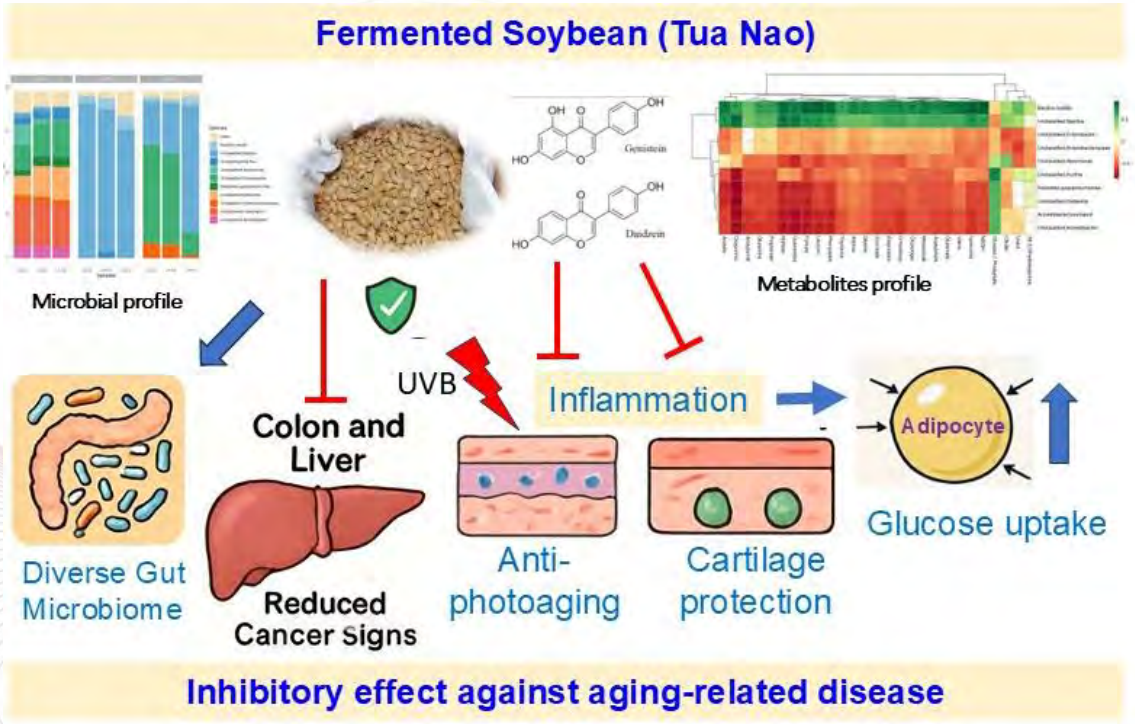
This study aimed to investigate the microbial and metabolite in the natural fermented soybean (Thua Nao) and its preventive effect against age-related diseases. Firstly, metabolomic analysis using NMR techniques identified 30 metabolites in fermented soybean, with a significant increase in several beneficial active phytochemicals. These metabolites play an essential role in inhibiting inflammatory processes and promoting the prevention of age-related diseases. By using the extract of fermented soybean, it could reduce cell death through apoptosis mechanisms, and enhance antioxidant and anti-inflammatory capacities in UVB-damaged skin cells. Moreover, key compounds in fermented soybean, such as diazein and genistein, were shown to reduce the expression of matrix metalloproteinases (MMPs) in cartilage cells stimulated by inflammation. These compounds also inhibited inflammatory signaling pathways, leading to reduced cartilage degradation and inflammation. Next, the fermented soybean dried-powder (FSB) was applied to study the preventive effect against rat liver and colon and carcinogenesis. FSB could reduce the number and size of pre-cancerous lesions in the colon (aberrant crypt foci, ACF) in carcinogen-induced rats. Additionally, it significantly inhibited the proliferation of cancer cells in the liver and colon. Furthermore, analysis of the gut microbiota in diabetic and cancer-induced mice revealed that fermented soybean caused significant changes in microbial diversity, which contributed to improved gut health. Overall, the study highlights the high potential of fermented soybean in preventing and alleviating various diseases associated with the aging process.

Keywords: Thua Nao, Metabolome, Aging-related disease, Functional food, Cosmetic

References:

Nutrients 16(20) (2024) 3506.
Int. J. Mol. Sci. 26(7) (2025) 3418.

Funding Source(s): Fundamental Fund (FF66) Chiangmai University


Fermented Soybean (Tua Nao)
Microbial profile
Metabolites profile
UVB
Inflammation
Adipocyte
Glucose uptake
Colon and Liver
Diverse Gut Microbiome
Reduced Cancer Signs
Anti-photoaging
Cartilage protection
Inhibitory effect against aging-related disease

Administration of A Probiotic Supplement Attenuates Nonalcoholic Fatty Liver Disease by Reducing Hepatic Lipid Accumulation, Oxidative Stress, and Inflammation

Pennapa Chonpathompikunlert[1], Wachirawadee Malakul[2], Pratoomporn Yingthongchai[3], Jurairat Khongrum[3,*]

[1]*Affiliation Biodiversity Research Centre (BRC), Thailand Institute of Scientific and Technological Research (TISTR), Pathumthani 12120, Thailand*

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[*]*E-mail: Jurairat.kh@cmu.ac.th*

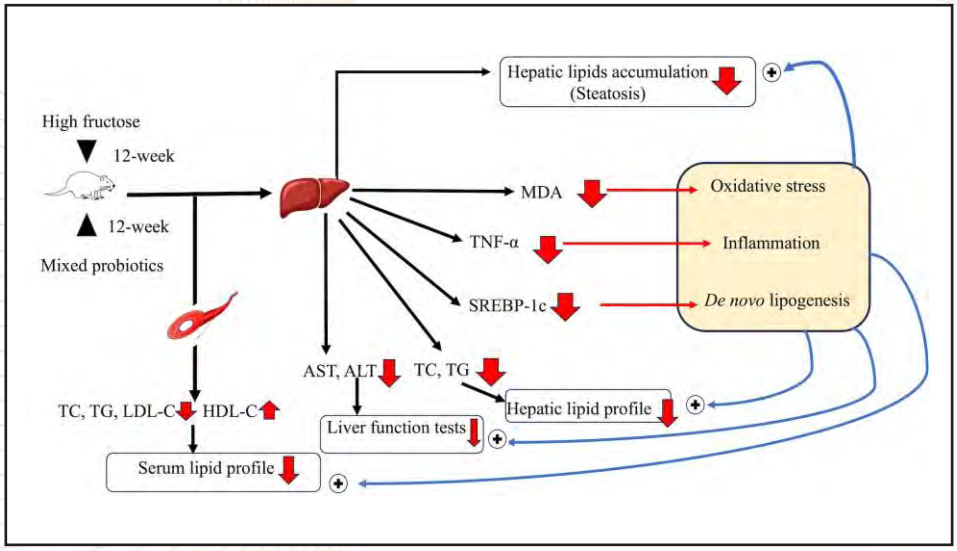
Due to the requirement for a novel and effective treatment for non-alcoholic fatty liver disease, this study aimed to determine the effects of a probiotic supplement on oxidative stress, inflammation, glucose and lipid metabolism, lipid accumulation, and liver function in the fructose-induced NAFLD rat model. A mixture of *L. zeae* TISTR 2529 and *L. reuteri* TISTR 2736 (2×10^8 CFU/mL) was administered daily to male rats with fructose-induced NAFLD from week 0 to week 12. The production of oxidative stress, expression of the TNF-α, SREBP-1c, liver enzymes, and lipid profiles, including the densities of lipid droplets in liver cells, were also evaluated. The results revealed that fructose-induced rats co-treated with the mixed probiotics had significantly decreased body weights, triglycerides, cholesterol, and liver enzymes. Furthermore, the expression of TNF-α, MDA, and SREBP-1c and the densities of lipid droplets in the liver tissue were reduced. Based on the results, the novel probiotic supplement containing *L. zeae* TISTR 2529 and *L. reuteri* TISTR 2736 might alleviate NAFLD by normalizing oxidative stress, inflammation, lipid metabolism, and lipid accumulation in the liver of NAFLD-induced model rats.

Keywords: *Lactobacillus zeae*, *Lactobacillus reuteri*, non-alcoholic fatty liver disease (NAFLD), lipid metabolism, SREBP-1c

References:

Nat Rev Gastroenterol Hepatol 7 (2010) 251–264.
Dig Liver Dis 43 (2011) 431–438.

Funding Source: CMU Junior Research Followship Program (No: JRCMU2566R_109)



Phytochemical Synergy in Nanostructures: A Dual-Action Anti-Aging and Anti-Inflammatory System of Turmeric and Green Tea

Chidchanok Prathumwon[1], Rattanaporn Khamsena[1], Wipanan Jandang[1], Songyot Anuchapreeda[2], Kanokwan Kiattisin[1], Siripat Chaichit[1,3], Wipawadee Yooin[1], Chalermpong Saenjum[1], Chadarat Ampasavate[1,3,*]

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[2] *Division of Clinical Microscopy, Department of Medical Technology, Faculty of Associated Medical Sciences, Chiang Mai University, Chiang Mai, 50200, Thailand*

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[*] *E-mail: chadarat.a@cmu.ac.th*

Curcumin (Cur), the primary active compound in turmeric, has been investigated for its anti-aging and anti-inflammatory potentials. To enhance their stability and bioactivities, the turmeric and other extract combinations were encapsulated in sustained-release nanostructured lipid carriers (NLCs). A significant enhancement in the antioxidant activities of the turmeric and green tea extract combination was observed, as demonstrated by the 2,2-diphenyl-1-picrylhydrazyl radical scavenging, ferric ion reducing antioxidant power, and lipid peroxidation inhibition assays, compared to turmeric extract alone without compromising the antioxidant activities and total phenolic content of green tea. For anti-aging and anti-inflammatory activities, the combination enhanced Sirtuin-1 protein expression and function and exhibited stronger inhibition of collagenase, elastase, and interleukin-6 (IL-6) compared to turmeric alone. When formulated NLCs into an emulgel base, the system demonstrated sustained release profiles over 48 hours, with 12.82 ± 0.99% release of Cur and 63.77 ± 5.76% release of epigallocatechin gallate (EGCG). Significantly higher skin retention of active substances was also observed after 24 hours. Therefore, turmeric and green tea extract-loaded NLC formulation can deliver the active compounds into the dermis, enhancing skin penetration, sustained delivery, and anti-aging and anti-inflammatory activities superior to turmeric as a single extract in topical formulations.

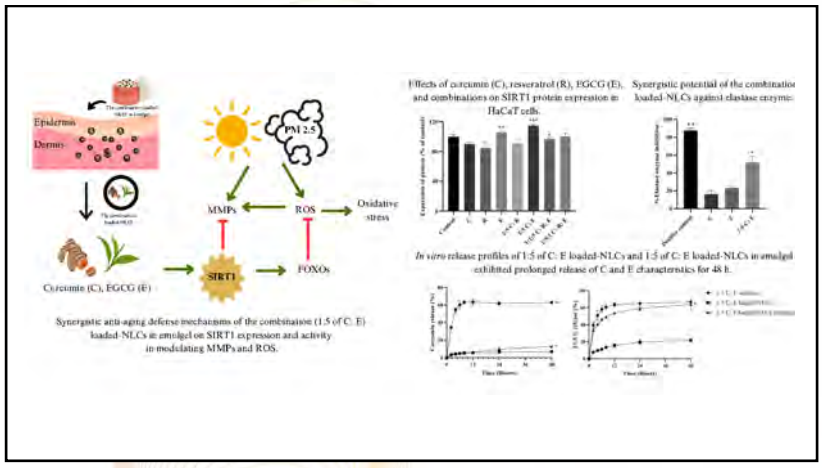
Keywords: Turmeric, Curcumin, Green tea, EGCG, Anti-inflammatory, Anti-aging, Nanostructured lipid carriers, NLCs, Combination

References:

Scientific Report. 13, (2023), 12681.

The Journals of Gerontology, Series A: Biological Sciences and Medical Sciences. 70, (2015), 959-968.

Funding Source(s): This research project was supported by Fundamental Fund 2024, Chiang Mai University (FF002/2567) and also Thailand Science Research and Innovation (TSRI) [Grant numbers FRB670083/0162]


Epidermis
Dermis
PM 2.5
MMPs
ROS
Oxidative stress
SIRT1
FOXOs
Curcumin (C), EGCG (E)
Synergistic anti-aging defense mechanisms of the combination (1:5 of C: E) loaded-NLCs in emulgel on SIRT1 expression and activity in modulating MMPs and ROS.
Effects of curcumin (C), resveratrol (R), EGCG (E), and combinations on SIRT1 protein expression in HaCaT cells.
Synergistic potential of the combination loaded-NLCs against elastase enzyme.
In vitro release profiles of 1:5 of C: E loaded-NLCs and 1:5 of C: E loaded-NLCs in emulgel exhibited prolonged release of C and E characteristics for 48 h.

Research Group: Clinical Research Center for Food and Herbal Product Trials and Development (CR-FAH), Driving Research and Innovation in Food and Herbal Products for Better Health and Wellness

Nut Koonrungsesomboon[1,2,*], Supat Jiranusornkul[1,3], Supanimit Teekachunhatean[1,2], Seewaboon Sireeratawong[1,2], Mingkwan Na Takuathung[1,2], Sunee Chansakaow[1,3], Nutthiya Hanprasertpong[1,2]

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[2]*Department of Pharmacology, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand*

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[*]*E-mail: nkoonrung@gmail.com*

Objective:
The Clinical Research Center for Food and Herbal Product Trials and Development (CR-FAH) aims to generate scientific evidence for the safety and efficacy of food and herbal products through high-quality clinical trials and to advance product development aligned with regulatory and intellectual property frameworks.

Research Problem:
Despite increasing interest in food and herbal products for health promotion, many products lack rigorous scientific validation and regulatory readiness, limiting their credibility, market access, and potential health impact.

Methods:
CR-FAH conducted a series of non-clinical and clinical studies following international standards. These studies included clinical trials, evidence synthesis, in vivo assessments, and mechanistic investigations to evaluate product safety, efficacy, and bioactivity.

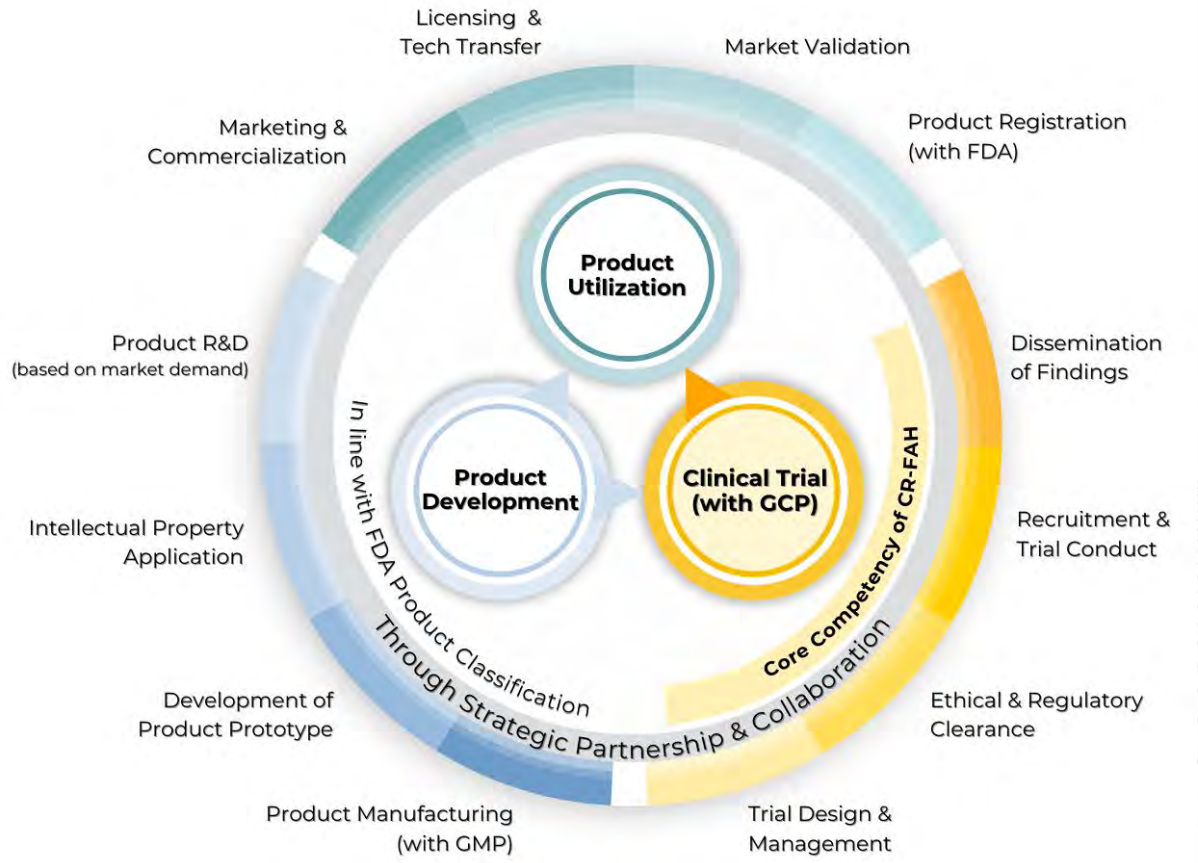
Major Findings:
Over the past year, key studies addressed (1) isoflavones for postmenopausal women, (2) Triphala's safety in animal models, (3) hepatoprotective effects of *Rhinacanthus nasutus*, (4) chitosan nanoparticles for lipid control, and (5) colostrum for immune enhancement in aging. Prototype products, such as natural sweeteners and herbal wellness beverages, are under development. Intellectual property applications were also filed for several natural-based products.

Conclusion:
CR-FAH successfully translated research into commercially viable food/herb innovations, contributing to sustainable development. These achievements reflect CR-FAH's capacity to deliver impactful solutions that enhance national competitiveness.

Keywords: Foods, Herbal products, Clinical trials, Product development, CR-FAH

References: None

Funding Source(s): This research was partially supported by Chiang Mai University.


Licensing &
Tech Transfer
Market Validation
Marketing &
Commercialization
Product Registration
(with FDA)
Product
Utilization
Product R&D
(based on market demand)
Dissemination
of Findings
Product
Development
Clinical Trial
(with GCP)
Intellectual Property
Application
Recruitment &
Trial Conduct
In line with FDA Product Classification
Through Strategic Partnership & Collaboration
Core Competency of CR-FAH
Development of
Product Prototype
Ethical & Regulatory
Clearance
Product Manufacturing
(with GMP)
Trial Design &
Management

Innovative Approaches in Green Chemical/Pharmaceutical Analysis Using Smartphone-Based Downscaling Platform

Chalermpong Saenjum[1,2*], Sutaninee apichai[1,3], Thanawat Pattananandecha[1,3], Suphakorn Katib[1,2], Kanokwan Kiwfo[1,3], Kate Grudpan[1,4]

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The development of green pharmaceutical analysis is trending to be environmentally and human health friendly to reduce the potential negative impact of chemicals and their production as well as sustainability towards UN SDGs. Various approaches involve the downscaling of analytical procedures and the replacement of harmful chemicals. Vegetable oil was developed as a natural solvent as an alternative to an organic solvent in active pharmaceutical ingredients (APIs) analysis, such as diphenhydramine and chlorhexidine. Furthermore, smartphone-based colorimetry for APIs analysis, such as ciprofloxacin, tetracycline, cefazolin, amoxycillin, ampicillin, benzalkonium chloride, and peracetic acid, was also developed for real-world applications in pharmaceutical product quality control. Using a downscaling with smartphone-based determination for green pharmaceutical analysis supported sustainable development in Thailand in terms of quality education (SDG 4) and reduced inequalities (SDG 10) and environmental sustainability (SDG 6; Clean water and sanitation, SDG 12; Responsible consumption and production, and SDG 14; Life be-low water).

Keywords: Green chemical/pharmaceutical analysis; Active pharmaceutical ingredients (APIs); Downscaling; Smartphone-based analysis; Natural solvent; Sustainability

References:

Sustainable Chemistry and Pharmacy 29 (2022) 100808.
Sustainable Chemistry and Pharmacy 73 (2024) 101411.

Funding Source(s):
Research Center Development, Chiang Mai University.
Research Center for Innovation in Analytical Science and Technology for Biodiversity-Based Economic and Society (I-ANALY-S-T_B.BES-CMU), Multidisciplinary Research Institute (MDRI), Chiang Mai University, Chiang Mai, Thailand (Grant number RG32/2567)

Novel Route toward 5-Sulfenyl-2-Iminothiazolines from 2-Mercaptobenzoxazoles with Bicyclic Amidines and Methyl Ketones

Wong Phakhodee[1,*], Muh Alfliadhi[1], Saranphong Yimklan[1], Surat Hongsibsong[2], Mookda Pattarawarapan[1]

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[2]*School of Health Science Research, Research Institute for Health Science, Chiang Mai University, Chiang Mai 50200, Thailand*
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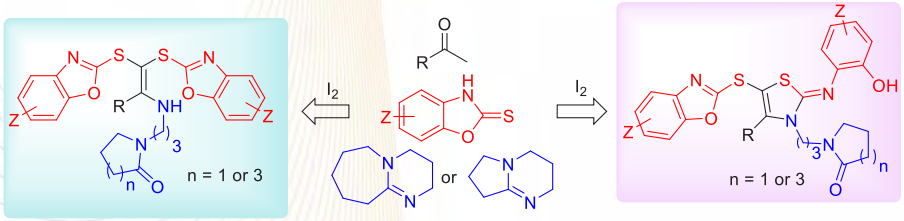
2-Iminothiazolines constitute a privileged heterocyclic scaffold with broad pharmacological potential, including antimicrobial, anticancer, and enzyme-inhibitory activities, making their efficient synthesis highly desirable in drug discovery. In this study, we report a practical approach to access 5-sulfenyl-2-iminothiazolines via an iodine-mediated sulfenylation reaction of 2-mercaptobenzoxazoles with ketones and amidine bases (DBU or DBN). These non-nucleophilic superbases are proposed to activate ketones through enamine formation, enabling bis-sulfenylation to afford bis(benzoxazol-2-ylthio)enamines incorporating ε-caprolactam or γ-lactam units. An intramolecular cyclization at elevated temperatures delivers the target 5-sulfenyl-2-iminothiazolines in a single step. This operationally simple protocol employs inexpensive reagents and tolerates diverse ketone substrates, providing a convenient route to functionalized dithioenamines and biologically relevant 2-iminothiazoline derivatives. The dual role of DBU and DBN as enamine-forming agents and reaction promoters also highlights their synthetic utility in heterocyclic construction.

Keywords: Thioenamines, Iminothiazolines, Iodine, Sulfenylation, Ketones, Amidines

References:

Asian Journal of Organic Chemistry 14(7) (2025) e202500021.
Journal of Molecular Structure 1303 (2024) 137510.

Funding Source(s): CMU Mid-Career Research Fellowship program, Chiang Mai University and the CMU Presidential Scholarship



Integrated Innovation Ecosystem for Creative Circular Economy: From Smart Sorting to Functional Beverage and Antimicrobial Materials

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[1]*Advanced Technology and Innovation Management for Creative Economy (AIMCE) research group, Faculty of Engineering, Chiang Mai University, Thailand*

[*]*E-mail: wassanai@eng.cmu.ac.th*

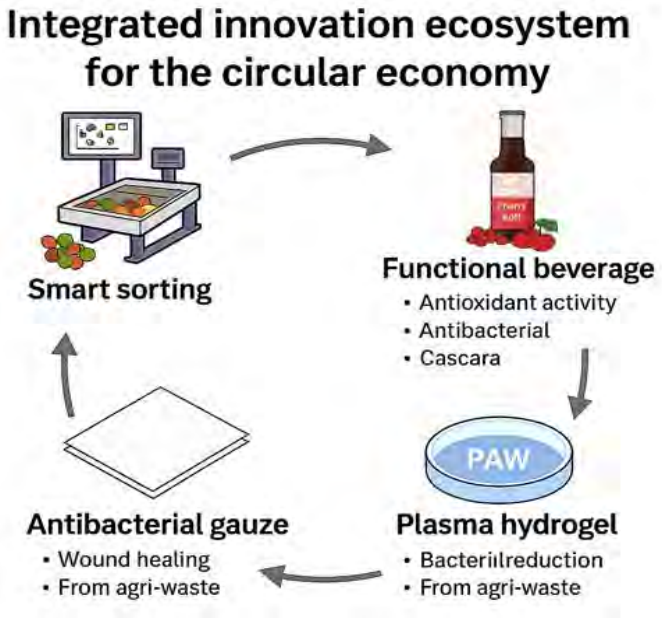
This study presents an integrated innovation framework developed by the AIMCE research group to promote the circular economy using coffee cherry as a value chain model. First, a smart sorting system utilizing computer vision was developed to classify cherries by size and color with >90% accuracy, reducing labor and improving quality. Unused cherries were then fermented to produce CherryKoff, a functional water kefir beverage with high antioxidant activity (4,214.58 µg GAE/mL) and antibacterial properties. Further, Plasma-Activated Water (PAW) was used to develop an antimicrobial hydrogel, showing >99.9% bacterial reduction and sustained hydrogen peroxide activity over 7 days. Building on this, a novel antibacterial gauze was created by coating textile substrates with natural actives derived from agri-waste, formulated to release reactive oxygen species at wound sites. The gauze design followed ISO 13485 and ISO 11607-1 standards and is undergoing pre-clinical collaboration for future regulatory approval. Together, these innovations demonstrate a circular, science-based model turning agri-waste into functional food, medical devices, and smart-farming tools — aligned with the BCG model and SDGs.

Keywords: Circular economy, Coffee cherry, Functional beverage, Plasma-activated water, Hydrogel, Antibacterial gauze, Smart agriculture

References:

LWT 219 (2025) 117539.
Food Chemistry 24 (2024) 101890.

Funding Source(s): Research Group Fund, Chiang Mai University & Agricultural Research Development Agency (Public Organization) [ARDA]



Enzymatic Xylanolysis and Assessment on Prebiotic Arabino- and Xylooligosaccharides from Defatted Rice Bran

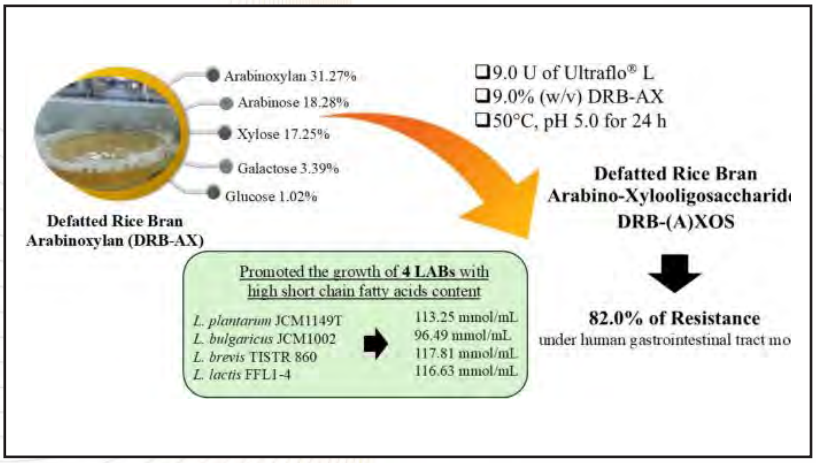
Wannaporn Klangpetch[1,*], Massalin Nakphaichit[2]
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[2]*Department of Biotechnology, Faculty of Agro-Industry, Kasetsart University, Bangkok, 10900, Thailand*
[*]*E-mail: wannaporn.u@cmu.ac.th*

Xylooligosaccharides (XOS) and arabino-xylooligosaccharides (A)XOS are prebiotic compounds widely used in functional foods to promote gut health. This study optimized alkali extraction (0.5 M NaOH, 40°C, 6 h) to arabinoxylan (AX) from defatted rice bran (DRB), followed by xylanolytic hydrolysis (50°C, pH 5.0, 24 h) using commercial xylanases (Ultraflo® L) to produce (A)XOS. The DRB-AX fraction, used as a substrate for (A)XOS production, contained 31.27% arabinoxylan, with 18.28% arabinose and 17.25% xylose. Under optimal conditions, (A)XOS yield reached 13.80%, primarily composed of xylobiose, xylotriose, 32-α-L-arabinofuranosyl-xylobiose, 33-α-L-arabinofuranosyl-xylotetraose, and some unidentified (A)XOS. Prebiotic analysis confirmed that over 80% of DRB-(A)XOS remained resistant to in vitro digestion, degrading into short chain oligomers. Furthermore, fermentation with *Lactococcus lactis* FFL1-4, *Levilactobacillus brevis* TISTR 860, *Lactiplantibacillus plantarum* JCM1149T, and *Lactobacillus bulgaricus* JCM1002 stimulated the production of beneficial organic acids, including acetic acid, propionic acid, and lactic acid. These findings highlight DRB (A)XOS as a potential prebiotic ingredient, capable of supporting gut microbiota while promoting the sustainable 34 utilization of agro-industrial byproducts in food applications.

Keywords: defatted rice bran, xylooligosaccharide, arabino-xylooligosaccharide, lactic acid bacteria, short chain fatty acid

References:
Biomass Convers. Biorefin. (2025) 1106.

Funding Source(s): CMU Junior Research Fellowship 2023 and the Science and Technology Thailand Toray Science Foundation (TTSF) 31st edition, 2024.



Anti-Pesticide Poisoning Effects of the Water Extract from *Litsea martabanica* (Kurz) Hook.f.

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One of the critical challenges faced by highland farmers is the extensive use of chemical pesticides in crop cultivation, which poses serious health risks. However, some highland communities retain traditional knowledge, including the use of *Litsea martabanica* (Kurz) Hook.f. as a detoxifying herbal remedy. Therefore, this study aimed to prepare a water extract from *L. martabanica* leaves following quality control procedures outlined in the Thai Herbal Pharmacopoeia (THP). The water extract from *L. martabanica* was evaluated for its efficacy and safety through genotoxicity, chlorpyrifos-induced toxicity, and acute toxicity tests in Sprague-Dawley rats. The results from the genotoxicity test revealed that the extract exhibited no mutagenic activity in *Salmonella typhimurium* strains TA98 and TA100. In the chlorpyrifos-induced toxicity model, rats co-administered with the extract for 16 consecutive days exhibited significant antioxidant activity and increased acetylcholinesterase (AChE) activity. Furthermore, acute toxicity assessment demonstrated that administration of the extract at a dose of 5,000 mg/kg body weight did not produce any signs of toxicity in rats. In conclusion, the findings suggest that the water extract from *L. martabanica* leaves possesses high safety and potential protective effects against pesticide-induced toxicity, supporting its further development as a prototype health-promoting product for highland communities.

Keywords: *Litsea martabanica* (Kurz) Hook.f., antitoxic effect, pesticides, medicinal plants, indigenous medicines

References:

Molecules 26(7) (2021) 1906.

Mutation Research/Environmental Mutagenesis and Related Subjects 113(3-4) (1983) 173-215.

Funding Source(s): Highland Research and Development Institute (Public Organization)


Ethnomedicinal knowledge of highland traditional healers
Highland populations practice rotational farming throughout the year
Agricultural practices that neglect the safety of chemical use
Litsea martabanica (Kurz) Hook.f.
Standardized extract
Genotoxicity test
No mutagenic activity in S. typhimurium
Chlorpyrifos-induced toxicity in rats
Antioxidant activity
AChE stimulatory activity
Acute toxicity in rats
LD50 > 5,000 mg/kg BW

Microemulsion-Based Cosmetics from *Citrus reticulata* Peel Essential Oil: A Sustainable Innovation in Skincare Development and Clinical Evaluation

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Small-sized *Citrus reticulata* fruits are often discarded due to their non-standard size and low market value, resulting in agricultural waste. This study aimed to evaluate the potential of *C. reticulata* peel essential oil, extracted by hydrodistillation, for cosmetic applications. The chemical composition was analyzed using gas chromatography-mass spectrometry. Biological activities relevant to cosmetics, including antioxidant, anti-tyrosinase, and anti-skin aging, were assessed. Safety evaluations included the hen's egg chorioallantoic membrane assay and cytotoxicity testing on human dermal fibroblasts. A microemulsion was developed and incorporated into cosmetic products. Clinical evaluations assessed irritation, efficacy, and user satisfaction. Results showed that *C. reticulata* oil, rich in limonene, demonstrated potent antioxidant, anti-tyrosinase, and anti-collagenase activities, indicating anti-aging and skin-whitening potential with no irritation or cytotoxicity. Microemulsion with droplet size of 266.5 ± 14.1 nm and narrow polydispersity index (0.396 ± 0.068) was successfully incorporated into various cosmetics, which showed significant clinical benefits: the soap reduced skin oiliness and roughness; the shampoo cleansed and softened hair; the facial cream improved wrinkles, pores, and dark spots; and the body lotion enhanced hydration and skin smoothness. Therefore, this study supported the sustainable use of *C. reticulata* peel waste to develop effective cosmetic products with added economic value.

Keywords: Citrus; Cosmeceuticals; Essential oil; Microemulsion; Orange

References: *Journal of Drug Delivery Science and Technology* 69 (2022) 103188.

Funding Source(s): Fundamental Fund 2023, Chiang Mai University (funding number: 66A104000013); CMU Presidential Scholarship 2021 for Post-Doctoral researcher.



Bioactive Potential of Acanthaceae Plant Extracts: Antioxidant Activity and Inhibition of Oral Pathogenic Bacteria

Sureeporn Suriyaprom[1,2], Pornpimon Ngamsaard[1], Varachaya Intachaisri[1], Nitsanat Cheepchirasuk[1], Aussara Panya[1,3], Thida Kaewkod[1,3], Yingmanee Tragoolpua[1,3,*]

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[2]*Office of Research Administration, Chiang Mai University, Chiang Mai 50200, Thailand*
[3]*Natural Extracts and Innovative Products for Alternative Healthcare Research Group, Faculty of Science, Chiang Mai University, Chiang Mai 50200, Thailand*
[*]*E-mail: yingmanee.t@cmu.ac.th*

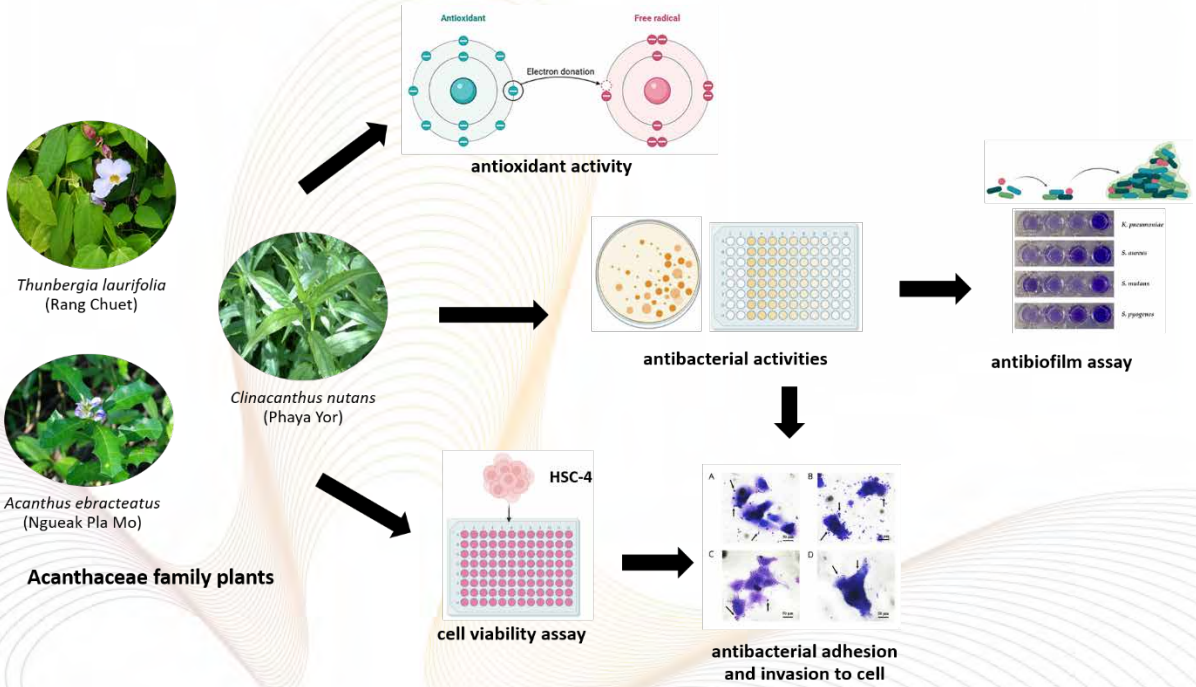
Medicinal plants, particularly those from the Acanthaceae family, possess diverse bioactive compounds and pharmacological properties, offering promising potential for developing modern therapeutics against infectious diseases, inflammation, and other health conditions. This study investigated the phytochemical composition, antioxidant activity, and antibacterial properties of leaf extracts from three Acanthaceae family plants: *Clinacanthus nutans* (Burm.f.) Lindau, *Thunbergia laurifolia* Lindl., and *Acanthus ebracteatus* Vahl. ethanolic extracts were analyzed for total phenolic content (TPC), antioxidant activity using 2,2-diphenyl-1-picrylhydrazyl (DPPH) and 2,2′-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS) assays. Antibacterial efficacy of the ethanolic plant extracts against *Streptococcus pyogenes*, *Streptococcus mutans*, *Staphylococcus aureus*, and *Klebsiella pneumoniae* using the agar well diffusion and broth dilution assays were also investigated. Ethanolic extract of *A. ebracteatus* showed the highest TPC (22.55 mg gallic acid equivalent/g extract) and the strongest antioxidant activity (IC_{50} = 0.24 mg/mL for DPPH; 3.05 mg/mL for ABTS). Antibacterial activity was observed from inhibition zones ranging from 14.7 to 17.3 mm, with minimum inhibitory concentration and minimum bactericidal concentration values of 7.81–250 mg/mL. Inhibition of the plant extracts on bacterial biofilm, the adhesion and invasion of bacterial cells on HSC-4 oral squamous carcinoma cells were also demonstrated. Notably, extracts of *C. nutans* and *A. ebracteatus* downregulated *gtfD* and *gbp* gene expression in *S. mutans*. These findings highlight the potential of Acanthaceae extracts as alternative therapeutics for bacterial infections and as functional ingredients in oral health products.

Keywords: Acanthaceae family plant, antioxidant, biofilm, oral pathogenic bacteria, *Streptococcus mutans*

References:

Plants 13(18) (2024) 2622.

Funding Source(s): Fundamental Fund 2023, Chiang Mai University [Grant No. FF66/038]


Antioxidant
Free radical
Electron donation
antioxidant activity
Thunbergia laurifolia
(Rang Chuet)
Clinacanthus nutans
(Phaya Yor)
Acanthus ebracteatus
(Ngueak Pla Mo)
Acanthaceae family plants
antibacterial activities
antibiofilm assay
HSC-4
cell viability assay
antibacterial adhesion
and invasion to cell

Development of Inhibitors and Delivery System for Anti-infective and Anti-inflammatory Therapeutics for COVID-19 via Medicinal Chemistry, Cellular Nanotechnology, and Molecular Simulations

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[2] *Department of Animal and Aquatic Sciences, Faculty of Agriculture, Chiang Mai University, Chiang Mai, 50200, Thailand*
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[4] *Faculty of Associated Medical Sciences, Department of Radiologic Technology, Chiang Mai University, Chiang Mai, 50200, Thailand*
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[7] *Department of Industrial Engineering, Faculty of Engineering, Chiang Mai University, Chiang Mai, 50200, Thailand*
[*] *E-mail: puttinan.m@cmu.ac.th; padchanee.sangthong@cmu.ac.th; panchika.p@cmu.ac.th; nuttee.suree@cmu.ac.th; hien.d@cmu.ac.th*

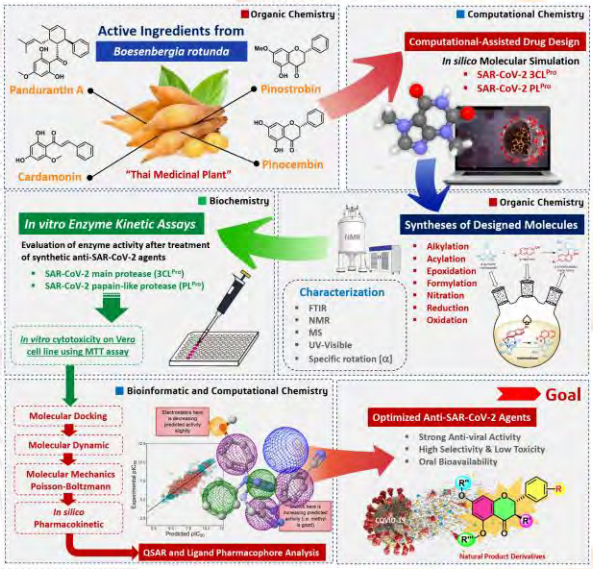
This research program aims to develop novel antiviral and anti-inflammatory agents against SARS-CoV-2 by integrating medicinal chemistry, nanotechnology, and molecular modeling. The program consists of three interrelated sub-projects. Sub-project 1 focuses on the discovery and structural optimization of antiviral compounds derived from *Boesenbergia rotunda*, employing synthetic chemistry and computational approaches to target key viral proteases such as $3CL^{Pro}$ and PL^{Pro}. Sub-project 2 is dedicated to the development of anti-inflammatory agents from Thai medicinal plants, including *B. rotunda* and *Syzygium nervosum* A., utilizing three-dimensional lung inflammation models and proteomic analyses to elucidate underlying molecular mechanisms. Sub-project 3 leverages theoretical chemistry, artificial intelligence, and structural bioinformatics to predict potential SARS-CoV-2 mutations that may impact drug efficacy. This sub-project also explores the design of peptide-based antivirals and advanced drug delivery systems for targeted therapeutic applications. Collectively, the projects contribute to the development of advanced therapy medicinal products (ATMPs) and the cultivation of high-level research capacity, in alignment with Thailand's national science, technology, and innovation (STI) policy. The integrated findings facilitate lead compound identification and the proactive design of antivirals, enhancing preparedness against emerging variants and promoting the value-added use of indigenous natural resources.

Keywords: COVID-19, antiviral agent, anti-inflammatory agent, drug delivery, molecular simulation

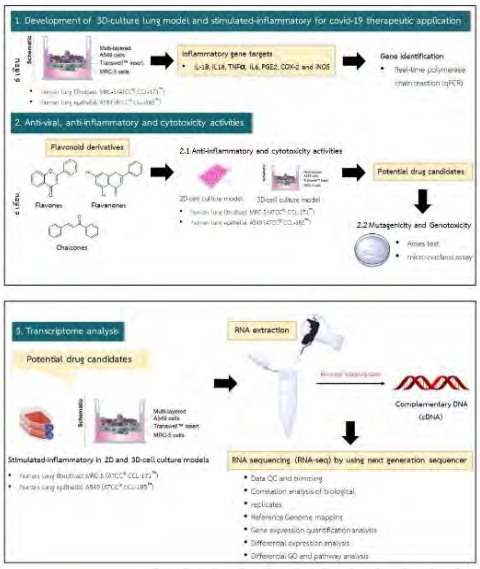
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Journal of Chemical Information and Modeling 63 (2023) 2104–2121.
Journal of Chemical Information and Modeling 64 (2024) 874–891.
European Journal of Pharmaceutics and Biopharmaceutics 195 (2024) 114166.
European Journal of Pharmacology 998 (2025) 177636.

Funding Source(s): Fundamental Fund 2023-2024, Chiang Mai University and Thailand Science Research and Innovation (TSRI)

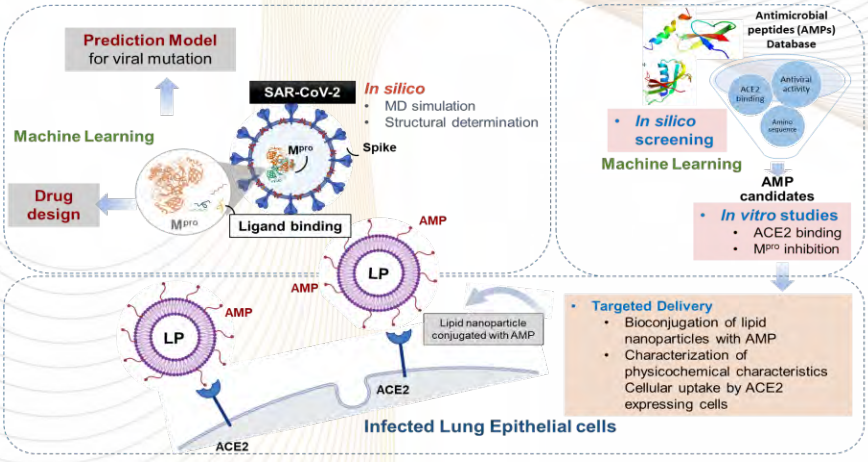
Sub-Project 1



Sub-Project 2



Sub-Project 3



Role of Anthocyanins in Protecting Chondrocytes from High Glucose Damage Through SIRT-1 and Autophagy in Diabetic Osteoarthritis

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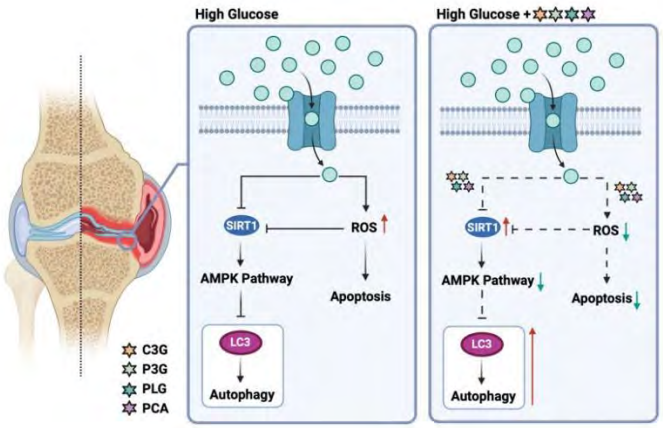
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Diabetes mellitus is a major risk factor for osteoarthritis (OA), driven by high glucose (HG)-induced inflammation and chondrocyte apoptosis, leading to cartilage degradation. This study aimed to investigate whether anthocyanins—Cyanidin-3-O-glucoside (C3G), pelargonidin-3-O-glucoside (P3G), peonidin-3-O-glucoside (P3G)—and their metabolite, protocatechuic acid (PCA), exert protective effects against HG-induced chondrocyte dysfunction. Using a type 2 diabetic rat model, human chondrocyte cultures (C28I2), and porcine cartilage explants, the study assessed the effects of HG on oxidative stress, apoptosis, and autophagy pathways. Results showed that high blood glucose levels promote a pro-catabolic and pro-apoptotic phenotype in chondrocytes of type 2 diabetes rats and high glucose levels induce oxidative stress, suppress AMPK/SIRT-1 signaling, impair autophagy, and promote apoptosis in C28I2 cells. Treatment with anthocyanins and PCA significantly attenuated these effects by reducing ROS generation, enhancing SIRT-1 and AMPK activation, and restoring autophagy. PCA also inhibited advanced glycation end product (AGE)-induced cartilage degradation in explant model. In conclusion, anthocyanins and PCA mitigate glucose-induced chondrocyte apoptosis and inflammation through modulation of AMPK/SIRT-1/autophagy pathways, suggesting their potential as therapeutic agents for diabetic OA.

Keywords: Anthocyanins, protocatechuic acid, osteoarthritis, advanced glycation end product, diabetes mellitus

Funding Source: Fundamental Fund (FF66/014)



A Dual Omics Approach Reveals How Bitter Leaf Extract Promotes Cancer Cell Death

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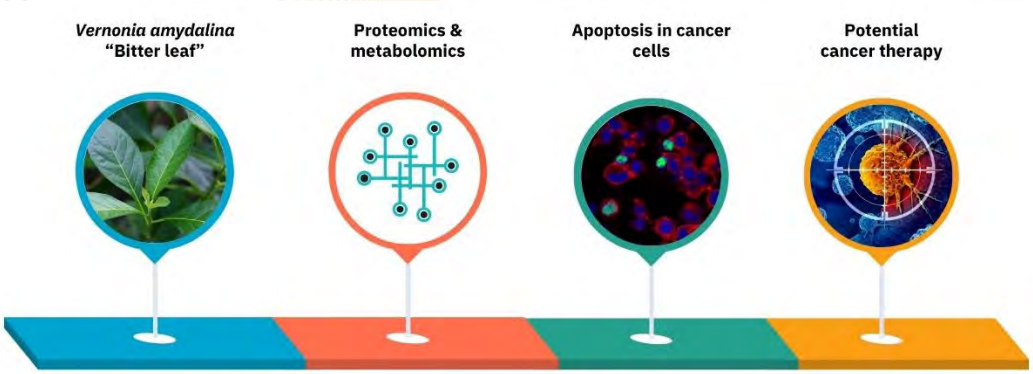
Vernonia amygdalina, a medicinal plant rich in diverse phytochemicals, has shown promising anti-cancer activity. This study explored the cytotoxic effects of its leaf extract on HeLa cervical cancer cells, utilizing metabolomics and proteomics to identify both active components and underlying mechanisms. The extract demonstrated dose-dependent cytotoxicity, with an IC_{50} of 0.767 µg/mL in HeLa cells and significantly less toxicity in normal Vero cells. LC-MS/MS analysis revealed 112 metabolites—mainly alkaloids, phenolics, and steroids—with deacetylvindoline and licochalcone B highlighted as potential bioactive contributors. Proteomic analysis showed the extract modulated stress and apoptosis-related pathways, similarly to doxorubicin, though at lower intensity. Key upstream regulators, including PTEN and XBP1, were activated, promoting apoptotic signaling. Further confirmation through annexin V/PI staining and increased expression of JNK, p53, and caspase-9 supported apoptosis as the primary cytotoxic mechanism. These findings suggest that V. amygdalina leaf extract selectively induces apoptosis in cancer cells through defined molecular pathways, highlighting its potential as a source of future anti-cancer agents.

Keywords: medicinal plants, metabolomics, proteomics, cancer, apoptosis

References:

Pharmaceuticals 17 (2024) 1-15.

Funding Source(s): Chiang Mai University/CMU Junior Research Fellowship Program (JRCMU2566R012)



Anticancer Potential of *Sophora exigua* Extracts and Nanoparticle Formulations from Traditional Thai Remedies

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This study aimed to investigate the antioxidant and anti-cancer properties of *Sophora exigua* root extracts and their active compounds. The root was sequentially extracted using hexane, ethyl acetate, and ethanol. Among the fractions, the ethyl acetate extract (SE-EA) exhibited the strongest antioxidant and cytotoxic activities. SE-EA liposomes were developed using the thin-film method for improved delivery, showing favorable nano-scale characteristics and enhanced drug release profiles. In lung cancer models, SE-EA and its active compounds–exigua- flavanone A (EGF-A), exiguaflavanone B (EGF-B), and sophoraflavanone G (SPG-G)–significantly inhibited proliferation, migration, and invasion of LPS-ATP-induced A549 and H1299 cells by suppressing the NLRP3 inflammasome pathway and related pro-inflammatory cytokines (IL-6, IL-1β, IL-18). In leukemia models (KG-1a and EoL-1), SE-EA No.010 (from Chaiyaphum province, Thailand) and its active compounds, particularly EGF-B and SPG-G, induced cell cycle arrest and apoptosis, with associated downregulation of Wilms' tumor 1 (WT1) protein. SE-EA liposomes further enhanced anti-leukemic effects and reduced the effective dose. In conclusion, SE-EA and its bioactive flavanones exert strong antioxidant and anti-cancer activities through multiple mechanisms, including suppression of inflammation and cell proliferation. SE-EA liposomes present a promising formulation for therapeutic delivery in both lung and leukemia cancer models.

Keywords: *Sophora exigua*, exiguaflavanone B, sophoraflavanone G, leukemia, lung cancer, liposome

References:

Front. Pharmacol. 14 (2023) 1243727.
Drug Discoveries & Therapies. (2024) 1-10.

Funding Source(s): Fundamental Fund 2023, Chiang Mail University, Chiang Mai, Thailand

Therapeutic Potential of *Arthrospira platensis* Extracts Against Skin Pathogenic Bacteria and Skin Cancer Cells

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Arthrospira platensis (commonly known as spirulina) is a cyanobacterium that is rich in bioactive compounds with potential therapeutic properties. This study aimed to evaluate the antioxidant, antibacterial, and anticancer activities of ethanolic and methanolic extracts of *A. platensis*. Antioxidant properties were assessed using 2,2-diphenyl-1-picrylhydrazyl (DPPH), 2,2′-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS), and ferric reducing antioxidant power (FRAP) assays. The ethanolic extract of *A. platensis* demonstrated the highest antioxidant activity by 8.96 ± 0.84 mg gallic acid equivalent per gram of extract (mg GAE/g extract), 53.03 ± 4.21 mg trolox equivalent antioxidant capacity per gram of extract (mg TEAC/g extract), and 48.06 ± 0.78 mg TEAC/g extract as determined by DPPH, ABTS, FRAP assays, respectively. Moreover, the ethanolic extract showed the highest total phenolic and flavonoid compound contents by 38.79 ± 1.61 mg GAE/g extract and 27.50 ± 0.53 mg of quercetin equivalent per gram of extract (mg QE/g extract). Gallic acid and quercetin in the extracts were also determined by HPLC. Antibacterial activity against skin pathogenic bacteria, including *Staphylococcus aureus*, methicillin-resistant *S. aureus* (MRSA), and *Pseudomonas aeruginosa*, was evaluated by agar well diffusion and broth dilution methods. The ethanolic extract of *A. platensis* significantly inhibited bacterial growth and biofilm formation. Minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) ranged from 31.25 to 125 mg/mL. Anticancer activity was also assessed in A375 human melanoma cells. Both extracts induced apoptosis by upregulating caspase-3, -8, and -9. These findings highlight the potential of *A. platensis* extracts as natural agents with antioxidant, antibacterial, and anticancer properties for treatment of skin infections and skin cancer. The ethanolic extract showed the highest antioxidant activity

Keywords: antibacterial, anticancer, antioxidant, *Arthrospira platensis*, skin pathogenic bacteria, spirulina

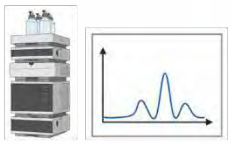
References:

Biology 14(5) (2025) 502.

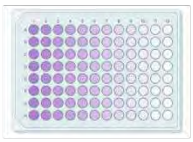
Funding Source(s): Targeted Research [Grant No. TGCMU2566P017/2566] and National Research Council of Thailand (NRCT) [Grant No. N41A640332]



Arthrospira platensis
(spirulina)

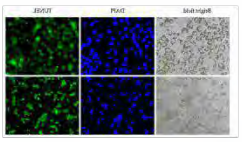


High-performance
liquid chromatography
(HPLC)

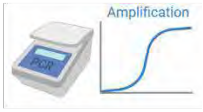


Cell viability assay:
A375 cell line

Apoptotic gene expression on A375 cells



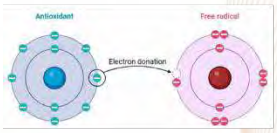
TUNEL



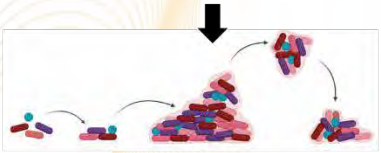
Real-time PCR



Antibacterial activity



Antioxidant activities



Antibiofilm assay

Effects of Genistein Plus Bakuchiol and Vitamins (GEN+) on Male Facial Skin: A Randomized Controlled Trial

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Increasing life expectancy, especially in Asia, has led to a rapidly growing aging population. Coupled with year-round ultraviolet (UV) exposure, this accelerates cutaneous aging. Male skin also presents distinct aging patterns due to its structural characteristics. This study aimed to investigate the efficacy and safety of a skincare formulation containing Genistein, Bakuchiol, and Vitamins (GEN+) on male facial skin. A 12-week randomized, double-blind, placebo-controlled trial was conducted in 80 men aged 45–65 years. Participants were assigned to apply either GEN+ or placebo (PLA) twice daily. Skin parameters—including tone, pigmentation, spots, redness, acne, elasticity, hydration, barrier function, and wrinkles—were assessed at baseline and weeks 4, 8, and 12. Results showed that GEN+ significantly improved cheek brightness (mean difference [MD] = 0.55, p = 0.04), color consistency (MD = –0.56, p = 0.03), and reduced forehead spots (MD = –0.60, p = 0.03). Improvements in skin roughness were also observed. No significant changes were noted in melanin, erythema, or acne. Mild, self-limiting adverse events occurred. In conclusion, GEN+ demonstrated measurable improvements in facial skin appearance and was well-tolerated, supporting its potential as a targeted skincare solution for men.

Keywords: Genistein; Bakuchiol; Male skincare; Randomized-controlled trial

References:

Journal of Clinical Medicine 12(4):1326 (2023) 1-13.
Journal of Functional Foods 113:106055 (2024) 1-9.

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CMU
CHIANG MAI UNIVERSITY
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Faculty of Medicine
Chiang Mai University
Topical Genistein Plus Bakuchiol and Vitamins (GEN+)
Product for Male Facial Skin
Increased cheek skin brightness
Increased color consistency
Decreased forehead spots
GEN+
Product for men
Genistein
(Glycine max)
Bakuchiol
(Psoralea corylifolia)
GEN+
GENISTEIN PLUS FOR MEN
GEN+
LUMINESCENCE FACIAL SERUM
GLOWING UP YOUR RADIANT SELF-CONFIDENCE
30 ML / 1 FL OZ

Transethosome to Enhance the Anti-Acne Potential of *Bouea macrophylla* Seed Extract: A Focus on Targeted Delivery, Antibacterial Action, and Skin Permeation

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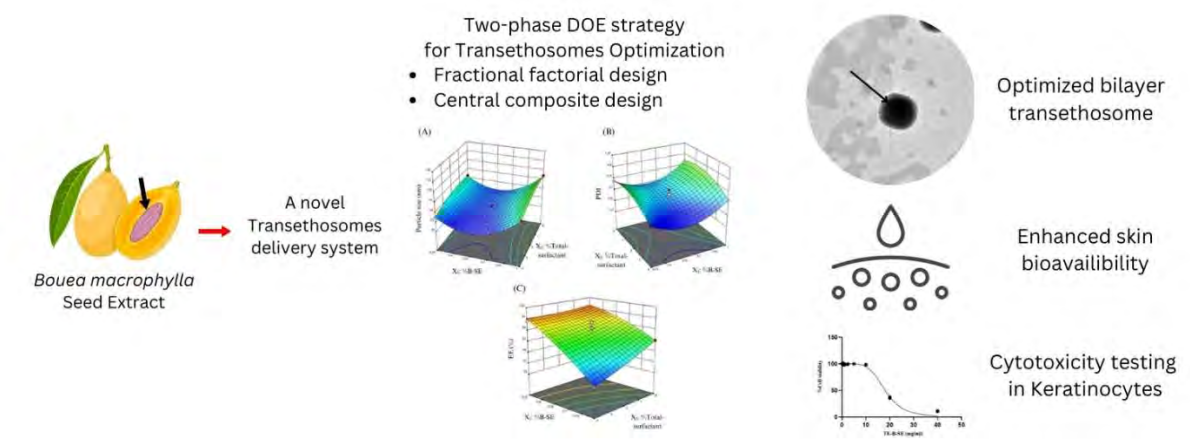
This study aims to systematically develop a transethosome-encapsulated *Bouea macrophylla* seed extract (B-SE) to improve overall performances of the extract. Initially, %co-surfactant, types of co-surfactant, %B-SE, %total surfactant, and %phospholipid were screened by a Fractional Factorial Design (FFD). Significant factors were then included in the Central Composite Design (CCD) to optimize the transethosome, aiming for small particle size, narrow polydispersity index (PDI), and high entrapment efficiency (EE). The optimal formulation was then characterized for its morphology by transmission electron microscopy (TEM) and its anti-*Cutibacterium acnes* activity by agar well diffusion. Additionally, *in vitro* release and skin permeation studies were determined. Cytotoxicity to the HaCaT cell was also conducted. From the FFD, the type of co-surfactant chiefly influenced particle size and PDI, with %contributions of 18.13% and 47.93%, respectively. From CCD, %extract and %total surfactant significantly impacted the particle size, PDI, and EE of the system. Besides, the optimal transethosome contained spherical particles with a size of 89.83±2.58 nm, a PDI of 0.299, and an EE of 92.221%. Furthermore, the optimal formulation inhibited *C.acnes* with an inhibition diameter of 15.14 ± 0.68 mm. To conclude, the developed transethosome presented desirable attributes which has the potential to be an advanced anti-acne cosmetic.

Keywords: *Bouea macrophylla* seed, Transethosome, Anti-acne, Response surface methodology

References:

J. Oleo. Sci. 71(10) (2022) 1521-1530.
Heliyon 5(7) (2019) e02052.

Funding Source(s): CMU Junior Research Fellowship Program



Comparative Study of Borneol and Myristic Acid-Based in Situ Forming Matrices Activated by Bi-Mechanisms for Hydrophilic Drug Delivery

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This study explores an emerging approach in drug delivery by employing in situ forming matrices (ISMs) based on small molecules instead of conventional polymeric systems. Due to limited understanding, managing the behavior and performance of these ISMs presents challenges. A comparative study was conducted to evaluate the physical properties and system performance of borneol and myristic acid-based ISMs using n-methyl-2-pyrolidone (NMP) and dimethyl sulfoxide (DMSO) as solvents. The ISMs were activated by bi-mechanisms (solvent exchange and crystal growth) to assess their potential as drug carriers for hydrophilic compounds, amoxicillin and clavulanate combination. Contact angle, surface tension, and viscosity of samples were measured. The performance of preparations was then evaluated as follows: matrix formation behavior, completeness of self-forming, and antimicrobial activity against *Staphylococcus aureus, Porphyromo-nas gingivalis,* and *Aggregatibacter actinomycetemcomitans*. All formulas showed contact angles less than 29.17±0.56 and 38.91±0.87 deg on glass slides and agarose (0.6% phosphate buffer), respectively. Borneol-based ISM surface tension in the range of 31.46 ± 0.17 to 36.78 ± 0.19 mN/m was significantly higher than that of myristic acid ISMs in both solvent systems, either drug loaded or non-drug-loaded. Borneol ISMs showed higher sensitivity to water (3.59±0.35 to 12.76±0.29% water). All preparations showed quite low viscosity (the highest value was 40% w/w drug-loaded myristic acid ISMs in DMSO, 9.95±0.08 cPs). Both ISMs show rapid transformation within 1 minute. However, myristic-based models showed faster completion. All the preparations showed antimicrobial activity. This would be beneficial for subsequent research and development efforts on ISMs induced by bi-mechanism.

Keywords: borneol; myristic acid; in situ forming systems; bi-mechanism

References: None

Funding Source(s): None

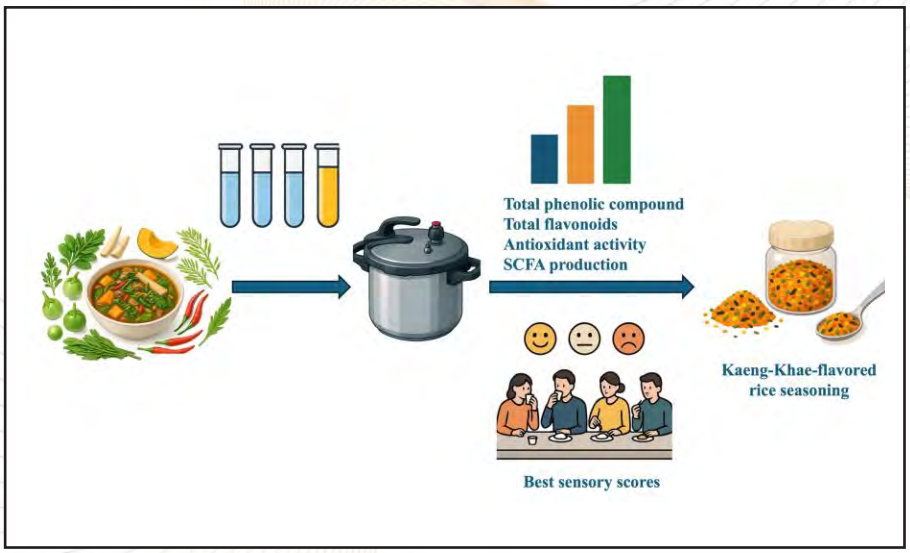
Pressure Cooking Enhances Bioactive Compounds in Rice Seasoning Applications

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This study aimed to develop a health-oriented product from Kaeng-Khae, a traditional Northern Thai dish, using the most bioactive-rich local curry paste. Among four formulations, curry paste from Mueang District, Chiang Mai, demonstrated significantly higher flavonoid content and antioxidant activity ($p < 0.05$), and was selected as the prototype. Product development tested varying amounts of curry paste (50–150 g per 3 L water); the 50 g formulation had the lowest sodium content (0.50 ± 0.01%), while maintaining high total phenolic levels and receiving the highest consumer acceptance. Pressure cooking for five minutes maximized retention of total phenolics (27.17 ± 1.59 mg GAE/g), flavonoids (19.66 ± 1.39 mg CE/g), and antioxidant activity (IC_{50} = 2.12 ± 0.11 mg/mL), and significantly increased chlorogenic acid and naringenin. This method also enhanced short-chain fatty acid (SCFA) production by colonic microbiota. Of all products, the Kaeng-Khae-flavored rice seasoning exhibited the highest bioactive compound levels and the best sensory scores, indicating strong potential as a commercial functional food.

Keywords: Kaeng-Khae, Traditional curry paste, Antioxidant activity, Pressure cooking, Prebiotic

Funding Source(s): Fundamental Fund 2023, Chiang Mai University and Thailand Science Research and Innovation (TSRI).



CMU Annual Research Summit 2025

Oral Presentation



Health and Well-being, Aging Society, Pandemics

Invited Speakers

ศ. (เชี่ยวชาญพิเศษ) ดร.ทพญ.สิริพร ฉัตรทิพากร คณะทันตแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่	Obesity Induces Premature Brain Aging: How to Intervene
ศ.ดร.นพ.ดำเนินสันต์ พฤกษากร คณะแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่	Building institutional readiness: Ecosystem of genomics for precision medicine

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Research Group of Functional Food for Well-being

Sanchai Jaturasitha[1]*, Jiraporn Tocharus[2], Chainarong Tocharus[2], Anusorn Lungkaphin[2]
Jetsada Ruangsuriya[2], Rawiwan Wongpoomchai[2†], Sukanya Mahatheeranont[3], Phumon Sookwong[3]
Hien Van Doan[4], Chompunut Lumsangkul[4], Charatda Punvittayagul[5]
Jurairat Khongrum[1], Sirinya Taya[1], Phatthawin Setthaya[1]
[1]*Multidisciplinary Research Institute, Chiang Mai University, Thailand* [2]*Faculty of Medicine, Chiang Mai University, Thailand* [3]*Faculty of Science, Chiang Mai University, Thailand* [4]*Faculty of Agriculture, Chiang Mai University, Thailand* [5]*Faculty of Veterinary Medicine, Chiang Mai University, Thailand*
**E-mail: sanchai.j@cmu.ac.th*

Research Group of Functional Food for Well-being, under the Multidisciplinary Research Institute, integrates expertise technological and health disciplines to advance research in functional foods and ingredients. Within one year, the Research Group achieved key outcomes: (1) develop internationally recognized publications (9 in Q1, 3 in Q2); (2) Petty Patent for an innovative white turmeric milk tablet, submitted for utility model registration; (3) Develop a commercial-ready yogurt drink from cashew nut milk with ginger and mulberry; (4) (4) Collaborative partnerships internationally, Institute of Food Science and Technology and Department of Animal Science and Technology, National Taiwan University (NTU); (5) health-promoting functional food research aligned with SDGs 1, 2, and 3, such as resistant starch from Thai organic rice with prebiotic properties; and (6) successful technology transfer to community enterprises, including turmeric milk tablets and herbal gummy from Chiang Da *Gymnema inodorum* (Lour.) Decne. The Research Group also enhanced research capacity through graduate students and support for early-career researchers. This integrated model promotes translational health innovation and contributes to sustainable food systems based on local bioresources, aligning with Chiang Mai University's mission for global academic impact.

Keywords: functional foods, Well-being, antioxidant, biodiversity, yogurt, turmeric tablet, rice

References:

BBA-Molecular Basis of Disease 1869 (2023) 166785.
BBA-Molecular Basis of Disease 1870 (2024) 166912.

Funding source(s): National Research Council of Thailand (NRCT), Thailand Institute of Scientific and Technological Research (TISTR), PMU-B Program, Kemin Industries (Asia), Sutthirat Yoovidhya Foundation, Chiang Mai University, and Thiptichang Community Rice Enterprise, Hang Chat District, Lampang Province

The Effects of Melatonin, Acetylcholine Receptor Agonists, and Mitochondrial Dynamics Modulators on Cardiac Metabolic Reprogramming in Doxorubicin-Induced Cardiotoxicity: A Cardiac Metabolomics Study in Rats

Chanisa Thonusin[1,2,3], Chayodom Maneechote[2,3], Thawatchai Khuanjing[1,2,3], Siriporn C Chattipakorn[2,3,4], Nipon Chattipakorn[1,2,3,*]

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Doxorubicin is a chemotherapeutic agent that commonly causes cardiotoxicity. We previously discovered that melatonin, acetylcholine receptor (AChR) agonists, and mitochondrial dynamics modulators exerted cardioprotection against doxorubicin via attenuating mitochondrial dysfunction, inflammation, and cell death. Since cardiac metabolic reprogramming plays a pivotal role in the pathophysiology of cardiotoxicity, this study investigated the effects of melatonin, AChR agonists, and mitochondrial dynamics modulators on cardiac metabolic reprogramming in doxorubicin-treated rats. Mass spectrometry-based metabolomics study in cardiac tissue showed that glycolysis and ketone body utilization were increased, whereas fatty acid oxidation, succinate oxidation, and adenosine triphosphate (ATP) production were decreased by doxorubicin. Melatonin restored glycolysis, ketone body utilization, and ATP production, while fatty acid oxidation, branched-chain amino acid catabolism, and anaplerosis were increased. AChR agonists ameliorated glycolysis, improved succinate oxidation, and recovered fatty acid oxidation and ATP production. Mitochondrial dynamics modulators restored glycolysis, ketone body utilization, and ATP production, while fatty acid oxidation and succinate oxidation were improved. Our results highlight the role of metabolomics in identifying metabolic reprogramming. Additionally, our findings suggest that melatonin, AChR agonists, and mitochondrial dynamics modulators exert different benefits to cardiac metabolic reprogramming in doxorubicin-induced cardiotoxicity. Therefore, combined treatment is likely to provide greater efficacy than single treatment regimens.

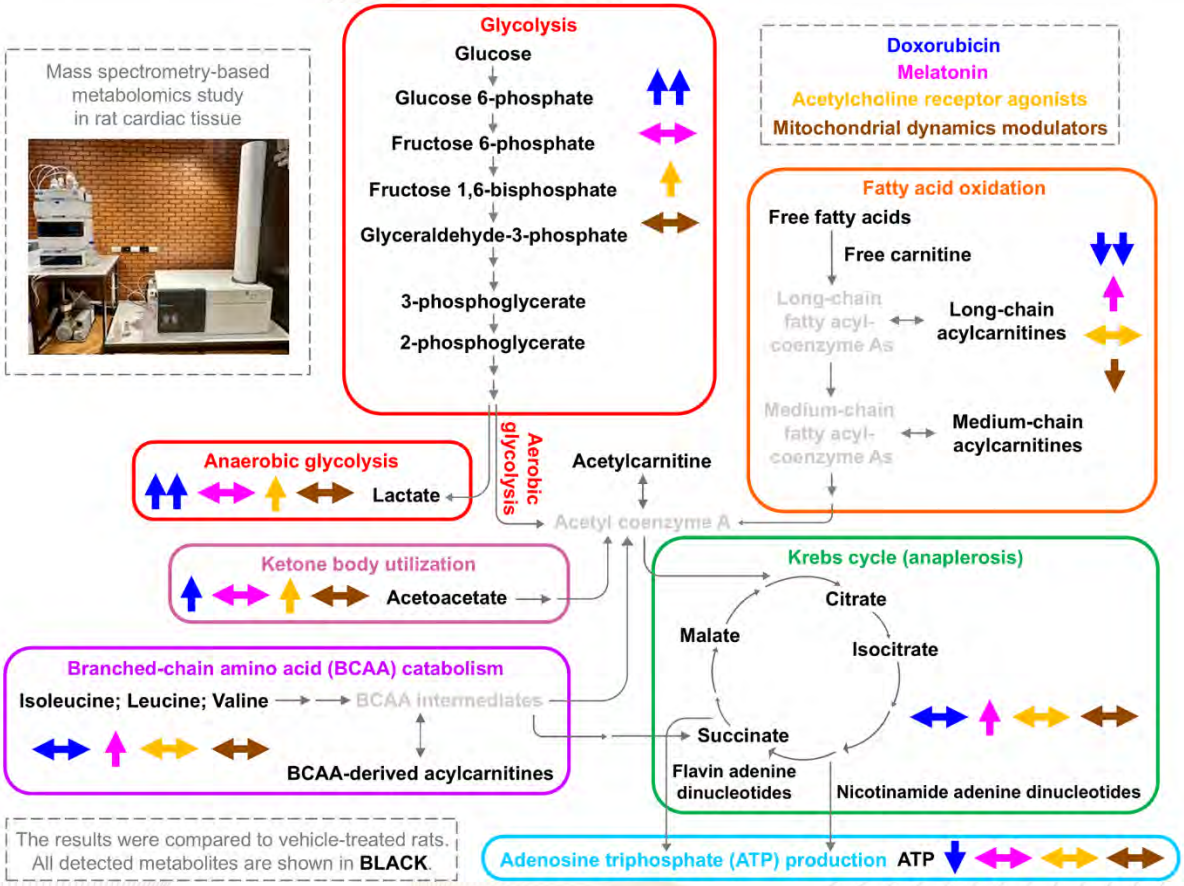
Keywords: Doxorubicin; Cardiotoxicity; Metabolic reprogramming; Metabolomics; Melatonin; Acetylcholine receptor agonist; Mitochondrial dynamics modulator

References:

Circulation Research 128 (2021) 1478-1513.
European Heart Journal 43 (2022) 4229-4361.

Funding Source(s): a Chiang Mai University Center of Excellence Award; the Research Chair Grant from the National Science and Technology Development Agency Thailand and the National Research Council of Thailand

Graphical abstract



Bipolar Electrochemiluminescence with a Low-cost Laminated-Porous Gold Leaf Electrode for Enzymatic Determination

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2 The graduate school, Chiang Mai University, Chiang Mai, Thailand.
3 Center of Excellence for Innovation in Chemistry, Faculty of Science, Chiang Mai University, Chiang Mai, Thailand.
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5 State Key Laboratory of Electroanalytical Chemistry, Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, Changchun, Jilin 130022, China.
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A bipolar electrochemiluminescence (bECL) is a wireless-controlled platform developed for multiple measurements via using a single power supply without using an expensive potentiostat. Recently, porous gold has been reported as a high conductive material. This work aims to utilize a low-cost laminated-porous gold leaf electrode (pAuLE) as a bipolar electrode in the bECL with a smartphone as a light detector for enzymatic determination. The laminated gold leaf electrode (AuLE) was fabricated using a laminating technique that provided a simple, rapid, and low-cost procedure. The fabricated electrode was modified as a porous gold by electrodeposition to enhance surface area, electron transfer, and electrocatalysis properties. The proposed bECL system was applied using luminol as a luminophore and H_2O_2 as a co-reactant with a low applied voltage of 2.0 V. The ECL intensity is proportional to the H_2O_2 concentration with the linear calibration range of 0 to 100 µM, with the limit of detection of 2.2 µM. The proposed bECL system was also applied for the determination of glucose in human serum samples based on the generation of H_2O_2 via glucose oxidase. The measuring bECL intensity is linearly proportional to glucose concentration in the range of 5 to 400 µM, with a detection limit of 3.8 µM. The multiple measurements using a single power source will be demonstrated.

Keywords: bipolar electrochemiluminescence, laminated gold leaf electrode, porous gold, enzymatic determination, human serum.

References:

1. Electrochimica Acta, 262 (2018) 182–186.
2. Electroanalysis, 35 (2023) 2100691.

Funding Source(s): CMU Mid-Career Research Fellowship program, Fundamental Fund 2024, Advanced Materials for Sensor and Biosensor Innovation, Center of Excellence in Materials Science, Chiang Mai University, Center of Excellence for Innovation in Chemistry (PERCH-CIC)

Generation of Chimeric Anti-CD99 Antibody with Selective Cytotoxicity Toward Malignant T Cells

Kamonporn Kotemul[1], Kadkanok Ruangkul[2], Supansa Pata[2,3], Witida Laopajon[2,3], Watchara Kasinrerk[3], Nuchjira Takheaw[2,3,*]

[1]Research Center for Molecular and Cell Biology, Research Institute for Health Sciences, Chiang Mai University, Chiang Mai 50200, Thailand [2]Division of Clinical Immunology, Department of Medical Technology, Faculty of Associated Medical Sciences, Chiang Mai University, Chiang Mai 50200, Thailand [3]Biomedical Technology Research Center, National Center for Genetic Engineering and Biotechnology, National Science and Technology Development Agency at the Faculty of Associated Medical Sciences, Chiang Mai University, Chiang Mai 50200, Thailand.

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Monoclonal antibodies (mAbs) have become effective non-chemotherapeutic agents for cancer treatment due to their high specificity, clinical efficacy, and relatively low adverse effects. Despite advances, no mAb-based targeted therapy has been successfully developed for T cell malignancies, aggressive and life-threatening hematologic cancers, mainly due to off-target toxicity affecting both malignant and normal T cells. In our previous study, we identified a promising murine anti-CD99 mAb clone MT99/3, which induced apoptosis in T lymphoblastic leukemia/lymphoma cell lines with minimal toxicity to normal peripheral blood cells. However, murine mAbs are not suitable for clinical use due to immunogenicity. This study aimed to develop a murine/human chimeric antibody, ChAbMT99/3, via antibody engineering technology. We successfully generated ChAbMT99/3 with high purity and stable expression in HEK293T cells. The chimeric antibody retained strong binding affinity to CD99, comparable to the parental murine mAb, and effectively induced apoptosis in malignant T cells without affecting normal PBMCs. These findings suggest that ChAbMT99/3 is a promising targeted therapeutic candidate for T cell malignancies with reduced off-target toxicity. Furthermore, this technology can be applied to develop other therapeutic antibodies, facilitating advances in cancer immunotherapy.

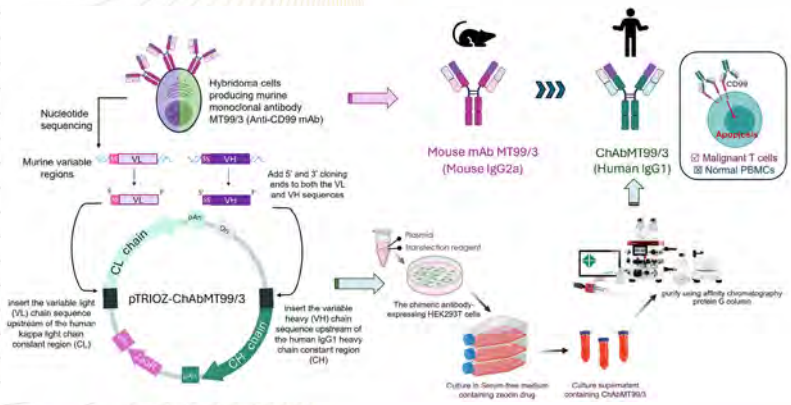
Keywords: Chimeric antibody, CD99, T cell malignancies, Monoclonal antibody therapy, Cancer immunotherapy

References:

Antibodies 13 (2024) 42-58.
Journal of Associated Medical Sciences 57 (2024) 52-64.

Funding Source(s): The Office of the Permanent Secretary, the Ministry of Higher Education, Science, Research and Innovation (OPS MHESI); Thailand Science Research and Innovation (TSRI) and Chiang Mai University/grant number RGNS 64—068. Targeted Research, Chiang Mai University/grant number TGCMU2566P006/2566.

Graphical Abstract



Fish Gelatin Hydrolysate from Bigeye Snapper (*Priacanthus tayenus*) Skin Protects against Diabetic Nephropathy through Regulation of Redox, Inflammatory, and ER Stress-Related Signaling Pathways

Krit Jaikumkao[1], Nattavadee Pengrattanachot[2], Prempree Sutthasupha[2], Napatsorn Montha[3], Sutee Wangtueai[4], Anusorn Lungkaphin[2,5,*]

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[4]*School of Agro-Industry, Faculty of Agro-Industry, Chiang Mai University, Chiang Mai, 50100, Thailand*
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[*]*E-mail: anusorn.lungka@cmu.ac.th*

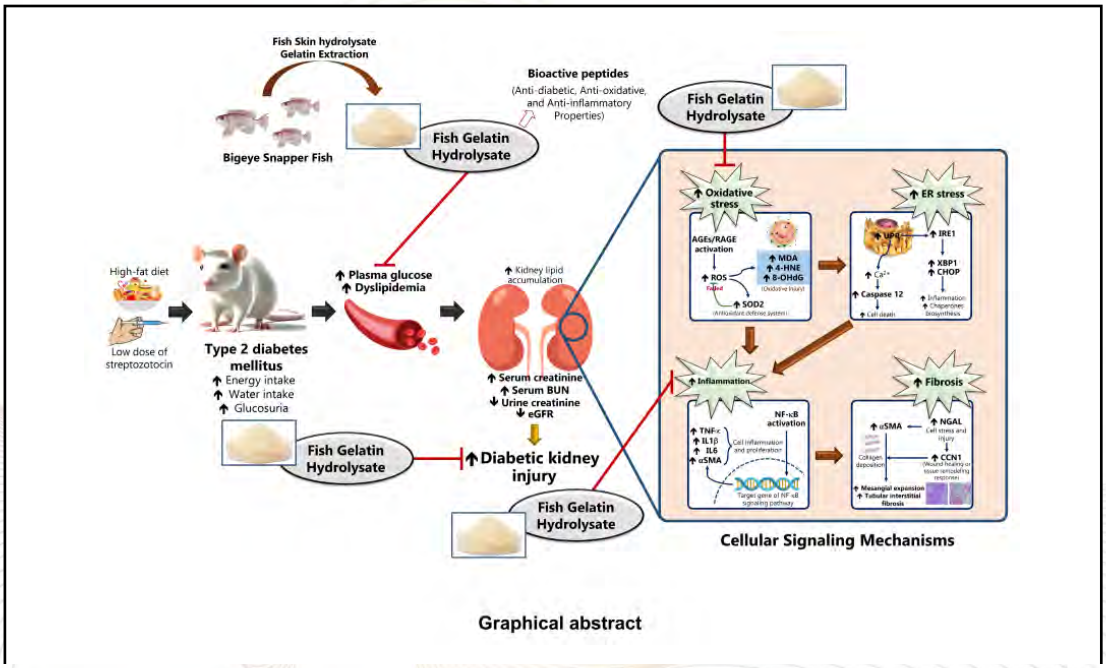
Diabetic nephropathy (DN) is a major complication of chronic hyperglycemia. Bioactive hydrolyzed fish gelatin possesses antioxidant, anti-inflammatory, and antihypertensive properties, but its nephroprotective effects in DN remain unexplored in vivo. This study evaluated its effects on oxidative stress, inflammation, fibrosis, and ER stress markers in a diabetic rat. Male Wistar rats were fed either a normal chow or a high-fat diet (HFD) for 4 weeks. Type 2 diabetes mellitus was induced in HFD-fed rats using low-dose streptozotocin (30 mg/kg, i.p.). Diabetic rats with fasting blood glucose >200 mg/dL were randomly assigned into five groups: normal (NM), diabetes (DM), diabetes + gelatin hydrolysate 250 mg/day (DMGL), diabetes + GH 500 mg/day (DMGH), and diabetes + metformin 100 mg/kg/day (DMM). Treatments were administered orally for 8 weeks. DMGH rats showed significant improvements in metabolic disturbance and kidney dysfunction. Interestingly, DMGL and DMM rats exhibited greater suppression of oxidative stress, evidenced by reduced 8-OHdG expression. Kidney injury scores, fibrosis, and inflammatory markers were reduced across treatment groups, while ER stress markers decreased, mainly via modulation of the IRE1/XBP1 axis. These findings provide tevidence that gelatin hydrolysate confers renoprotective effects in diabetic rats through anti-diabetic, antioxidant, anti-inflammatory, anti-fibrotic, and partial anti-ER stress mechanisms.

Keywords: Diabetic nephropathy, Fish Gelatin hydrolysate, Oxidative stress; Inflammation, ER stress

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2. Pengrattanachot, N., Cherngwelling, R., Jaikumkao, K., Pongchaidecha, A., Thongnak, L., Swe, M. T., ... Lungkaphin, A. (2020). Atorvastatin attenuates obese-induced kidney injury and impaired renal organic anion transporter 3 function through inhibition of oxidative stress and inflammation. *Biochim Biophys Acta Mol Basis Dis, 1866*(6), 165741.

Funding Source(s): Fundamental Fund 2023, Chiang Mai University and also Thailand Science Research and Innovation (TSRI)



Graphical abstract

The Anti-Oxidative Effect of Shrimp Oil on Chronic Cerebral Hypoperfusion Rats

Jirakhamon Sengking[1], Phakkawat Thangwong[2], Pranglada Jearjaroen[3], Luckika Panthiya[1], Natchaphol Buamard[4], Soottawat Benjakul[4,5], Jiraporn Tocharus[3], Chainarong Tocharus[1,6,*]

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[*]E-mail: chainarong.t@cmu.ac.th

Shrimp oil, notable for its abundance of polyunsaturated fatty acids and astaxanthin with strong antioxidant properties, was examined in this study for its potential to shield the brain from injury and support neurological recovery following chronic cerebral hypoperfusion. Male Wistar rats underwent bilateral common carotid artery blockage and were randomly assigned to one of six groups: sham control, 2-vessel occlusion (2VO), 2VO given shrimp oil at doses of 130, 260, or 520 mg, and 2VO treated with resveratrol. Each rat received either shrimp oil or resveratrol by oral gavage every day for four weeks after surgery. Treatment with shrimp oil was found to diminish brain injury related to CCH, demonstrated by decreases in markers of oxidative stress such as malondialdehyde, reactive oxygen species, nitric oxide, and 4-hydroxynonenal. In addition, shrimp oil activated antioxidant responses via the Nrf2/HO-1 pathway, lessened tau protein hyperphosphorylation, decreased neuronal loss, and enhanced synaptic plasticity, ultimately resulting in improved cognitive performance. These findings indicate that shrimp oil has neuroprotective potential against CCH-induced cognitive deficits, likely through its influence on oxidative stress management and prevention of neuronal cell death.

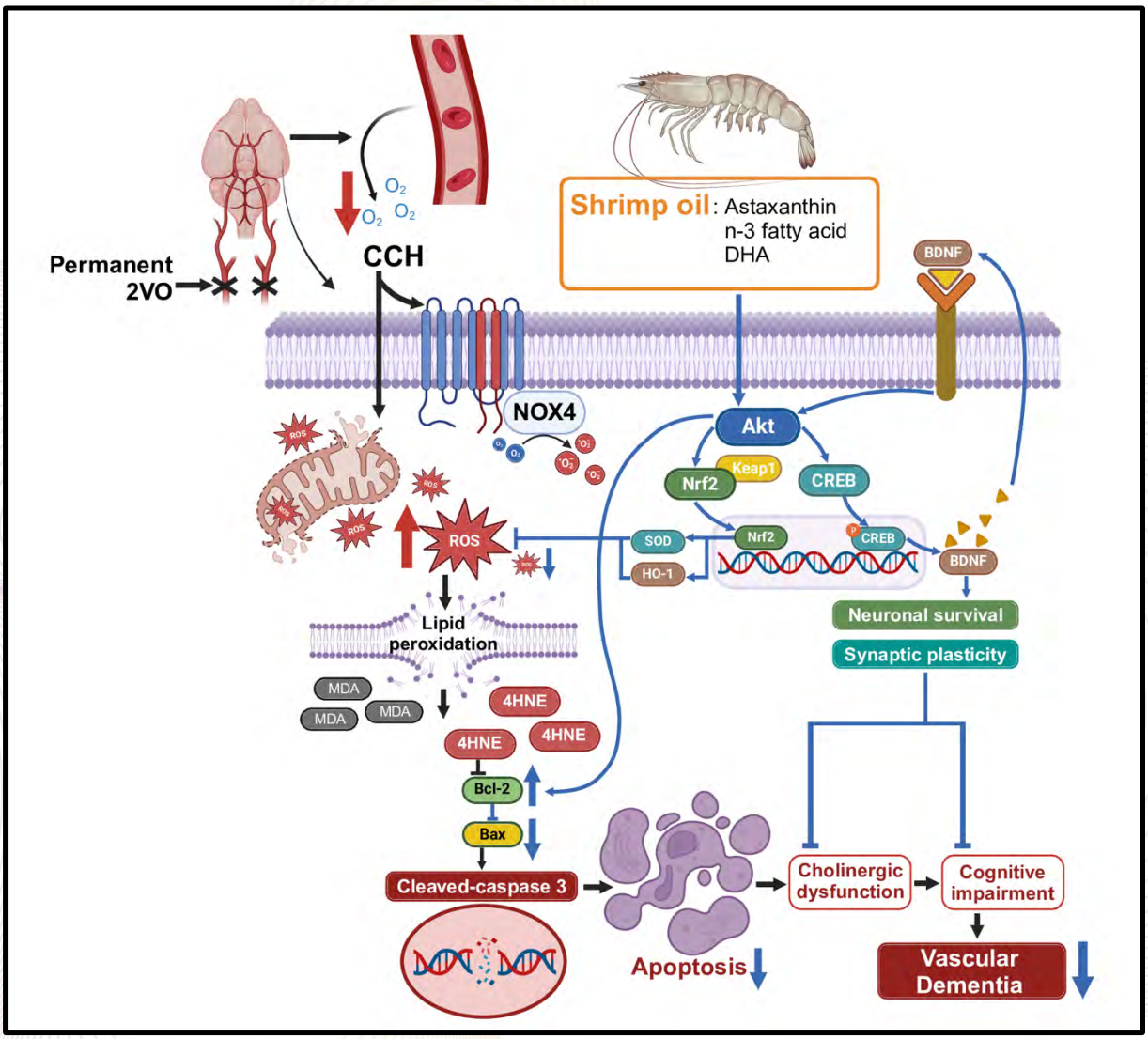
Keywords: Apoptosis, Chronic cerebral hypoperfusion, Oxidative stress, Shrimp oil, Vascular dementia

References:

Molecular nutrition & food research 69,13 (2025) e70079.

Funding Source(s): This study was supported by National Research Council of Thailand (NRCT): NRCT Research Chair grant (contract number N42A670596), CMU Junior Research Fellowship Program 2023 (Grant no. JRCMU2566R_020), Chiang Mai University, and Faculty of Medicine, Chiang Mai University, Thailand.

Graphical Abstract



Genetic Modifications of *EGLN1* Reactivate HbF Production in β^0-thalassemia/HbE

Varit Jan-ngam [1,2], Siriraj Boontha [3], Alisa Tubsuwan [4], Somsakul Pop Wongpalee [5], Kanda Fanhchaksai [6,7], Adisak Tantiworawit [8], Pimlak Charoenkwan [6,7], Pinyaphat Khamphikham [2,9,*]

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Reactivation of fetal hemoglobin (HbF, α2γ2) potentially alleviates clinical presentation in β-thalassemia. Prolyl hydroxylase domain enzymes (PHDs) play roles in the canonical oxygen-sensing pathway and maintain the stability of cellular hypoxia-inducible factor α (HIF-α) in response to low oxygen levels or hypoxia. Pharmacological inhibition of PHDs has been shown to increase HbF production in erythroid progenitors derived from healthy donors. Here, we demonstrated the relationship between PHD2, the main PHD isoform, and clinical phenotypes in β0-thalassemia/HbE disease. Although the targeted sequencing annotated several common variants within *EGLN1*, the gene encoding PHD2, none of these variants were located in the functional domains of PHD2 and were irrelevant to the clinical phenotypes. CRISPR-mediated *EGLN1* modifications at the functional regions; however, led to significantly reduce PHD2 expression and increase HbF expression levels in severe β-thalassemia erythroblasts. Moreover, these beneficial phenotypes were independent to the two well-known HbF regulators including BCL11A and GATA1. Our findings introduce an additional mechanism for HbF regulation in β-thalassemia and propose that targeting the canonical oxygen-sensing pathway, particularly PHD2 functional domains, might offer a promising therapeutic strategy to β-thalassemia diseases.

Keywords: β-thalassemia, Fetal hemoglobin, Oxygen-sensing pathway, *EGLN1,* PHD2

References:
Heliyon 10 (2024) e38020.

Funding Source(s): Fundamental Fund 2023/ Chiang Mai University (Grant number: FF66/028).

Erythropoiesis and Gene Expression Analysis in Erythroid Progenitor Cells Derived from Patients with Hemoglobin H/Constant Spring Disease

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Hemoglobin H/Constant Spring (Hb H/CS) disease represents a form of non-deletional Hb H disease characterized by chronic hemolytic anemia.To study the underlying mechanisms of this disease, we conducted an analysis of erythropoiesis and gene expression in erythroid progenitor cells derived from CD34+ hematopoietic stem/progenitor cells from patients with Hb H/CS disease and normal controls. Twelve patients with Hb H/CS disease and five normal controls were enrolled. Peripheral blood samples were collected to isolate CD34+ hematopoietic stem/progenitor cells for the analysis of cell proliferation and differentiation and gene expression by next generation sequencing analysis. Erythroid progenitor cells derived from patients with Hb H/CS disease exhibited a trend towards increased rates of erythroid proliferation, decreased cell viability and delayed terminal differentiation compared to those from controls. Gene expression profiling revealed elevated levels of genes encoding molecular chaperones, including the heat shock protein genes (HSPs) and the chaperonin containing TCP-1 subunit genes (CCTs) in the Hb H/CS disease group. In summary, erythroid progenitor cells derived from patients with Hb H/CS disease exhibit a trend towards heightened erythroid proliferation, diminished cell viability, and delayed terminal differentiation. Additionally, the increased expression of genes encoding molecular chaperones was observed, providing information on underlying pathophysiological mechanisms.

Keywords: α-thalassemia, erythropoiesis, gene expression, hemoglobin H/Constant Spring disease, molecular chaperone

References:
International Journal of Molecular Sciences 25 (2024) 11246.

Funding Source(s): Fundamental Fund 2023/ Chiang Mai University (Grant number: FF66/028)

The role of labile iron on brain proteostasis; could it be an early event of neurodegenerative disease?

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Iron accumulation, especially in the form of labile iron, can trigger a cascade of adverse effects, eventually leading to neurodegeneration and cognitive decline. Herein, we investigated the effect of ferric citrate, considered as labile iron, on various aspects of proteostasis of neuronal cell lines, and also established an animal model having a labile iron diet in order to evaluate proteostasis alteration in the brain along with behavioral effects. According to an in vitro study, labile iron was found to activate lysosome formation but inhibits lysosomal clearance function. Furthermore, the presence of labile iron can alter autophagic flux and can also induce the accumulation of protein aggregates. RNA-sequencing analysis further reveals the upregulation of various terms related to proteostasis along with neurodegenerative disease-related terms. According to an in vivo study, a labile iron-rich diet does not induce iron overload conditions and was not detrimental to the behavior of male Wistar rats. However, an iron-rich diet can promote iron accumulation in a region-dependent manner. By staining for autophagic markers and misfolding proteins in the cerebral cortex and hippocampus, an iron-rich diet was actually found to alter autophagy and induce an accumulation of misfolding proteins. These findings emphasize the importance of labile iron on brain cell proteostasis, which could be implicated in developing of neurological diseases.

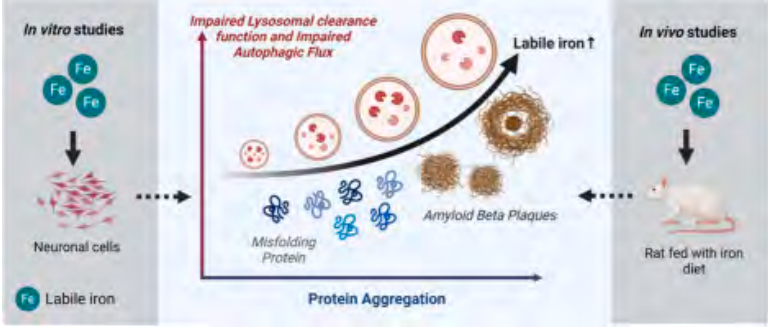
Keywords: Labile iron, Proteostasis, Misfolding peptide, Lysosome, Autophagy

References:

Archives of Biochemistry and Biophysics, 756 (2024) 110020

Funding Source(s): Targeted Research 2023 ((project code: TGCMU2566P005))

Graphical Abstract



Research Center for Multidisciplinary Approaches to Miang

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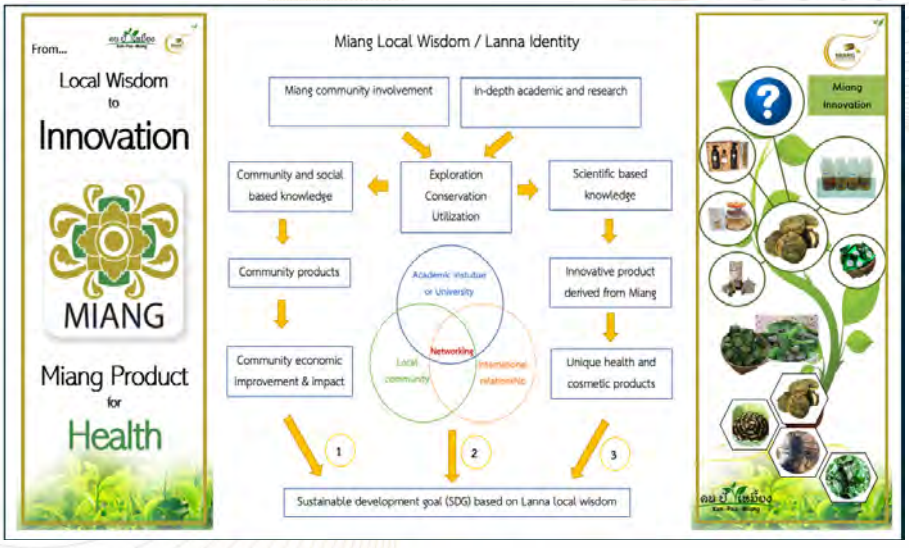
This project presents the outcomes of the Research Center for Multidisciplinary Approaches to Miang, Chiang Mai University. The project was initiated with the objectives of producing in-depth research on Miang-related traditional knowledge suitable for international dissemination, and fostering product innovation based on this local wisdom for practical adoption by farmers and community enterprises. The project successfully leveraged the "People-Forest-Miang" paradigm to achieve academic, social, and economic impact. Key achievements include eight international journal publications, one book chapter, and the filing of two patents. Beyond these intellectual contributions, the project facilitated various activities, including network meetings, the establishment of Memoranda of Understanding between the Research Center for Multidisciplinary Approaches to Miang and local administrative organizations from five Miang forest communities across Northern Thailand (Chiang Mai, Phare and Nan provinces), and the creation of community learning networks aimed at revitalizing Miang-related traditions and promoting forest conservation. Additional initiatives included knowledge transfer workshops on Miang-based product development, particularly a particular focus on Miang candies. These efforts have helped people in Miang communities become more aware of the importance of keeping their local wisdom and conserving Miang forests for the future.

Keywords: Miang, Fermented tea, Local wisdom, Multidisciplinary, Lanna identity

References:

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PLoS ONE 19(2024): e0302717.

Funding Source(s): Targeted Research Fund 2023, Chiang Mai University



Management factors affecting animal welfare of shelter dogs in Chiang Mai, Thailand

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The management of stray dogs poses considerable issues worldwide, especially in Thailand, where stray populations persistently rise. This study evaluated management practices and welfare conditions in eight dog shelters in Chiang Mai Province, emphasizing space allocation and its impact on behaviors and health. Additionally, three shelters with varying space-per-dog ratios were evaluated for physiological welfare using fecal glucocorticoid metabolite (fGCM) concentrations. The findings indicated that higher-density shelters correlated with elevated occurrences of lameness, coughing, dermatological conditions, and stress-related behaviors, including panting and excessive barking. Conversely, lower-density shelters were associated with markedly elevated body condition scores ($p < 0.05$). Shelters devoid of veterinary services exhibited a greater incidence of disease. Regarding physiological indicators, dogs housed in the shelter which featured more space, consistent routines, and an enrichment program exhibited lower fGCM levels. In contrast, dogs confined to a cramped, overcrowded temple-based refuge had increased fGCM concentrations. These findings underscore the essential importance of effective shelter management, environmental enrichment, and availability to veterinary treatment in enhancing the physical and psychological welfare of shelter dogs. The research advocates for the establishment of national guidelines for the compassionate and efficient management of stray dog populations in Thailand.

Keyword: shelter dogs, stray dogs, glucocorticoid, stress, animal welfare

References:

Applied Animal Behaviour Science Volume 288 (2025) 106666.
Scientific Report Volume 14 (2024) 20477.

Funding Source(s): This research project was successfully completed with research funding from the Smithsonian Conservation Biology Institute (SCBI), Shared Earth Foundation, Anela Kolohe Foundation, Targeted Research Scholarship of Chiang Mai University (grant number R66IN00430), and the TA/RA scholarship from Chiang Mai University.

Directional Spatial Distribution Trend and Spatio-Temporal Distribution clustering patterns of Lumpy Skin Disease Outbreaks in cattle herds across Thailand

Veerasak Punyapornwithaya[1,2*], Supitchaya Siriyakhun[2], Kusnul Yuli Maulana[1], Kenny Oriel Aranas Olana[3]

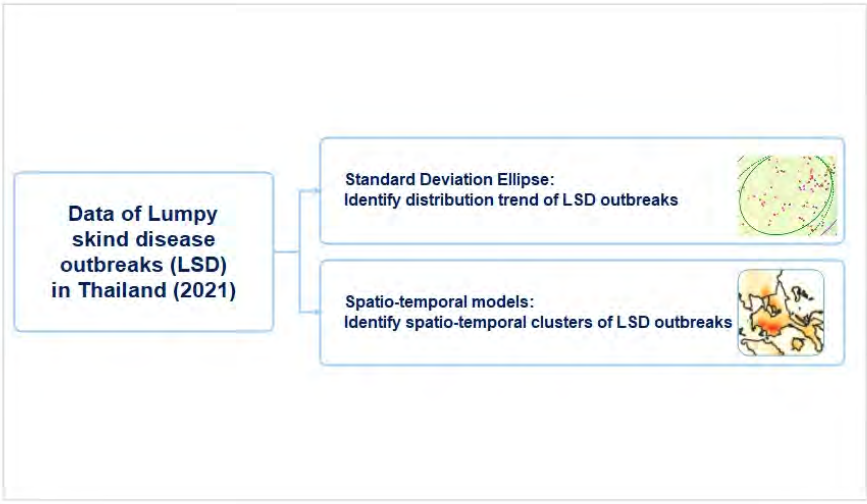
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Lumpy Skin Disease (LSD) is an emerging transboundary disease affecting cattle and buffaloes, posing serious threats to animal health and economic stability. In 2021, Thailand reported the highest number of LSD outbreaks in Southeast Asia. This study aimed to determine distribution patterns and characterize the spatio-temporal clusters of LSD outbreaks across the country. Outbreak data recorded between March and December 2021 were analyzed using a standard directional ellipse method to assess spatial distribution trends, while spatio-temporal clustering was evaluated using the Space-Time Permutation (STP) and Space-Time Poisson models. A total of 642 confirmed LSD outbreaks exhibited strong spatial autocorrelation and a clear directional spread from the northeastern region toward the southern and southwestern parts of Thailand. Multiple spatio-temporal clusters were detected, with a concentration in the northeastern region. The STP model identified more localized and compact clusters compared to the broader clusters detected by the Poisson model. This study presents the first nationwide spatial assessment of LSD in Thailand. The integrated geospatial approach provides valuable insights to enhance surveillance systems, inform vector control strategies, and support targeted responses to LSD outbreaks.

Keywords: Lumpy Skin Disease, Outbreaks, Spatio-Temporal Clusters, Predictive Risk Surfaces, Thailand

Funding Source(s): Research Center for Veterinary Biosciences and Veterinary Public Health, Chiang Mai University (R68IN00028)

Graphical Abstract



Data and methods utilized to determine distribution and spatio-temporal of lumpy skin disease outbreak in Thailand.

Biomarkers of Oxidative Stress, Systemic Inflammation and Thrombosis in Adult Asthmatic Patients Treated with Inhaled Corticosteroids during Exposure to Fine Particulate Matter

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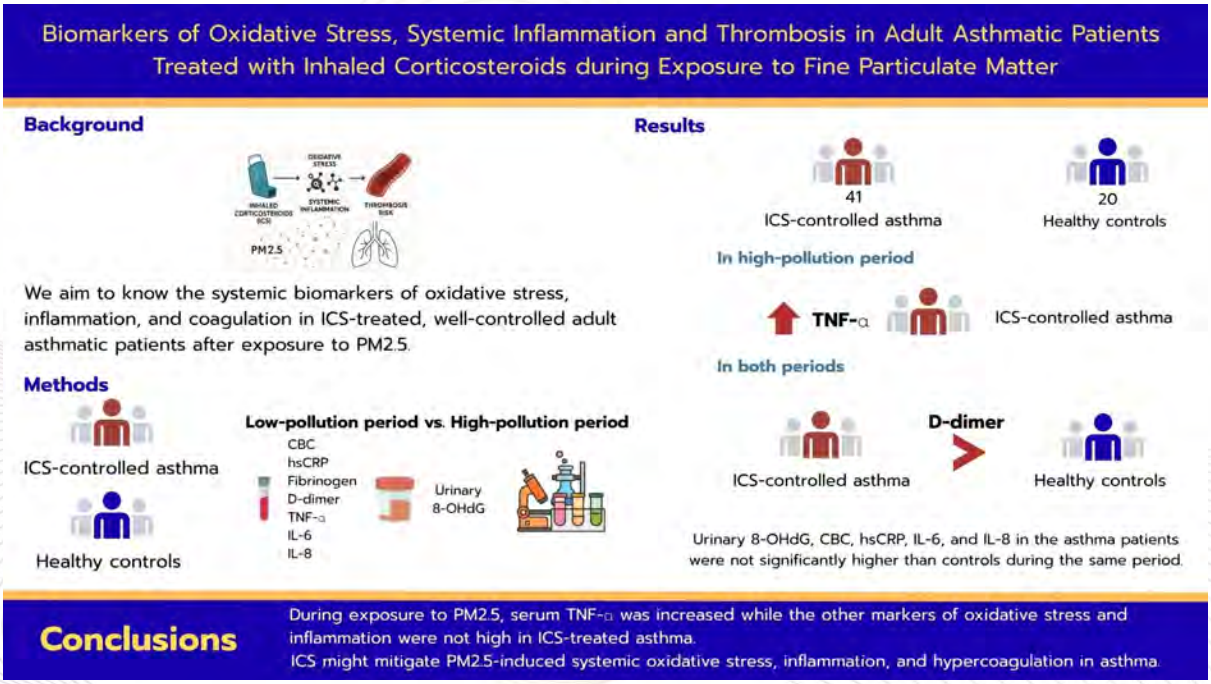
Background/Objectives: Inhaled corticosteroids (ICS) affect oxidative stress and systemic inflammation, which might modify the risk of thrombosis in asthmatic patients exposed to particulate matter with an aerodynamic diameter smaller than 2.5 microns (PM2.5). Therefore, we aim to know the systemic biomarkers of oxidative stress, inflammation, and coagulation in ICS-treated, well-controlled adult asthmatic patients after exposure to PM2.5.
Methods: This study was conducted to compare urinary biomarkers of oxidative stress, i.e., 8-hydroxydeoxyguanosine (8-OHdG), and blood biomarkers of inflammation and hypercoagulation, i.e., complete blood count (CBC), high-sensitivity C-reactive protein (hsCRP), fibrinogen, D-dimer, tumor necrosis factor-alpha (TNF-α), and interleukins (IL-6 and IL-8), between well-controlled adult asthmatic patients and healthy controls in low and high-pollution periods.
Results: Forty-one ICS-controlled asthmatic patients and twenty controls were included. Urinary 8-OHdG, white blood cells and differential counts, platelets count, hsCRP, IL-6, and IL-8 in the asthma group were not significantly higher than controls during the same period. The D-dimer level of the asthma patients was significantly higher than the controls ($p < 0.05$). The median level of TNF-α levels during the pollution period in asthma patients was significantly higher than the non-pollution period with levels of 14.3 (9.3, 27.4) and 11.3 (7.8, 21.1) pg/mL, $p = 0.041$, respectively. **Conclusions:** During exposure to PM2.5, serum TNF-α was increased while the other markers of oxidative stress and inflammation were not high in ICS-treated asthma. ICS might mitigate PM2.5-induced systemic oxidative stress, inflammation, and hypercoagulation in asthma.

Keywords: PM2.5, asthma, inhaled corticosteroids, biomarkers, oxidative stress, systemic inflammation, thrombosis.

References: J Clin Med. 2025;14(7):2360.

Funding Sources: Fundamental Fund 2023, Chiang Mai University and also Thailand Science Research and Innovation (TSRI).

Graphical Abstract (Compulsory)



Clinical Surgical Research Center: Translational research and Clinical research study

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Abstract

This presentation synthesizes findings from fourteen published studies covering trauma, oncology, surgery, perioperative care, cardiovascular disease, and public health. Key contributions include systematic reviews and long-term audits identifying critical predictors of mortality and outcomes in older adult trauma patients and injured populations. In surgical research, novel tools such as the Liver Resection Transfusion (LiReT) Score and portal flow modulation techniques have improved risk assessment and postoperative management in liver surgery. Cancer studies focus on advancements in imaging modalities, including digital breast tomosynthesis and shear-wave elastography, alongside analyses of prognostic markers like Ki-67 and nodal micro-metastasis in breast and lung cancers. Comparative outcome studies between surgical techniques for gastroschisis and breast cancer add to treatment optimization. Perioperative research includes a meta-analysis comparing balanced salt solutions and hydroxyethyl starch for major abdominal surgery. Further, we explore mortality predictors in diabetic patients with peripheral arterial disease and assess a health belief model-based mobile intervention's effectiveness in improving smoking knowledge and self-efficacy among Myanmar industrial workers. Together, these studies showcase multidisciplinary progress in diagnostics, surgical strategies, outcome prediction, and public health, supporting evidence-based care across a range of healthcare settings and patient populations.

Keywords: Surgical Research, Clinical Outcomes, Prognostic factors, Predictive factors, Diagnostic Research

Research Titles	New Knowledge	Human resource development	Sustainable development according to the SDGs
1. Association between clinical factors and mortality in older adult trauma patients: A systematic review and meta-analysis	/		/
2. Two-Dimensional Shear-Wave Elastography: Accuracy in Liver Fibrosis Staging Using Magnetic Resonance Elastography as the Reference Standard			
3. The outcomes of treatment between primary closure and staged closure in gastroschisis in the pre and post era of the bedside wound retractor silo placement technique			
4. Exploring Prognostic Factors and Survival Outcomes in Advanced Non-Small Cell Lung Cancer Patients Undergoing First-Line Chemotherapy in Limited-Resource Settings			/
5. Prognosis of nodal micrometastasis in resectable pN0 non-small cell lung cancer (NSCLC)			
6. Comparison of Survival Outcomes of Breast-Conserving Surgery Plus Radiotherapy with Mastectomy in Early Breast Cancer Patients: Less Is More?			/
7. The association between Ki-67 expression and survival in breast cancer subtypes: a cross-sectional study of Ki-67 cut-point in northern Thailand	/		
8. Portal flow modulation by splenic artery ligation to prevent posthepatectomy liver failure: A randomized controlled trial	/		
9. Development of the Liver Resection Transfusion (LiReT) Score to Assess the Requirement for Blood Transfusion During Open Liver Surgery	/	/	
10. Clinical diagnostic accuracy and non-inferiority of digital breast tomosynthesis by synthetic 2D mammography compared with conventional 2D mammography for the diagnosis of breast cancer: A single center retrospective study		/	/
11. Trauma referral audit impact assessment on the outcomes of injured patients via an interrupted time-series analysis: an 11-year before-and-after study of trauma cases at the Maharaj Nakorn Chiang Mai hospital, Thailand	/	/	/
12. Comparative Balanced Salt Solution and 6% Hydroxyethyl Starch in Goal-Directed Therapy for Major Abdominal Surgery: A Systematic Review and Meta-Analysis			
13. Incidence and predictors of cardiovascular disease mortality and all-cause mortality in patients with type II diabetes with peripheral arterial disease			/
14. Effectiveness of a Health Belief Model-Based Integrated Health Education and Mobile Phone Short Message Service Intervention on Health Knowledge, Perception, and Self-Efficacy toward Smoking: A Quasi-Experimental Study among Industrial Workers in Myanmar	/	/	/

5-Alpha Reductase Inhibition Reduces Cardiac Oxidative Stress in Obese and Aging Male Rats by Enhancing Antioxidant Defenses and Suppressing p53 Expression

Nattayaporn Apaijai[1,2,3], Hiranya Pintana[1,2], Thiraphat Saengmearnuparp[1,2,4], Apisek Kongkaew[5], Busarin Arunsak[1,2], Titikorn Chunchai[1,2], Siriporn C. Chattipakorn[1,2,6], Nipon Chattipakorn[1,2,3*]

[1]Cardiac Electrophysiology Research and Training Center, Faculty of Medicine; [2]Center of Excellence in Cardiac Electrophysiology Research;[3]Cardiac Electrophysiology Unit, Department of Physiology, Faculty of Medicine,[4]Division of Urology, Department of Surgery, Faculty of Medicine;[5]Animal House Unit, Faculty of Medicine;[6]Department of Oral Biology and Diagnostic Sciences, Faculty of Dentistry, Chiang Mai University, Chiang Mai, 50200, Thailand.
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Oxidative stress contributes significantly to cardiovascular pathology in aging and metabolic syndrome. While 5-α reductase upregulation is linked to cardiac hypertrophy, its inhibition during oxidative stress remains unclear. We hypothesized that finasteride (Fin), a 5-α reductase inhibitor, could enhance antioxidant responses and improve cardiac function in obese and aging rats. Male rats were divided into three groups: normal diet (ND), ND with D-galactose (D-gal) to induce aging, and high-fat diet (HFD) to induce obesity. After 13 weeks on their respective treatments, rats received either vehicle or Fin (5 mg/kg/day) for five weeks. Both D-gal and HFD models successfully induced cardiometabolic abnormalities, oxidative stress, mitochondrial dysfunction, and DNA fragmentation. While Fin did not alleviate metabolic disturbances, it significantly improved cardiac function and sympathovagal balance by reducing oxidative stress and enhancing antioxidant activity. These effects were associated with decreased p53 expression and reduced DNA fragmentation. Notably, Fin induced insulin resistance in ND-fed rats. Fin improved cardiac function in both aging and obesity models by promoting antioxidant defenses and reducing oxidative damage and DNA fragmentation. However, it did not improve metabolic parameters.

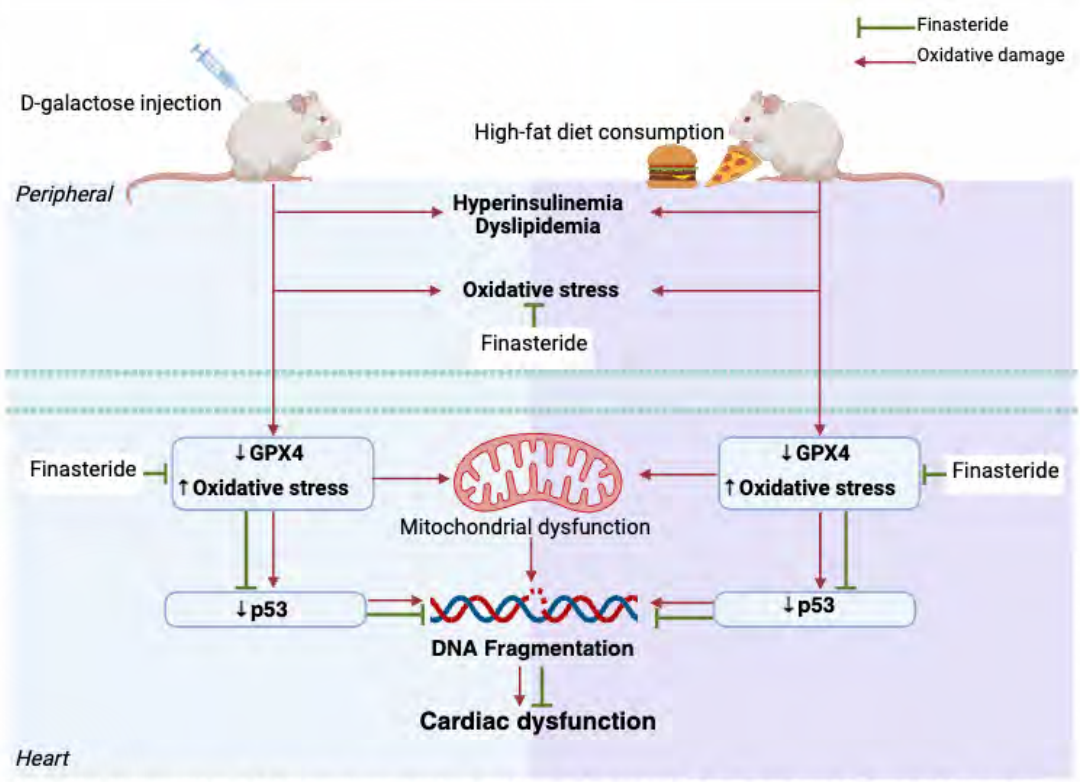
Keywords: D-galactose; High-fat diet; metabolic function; cardiac function; p53

References:

J Cell Mol Med 22 (2018) 1392-1410.
Toxicology 492 (2023) 153553.

Funding Source(s): This work was supported by Distinguished Research Professor from the National Research Council of Thailand (N42A660301 to SCC), the National Science and Technology Development Agency (NSTDA) Research Chair Grant (NC), the National Research Council of Thailand (N42A660432 to NA, N42A650207 to HP), Thailand Science Research and Innovation-Chiang Mai University (Fundamental Fund 2566 to NA), and the Chiang Mai University Center of Excellence Award (NC). **Published in Apaijai N et al. Chem Biol Interact 403 (2024) 111240.*

Graphical Abstract



Proposed mechanism of the cardioprotective effects of finasteride in D-gal-treated and HFD treated rats

Ficus lindsayana Leaf Extract Protects C2C12 Mouse Myoblasts Against the Suppressive Effects of Bisphenol-A on Myogenic Differentiation

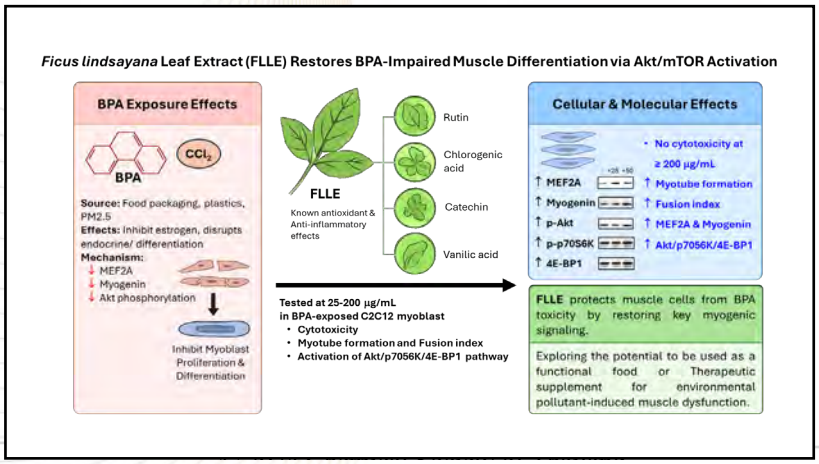
Pornsiri Pitchakarn [1], Jirarat Karinchai [1], Pensiri Buacheen [1], Arisa Imsumran [1], Ariyaphong Wongnoppavich [1], Kongsak Boonyapranai [2] and Sakaewan Ounjaijean [2,*]
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Recent toxicological and epidemiological research strongly supports the detrimental effects of Bisphenol A (BPA) on myogenesis, prompting a critical search for mitigating strategies. Plant extracts, recognized for their therapeutic potential, are emerging as promising candidates. Our prior work on *Ficus lindsayana* leaf extract (FLLE) revealed its anti-inflammatory properties and ability to reduce insulin resistance. Building on this, the present study investigated whether FLLE protects C2C12 mouse myoblasts against BPA-induced suppression of myogenic differentiation. Our findings indicate FLLE (200 µg/mL) significantly increased the viability of BPA-stimulated C2C12 myoblasts, suggesting it lessens BPA's inhibitory effects on cell division. Furthermore, FLLE enhanced neo-myotube formation by promoting myoblast fusion. Crucially, FLLE (50 µg/mL) markedly increased levels of myogenin and myocyte enhancer factor 2A (MEF2A), key myogenesis regulators, in BPA-treated cells. This suggests FLLE effectively improved myogenic differentiation in BPA-exposed myoblasts. Mechanistically, FLLE (50 µg/mL) elevated total Akt protein levels and enhanced phosphorylation of p70S6K and 4E-BP1, key downstream targets of the Akt/mTOR signaling cascade. These results collectively indicate FLLE attenuates BPA-induced declines in myogenic differentiation via regulating essential myocyte differentiation-related signaling pathways. This study underscores FLLE's potential health benefits, warranting further investigation as an alternative medicine or functional ingredient to counteract BPA's negative health effects.

Keywords: pollutants; endocrine-disrupting chemicals; myogenesis; muscle; *Ficus lindsayana*

References:
Int. J. Mol. Sci. 26 (2025) 476.

Funding Source(s): Fundamental Fund 2023, Chiang Mai University and also Thailand Sciences Research and Innovation (TSRI).



CMU Annual Research Summit 2025
18-19 August 2025
CMU CHIANG MAI UNIVERSITY

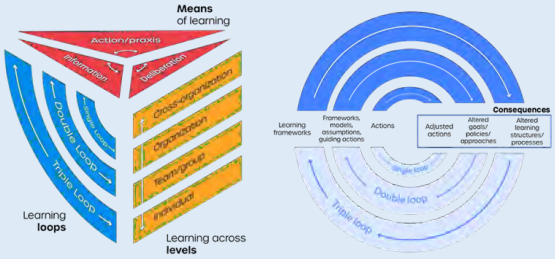
The development of learning health system and active patient link tool for the management of hypertension, type 2 diabetes mellitus, and chronic kidney disease in primary care in Thailand: A stratified cluster randomized study protocol

Nutchar Wiwatkunupakarn1,*, Wichuda Jiraporncharoen1, Nida Buawangpong1,Piyachon Aramrat1, Chanchanok Aramrat1, Kanokporn Pinyopornpanish1, Milena Marszalek2, Chris Carvalho2,John Ford2, Borislava Mihaylova2, Tracey Chantler3, Dorothea Nitsch3, Rohini Mathur2, Chaisiri Angkurawaranon1
Affiliation: 1Family Medicine Department, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand; 2Wolfson Institute of Population Health, Queen Mary University of London, London, United Kingdom; 3London School of Hygiene and Tropical Medicine, London, United

Introduction

Non-communicable diseases (NCDs) are a leading cause of mortality in Thailand, with primary care units (PCUs) as a key for NCD prevention and control. Thailand is a new settler of Learning health system (LHS) - a process of icteratively learning through transfroming EHR data to knowledge and knowledge to practice in order to improve quality of care.

This study **aims** to develop a LHS intervention to improve the quality of **hypertension (HTN)**, **diabetes mellitus (DM)**, and **chronic kidney disease (CKD)** cares in primary care settings, using EHR data.



Objectives

- Conduct a **quantitative study** of baseline characteristics of PCUs in Chiang Mai and Lamphun provinces
- **Co-design the LHS** interventions with PCU providers to improve the management of HTN, DM, and CKD
- **Develop the Active Patient Link (APL) tool** – a software to manipulate EHR data - to support evidence-based decision-making andLHS implementation.
- **Provide training course** of the APL tool for PCU providers
- **Assess the feasibility and usability of the APL tool**
- **Develop an initial programe theory** of the implemetation of the LHS
- **Iteratively refine the initial programe theory**

Methods

Settings PCUs in Chiang Mai and Lamphun provinces in Thailand.

Study population A multidisciplinary team of healthcare providers, including general practitioners, clinical nurses, pharmacists, public health technical officers, and village health volunteers.

Participant sampling
Stratified clustered randomization for 16 PCUs.



Outputs
- Baseline characteristics of PCUs
- Initial program theory for LHS implementation
- APL tool and its feasibility and usability
- Learning materials and training courses

Outcomes
- Higher **proportion of patients** with hypertension, diabetes mellitus, and chronic kidney disease who are **under control,** using the criteria of national key performance indicator (KPI) targets.
- Lower **proportion of patients** with hypertension, diabetes mellitus, and chronic kidney diseases **lost follow-up.**

Interventions
1. Co-design the LHS intervention and design APL tool's function and feature with PCU staff through stakeholder consultation workshop and individual PCU onsite visit
2. Develop and pilot the designed LHS intervention and the APL tool in those 16 PCUs for 12 months
3. Provide technical support for PCU staff to use the APL tool through training course
4. Develop and refine the initial program theory of the implementation of LHS in PUCs.

Project timeline
1st year: Develop the LHS and APL tool for **HTN care**
2nd year: Develop the LHS and APL tool for **DM care**
3rd year: Develop the LHS and APL tool for **CKD care**



Ethics and grants

Ethical approval is granted by the Faculty of Medicine, Chiang Mai University (No. 409 / 2567)

Funding

Research Group Development, Chiang Mai University (RG11/2566).
National Institute for Health and Care Research, UK (NIHR156161).

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Molecular Epidemiology of Classic and Novel Human Astroviruses in Pediatric Patients with Acute Gastroenteritis in Chiang Mai, Thailand

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Human astroviruses are important causative pathogens of acute gastroenteritis (AGE), particularly in young children worldwide. Understanding their molecular epidemiology is essential for monitoring emerging strains and viral evolution. This study investigated the epidemiological trends and genotype diversity of astroviruses in pediatric AGE patients in Chiang Mai, Thailand from 2021 to 2023. A total of 1,124 fecal samples were collected from hospitalized children and screened for astrovirus using reverse transcription polymerase chain reaction. Positive samples were subsequently analyzed by nucleotide sequencing and phylogenetic analysis. The overall prevalence of astrovirus infection was 2.0% (23/1,124), with increasing detection rates following the COVID-19 pandemic: 0.9% in 2021, 1.4% in 2022, and 3.4% in 2023. Phylogenetic analysis revealed the co-circulation of classic human astrovirus (HAstV) and novel emerging MLB and VA strains, with five distinct genotypes identified. HAstV1 (34.8%) was the most common genotype, followed by MLB1 and MLB2 (21.7% each), HAstV5 (13.1%), and VA2 (8.7%). Our findings demonstrate the circulation of diverse astrovirus genotypes in children with AGE and an upward trend in infections in the post-COVID-19 era, highlighting the need for continued surveillance to monitor genetic variation and assess disease burden.

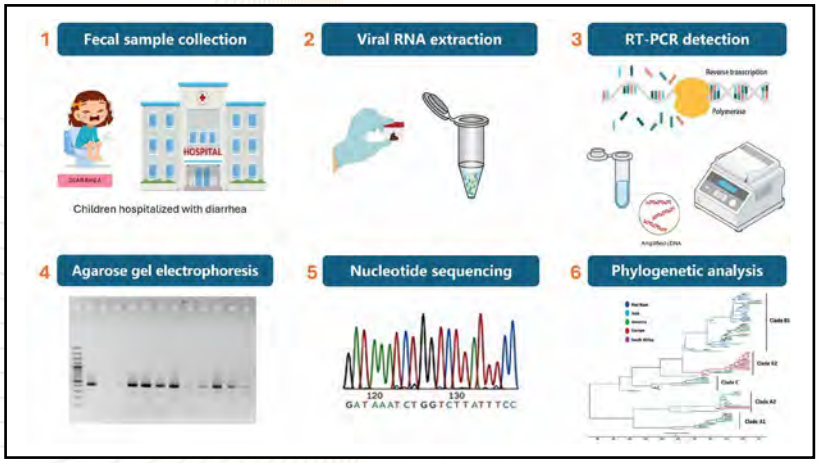
Keywords: astrovirus, children, epidemiology, gastroenteritis, pediatric patient

References:

Kumthip K, Khamrin P, Ushijima H, Maneekarn N. Molecular epidemiology of classic, MLB and VA astroviruses isolated from <5 year-old children with gastroenteritis in Thailand, 2011-2016. *Infect Genet Evol.* 2018;65:373-379.

Wei H, Khamrin P, Kumthip K, Yodmeeklin A, Maneekarn N. High divergence of human astrovirus genotypes circulating in pediatric patients hospitalized with acute gastroenteritis in Chiang Mai, Thailand, 2017-2020. *Sci Rep.* 2021;11(1):23266.

Funding Source: Fundamental Fund 2566 (FF 66/006)



CMU Annual Research Summit 2025

Oral Presentation



Tourism, Hospitality & Creative Economy

Invited Speaker

ผศ.ดร.พิพัฒพงศ์ ฟักแฟ
คณะมนุษยศาสตร์และการจัดการการท่องเที่ยว มหาวิทยาลัยกรุงเทพ

Publishing with Impact: How to Position Your Research for International Recognition

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คุณรุ่งเรือง วิโรจน์ชีวัน
บริษัท แอสเสท เวิร์ด คอร์ป จำกัด (มหาชน)

"Lannatique" กรณีศึกษาโอกาสของการวิจัยและพัฒนาเพื่อสร้างผลกระทบทางเศรษฐกิจของเชียงใหม่

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The Potential Analytical Impact of Significant Sectoral Creative Economy on Thailand's Economy: A Case Study of the IRS-CGE Model vs. the CRS-CGE Model for Both the National and Provincial Economies

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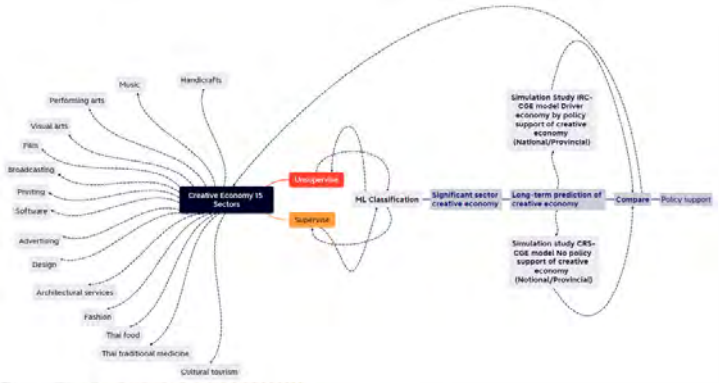
The United Nations has promoted and supported the UNCTAD Creative Economy Programme since 2004 to help countries around the world understand how to promote economic development through creativity in industries. This research article aims to determine whether the creative economy will be the major engine to accelerate Thailand's economic development in the coming decade or not, and what the major creative economy sectors are that must be prioritized or initiated and focused on. The data implemented in this research cover 2011–2018, which consist of creative economy sector income, the IO table, and the SAM table. The methodology utilized in this research was the ML model, the GREY model for predicting the growth rate of income from the major creative economy sectors contribute to Thailand's economy between 2019–2025, and the CGE model. The study's empirical findings show that the significant sectoral creative economy consists of fashion, advertising, Thai food, and cultural tourism, which need to be given more stimulus. Furthermore, the economies of Chiang Mai, and Thailand as a whole, would eventually be high-income economies if creative economy sectors were to be promoted and continuously supported by efficient policies. the economic growth of Thailand and Chiang Mai would eventually become high income whenever these economies allow creative economy sectors to be promoted or supported by efficient policies continuously.

Keywords: Creative Economy Sectors, Thailand's Economy, Chiang Mai's Economy, ML model, GREY model, Prediction, CGE model, Long-Run Growth

References:

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International Journal of Innovation, Creativity and Change 71 (2019) 31–49. Cong, P.T.: Creative industries, Investment trends and their impact on the Economy and Financial Sectors: A study from Vietnam.

Funding Source(s): Target Research funding 2023(R66IN00412), Chiang Mai University, Chiang Mai, Thailand.



The conceptual framework and research methodology for examining the possible analytical effects of the main creative economy sectors on the long-term growth of Thailand's economy.

The Development of a Creative Space Prototype for Horse Carriages in Lampang

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This research project aims to develop communication skills, test the creation of a prototype for a creative space for horse carriages in Lampang City, and promote tourism through local festivals. The project methodology employs Participatory Action Research (PAR) in collaboration with horse carriage drivers, government agencies, local communities, and their networks. The project is grounded in creative space management concepts, focusing on enhancing communication skills through photography, creative storytelling, and integrated online communication. Key qualitative outcomes include successful collaboration in organizing creative activities, such as the mini exhibition, the "Horse Carriage Kathin Festival," and the "Happy Railway & Horse Carriage Festival. Additionally, the project has improved access to information about horse carriages in the city. Quantitative outcomes include the creation of a registry and identity cards for 102 horse carriages drivers, as well as a survey of 400 tourists, revealing that the image of the horse-drawn carriage is strongly associated with Lampang's identity. Furthermore, the survey shows that the image of the horse carriage has a significant influence on tourists' travel motivation. The knowledge gained from this project can serve as a model for cultural local development, which can be expanded into policy and generate economic, tourism, and identity value for Lampang, thus promoting sustainable cultural tourism.

Keywords: Creative Space, Horse Carriages, Development

References:

Karapan, R., Sangkakorn, K., Krajangchom, S., & Jaroennet, S. (2022). Prototype Development of A Creative Living Space in Lampang, Northern Thailand. *Journal of Southeast Asian Studies*, *27*(2), 1–21

Karapan, R., Susuwan, P., Chokpiriyawat, T., Munsub, Y., Sangkakorn, K., & Porpalee, T. (2025). Lampang Carriages: Driving Creative Tourism Through the Power of Storytelling Media. *Journal of Lifestyle and SDGs Review*, *5*(3), e02760.

Funding Source(s): Mid-Career Researcher

Moving towards Lamphun Sustainable Creative Economy

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The study "Moving towards Lamphun Sustainable Creative Economy" aims to (1) explore the framework for sustainable development of Lamphun as a creative city, (2) develop models to upgrade cultural products with economic potential, (3) drive Lamphun's sustainable creative economy, and (4) establish a local creative city network. A mixed-methods approach was applied, combining quantitative surveys and qualitative tools such as informal interviews and soundscape data collection, with active participation from public, private, and community sectors. Data were analyzed using statistical software for quantitative data and content analysis for qualitative insights. Key outputs include: survey results on public perceptions, a context-specific set of sustainable creative city indicators, GIS-based mapping of Lamphun's cultural assets, a soundscape database, a creative handicraft value model based on emotional marketing, and strategies for promoting local food rooted in cultural wisdom. The outcomes highlight the formation of active networks, product development aligned with customer needs, and collaborative engagement strategies among stakeholders. Moreover, musical compositions derived from local soundscapes promote cultural continuity. This research contributes to sustainable development (SDGs) by enhancing cultural awareness, creating employment, and generating local income through the creative economy rooted in Lamphun's unique identity.

Keywords: Lamphun, Sustainable Creative Economy, Cultural Products, Community Participation, Emotional Marketing, Soundscape

References:

Sansanee Krajangchom, Ratchapan Karapan, Thitinadda Chinachan, Pachernwaat Srichai, Sudarat Auttarat, Korawan Sangkakorn. (2025) Strategic Innovation and Entrepreneurial Development in Lamphun, Thailand: Enhancing Food Products Through Cultural and Environmental Resources. *Food Studies: An Interdisciplinary Journal*, 15 (1): 103-127

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Funding Source(s): Fundamental Fund 2023

Center of Tourism Research and Development (CTRD)

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Established in 2019, the Center of Tourism Research and Development (CTRD) at Chiang Mai University was founded with the objective of conducting high-quality research in tourism and related fields. The Center aims to generate new knowledge, develop tourism strategies, and produce academic articles for national and international publication and conferences. These efforts support funding acquisition and foster national and international collaborations in tourism research. The CTRD applies both qualitative and quantitative research methodologies and has secured funding from internal university sources and external agencies. Research topics include cultural tourism, senior tourism, cross-border tourism, tourist behavior, tourism marketing, wellness tourism, etc. Key research outputs have contributed to academic publications, policy recommendations, and practical applications across the public and private sectors. In addition, the CTRD maintains a tourism research database, produces infographics to disseminate findings, and builds strategic networks with government, private sectors, local communities, and academic institutions. Public outreach is enhanced through a dedicated website and the CTRD's official Facebook page. The CTRD's ongoing mission is to promote evidence-based tourism development and strengthen Thailand's tourism ecosystem in alignment with sustainable and inclusive growth goals.

Keywords: Tourism Research, Sustainable Development, Cultural Tourism, Academic Collaboration, Policy Recommendations, Wellness Tourism

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Damijanić,A.T. (2020). Travel motivations as criteria in the wellness tourism market segmentation process. *Academica Turistica-Tourism and Innovation Journal*, 13(2), 201–213.

Funding Source(s): Research Group Development

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Annual Research Summit 2025

Oral Presentation



Social Engagement

Social Engagement through Public Investment: The Impact of Education, Health, and Capital Spending on Economic Growth

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This study investigates the macroeconomic determinants of economic growth by employing a random-effects Generalized Least Squares (GLS) regression model using panel data from 158 countries over the period 1980–2024. The research examines how public investment in human capital and physical capital contributes to Gross Domestic Product (GDP) growth, with a particular focus on social expenditure. Social expenditure—specifically public spending on education and health as a percentage of GDP—serves as a key proxy for investment in human capital. The dependent variable is the annual GDP growth rate, while the independent variables include public expenditure on education, public health expenditure, gross fixed capital formation, and employment-to-population ratio. The results indicate that all independent variables are positively and statistically significantly associated with GDP growth. Social expenditure on health and education demonstrates robust and significant impacts, reinforcing the role of social investment in driving economic performance. These findings highlight the strategic value of integrated social and capital investment policies, especially for achieving sustainable growth in developing countries.

Keywords: Social engagement, Public expenditure, Economic growth, Human capital, Panel data analysis

References:

Ahuja, Deepti; Pandit, Deepak (2022) : Social spending as a development tool: Evidence from developing countries, European Journal of Government and Economics (EJGE), ISSN 2254-7088, Universidade da Coruña, A Coruña, Vol. 11, Iss. 1, pp. 73-96, https://doi.org/10.17979/ejge.2022.11.1.7385
Chakroun, M. (2024). Health and economic growth: new evidence from a panel threshold model. Cogent Economics & Finance, 12(1). https://doi.org/10.1080/23322039.2024.2331010

Funding Source(s): This research was partially supported by Chiang Mai University.

The Center for Research on Inequality Reduction and Social Opportunity Advancement, Chiang Mai University

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Abstract

The Center for Research on Inequality Reduction and Social Opportunity Advancement, Chiang Mai University has the following objectives 1) enhance management systems through participatory and cross-disciplinary collaboration based on multi-dimensional data; 2) develop new knowledge and social innovations in health, education, society, economy, environment, and arts and culture to empower underprivileged groups to live independently across life stages; and 3) foster national and international collaborative networks using diverse methods and tools.

The Center's participatory management initiatives have successfully engaged government agencies, private sectors, and communities in cross-disciplinary research involving 36 researchers, supported by 722,000 THB in funding from business enterprises. The Center has undertaken multi-dimensional research and data collection efforts.

In terms of knowledge creation and social innovation, the Center has published over 26 academic works in recognized databases, including Scopus (Q1–Q4) and TCI (Tier 1–2), exceeding its target by 18%. More than 20 training programs and manuals have been developed, covering areas such as **health** (e.g., exercise programs for the elderly, caregiver training for stroke patients, and stress management for caregivers), **education** (e.g., digital life skills training for disadvantaged groups and educators), **society** (e.g., life skills and digital health promotion), **economy** (e.g., business planning for children and safe food production using aquaponics), and **arts and culture** (e.g., storytelling and media production on TikTok for cultural promotion and Lanna lantern crafts from natural materials).

Regarding collaborative networks, the Center has established eight key national and international partnerships, including agreements with the Chiang Mai Provincial Education Office and Central Group to strengthen teacher and educator development, as well as advance educational ecosystems in Chiang Mai's innovation districts. Internationally, the Center collaborates with The Teacher Education Center under the auspices of UNESCO and The Department of Educational Administration at Chiang Mai University, benefiting over 200 faculty members, master's, and doctoral students.

Furthermore, the Center has secured external research funding amounting to 19,889,811 THB from national funding agencies such as PMU-A and PMU-B. Through these initiatives, the Center has achieved its objectives by generating new knowledge, expanding academic collaborations, and maximizing the impact of research and innovation to reduce inequality and drive sustainable development.

Keywords: Inequality Reduction, Advancement of Social Opportunity, Underprivileged

A Riverscape Visual Assessment for Sustainable Development of Chiang Mai City

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Chiang Mai city has preserved its historic value through physical rehabilitation along the Ping River to promote public use. However, the lack of considering a townscape concept has resulted in inappropriate development projects that impede people's engagement with the river. Consequently, this has adversely affected the city's historic landscape.

In this context, researchers have proposed features of the relationship between the visibility and accessibility of the landmarks to preserve heritage sites. This project evaluated riverscape landmarks in Chiang Mai city using a procedural technique that combines spatial and statistical analyses to assess cultural resources and to identify potential areas for improvement to further aid in historic riverscape conservation and design guidelines. GIS was used to analyze interconnections and classify landmarks based on visibility and accessibility using hierarchical clustering analysis (HCA).

The findings reveal differences in accessibility of angular step coverage (ASC) and walking distance coverage (WDC), which influence landmark designation. City-level landmarks have the highest ASC, while religious landmarks are most visible. These unique factors impact HCA results, categorized into six groups aligned with historical significance and purpose. The clustered groups represent the strategic design of the riverscape, requiring policies to preserve these icons as part of the historic landscape.

Keywords: Riverscape, Historic Landscape, Landmark, Viewshed, Accessibility, GIS

References:

Reconnecting River-City: A Visibility and Accessibility Assessment of the Ping River's View Characters in Chiang Mai City. Heritage 2024, 7, 6101–6124. https://doi.org/10.3390/heritage7110286

Funding Source(s): Chiang Mai University Junior Research Fellowship Program 2023

Smart Urban Forest: Urban Tree Management Using Valued-based Approach for Sustainable City of Chiang Mai

Nattasit Srinurak[1*], Janjira Sukwai[1], Lakhana Srihong[2], Bunjong Somboonchai[3], Warong Wonglanka[4], Wongkot Wong a-pai[5], Tassawan Jaitheung[5]

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This research utilized GIS as the primary instrument to develop an urban forest management system that allows locals to participate in the survey. Urban tree management is crucial for maintaining a sustainable urban green space and reducing complexity and conflict. The initiative adopted a nature-based and value-based approach to tree care, combining species-specific care with a people-centered smart city approach to assess tree health in historic urban areas. A total of 4607 records were collected from the field survey event using a mobile application. During the field survey, the basic name, spatial characteristics, position, and potential risks of each tree were gathered. GIS converted the tree's general or local name into its scientific name, enabling the analysis and evaluation of the data. The findings revealed that animals and insects have posed the greatest threat to trees, accounting for 56.39% (2748) of the total risk. Notably, these trees are primarily located in areas with poor soil suitability. To optimize resource allocation, the study recommended prioritizing tree care in these hot-spot areas. Additionally, maps of tree blooming and fruiting indicated the potential to enhance the benefits of urban trees in the research region by aligning their phenological patterns with local conditions.

Keywords: Urban Forest Management, GIS, Nature-Based Solution, People-Centered Smart City; Chaing Mai

References:

Smart urban forest initiative: Nature-based solution and people-centered approach for tree management in Chiang Mai, Thailand. Sustainability 2024, 16, 11078. https://doi.org/10.3390/su162411078

Funding Source(s): Chiang Mai University Targeted Research Program 2023

CMU Annual Research Summit 2025

Oral Presentation



Social Science, Humanities & Art

Invited Speakers

ศ.ดร.สิทธิพล เครือรัฐติกาล
วิทยาลัยสหวิทยาการ
มหาวิทยาลัยธรรมศาสตร์

ประสบการณ์ด้านการวิจัยและการขอตำแหน่งทางวิชาการในสายสังคมศาสตร์และมนุษยศาสตร์

รศ.ดร.นัธนัย ประสานนาม
คณะมนุษยศาสตร์
มหาวิทยาลัยเกษตรศาสตร์

มนุษยศาสตร์ใหม่?: ประสบการณ์ของนักวิจัยรุ่นกลาง

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Sustainable Development for Highland Handicrafts

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Handicrafts contribute significantly to sustainable development by generating employment in remote areas while preserving traditional knowledge, cultural heritage, and supporting local economies. This study focuses on highland handicrafts in Northern Thailand, where ethnic diversity and local contexts such as geography, climate, beliefs, and materials which shape distinctive craft identities. Using a qualitative approach, the research involved fieldwork in ten highland villages, employing participant observation, semi-structured interviews, and case studies to document current practices and propose strategies for craft development. Findings reveal that most groups are informal, with 3–25 members, and varying levels of establishment. Craft knowledge is typically passed down through households, with most members participating in the full production process. Distribution is primarily through the Royal Project Foundation, although some use social media platforms. Raw materials are largely purchased, with limited integrated production. Key crafts include bamboo basketry and embellished hand-woven textiles, reflecting ethnic traditions but lacking strong group identities. Many artisans have deep technical knowledge but limited exposure to design innovation, tools, or market trends. The study concludes that while highland artisans possess rich cultural capital, enhancing their design and market capacities is essential for sustaining and evolving highland crafts in contemporary contexts.

Keywords: Highland handicrafts, Sustainable development, Ethnic communities, Local wisdom

References:
Journal of Fine Arts, Chiang Mai University 17-2 (2026).

Funding Source(s): This research was supported by the Targeted Research Fund from Chiang Mai University.

A study of pottery work at Ban Muang Kung, Nong Kwai Subdistrict, Hang Dong District, Chiang Mai Province for conservation and sustainable development

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This research project focuses on preserving and sustainably developing the traditional ceramic craftsmanship of Ban Muang Kung in Chiang Mai. Known for its Lanna pottery heritage, the community holds rich cultural identity and local wisdom. In its second year, the project emphasized adapting traditional forms into contemporary product designs while retaining authenticity. Prototypes include Nam-Oon, Nam-Mak, Nam-Ton mascot, Nam-Ton cookies, and stickers—modern reinterpretations of the Nam-Ton (water jar) and Nam-Mor (drinking pot). These designs combine cultural storytelling with modern living, engaging younger audiences and expanding market relevance. The project also introduces the concept of the "Under-the-House College of Ban Muang Kung," a community-based learning platform to transmit pottery skills and knowledge across generations. Development is structured into four phases, ranging from small-scale crafts for youth and tourists to architectural ceramics and social innovation products for specialized groups. This model encourages community participation, supports creative product development, and strengthens local wisdom across cultural, economic, and social dimensions. The initiative offers a replicable framework for sustainable craft revitalization in traditional communities.

Keywords: Ceramics, Ban Muang Kung, Under-the-House College, Contemporary Craft, Cultural Preservation

References:

Founding Report and Handbook of the Under-the-House College for Ceramic Artisans of Ban Muang Kung and Community Product Development Handbook of Ban Muang Kung

Funding Source(s): Mid-Career Researchers, Chiang Mai University



Center of Excellence in Econometrics

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The Center of Excellence in Econometrics (CEE), founded in 2013, aims to be a regional leader in quantitative economic research. Its mission includes advancing econometric methodologies, promoting knowledge transfer, and fostering academic collaboration. Over the years, CEE has become a recognized hub for international cooperation, engaging with leading scholars from Asia, Europe, and the United States. Recent initiatives focus on integrating machine learning, quantum econometrics, and symbolic data analysis into practical domains such as energy, environment, finance, and social development. From 2023 to 2024, the Center achieved remarkable outcomes. In FY2023, CEE exceeded publication and funding targets by 140% and 110%, respectively, and fulfilled 320% of SDG-related research goals. It also produced several knowledge innovations and prototypes. In FY2024, external funding reached 182%, SDG-related research rose to 460%, and technology transfer initiatives were completed successfully. These results underscore CEE's commitment to research excellence, innovation, and high-impact applications. Beyond research, the Center plays a key role in capacity building by training researchers and strengthening academic networks. Through its services, workshops, and policy-relevant studies, CEE continues to promote the application of econometric tools to address critical socioeconomic challenges in Thailand and the wider region.

Keywords: SDGs, Econometrics, Machine learning, Quantitative economics, Academic collaboration

References:

CEE Annual Report (2024).
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Funding Source(s): Chiang Mai University.

Developing a sustainable assessment and management system of business incubation in Thailand

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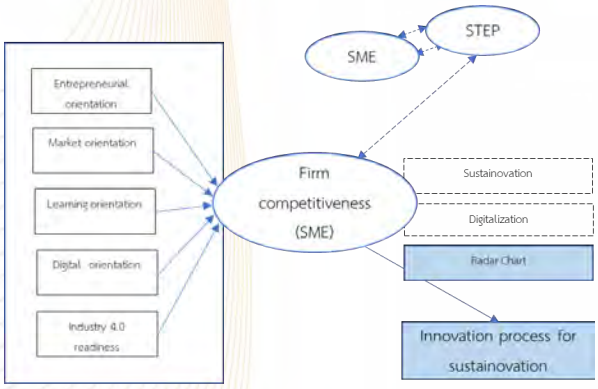
This research develops an assessment framework for evaluating the sustainable performance of business incubators and new entrepreneurs. Recognizing the pivotal role of business incubators in supporting start-ups, the study comprises two core subprojects. The first subproject formulates a sustainable performance assessment framework for Thai business incubators, utilizing the Delphi and DEMATEL methods to define and prioritize key success indicators. Results show that sustainability within the Thai context is largely defined by social and economic factors. Among the identified indicators, social aspects such as business network expansion, enhancement of local products through innovation, and technology transfer to local communities are the most critical. In contrast, economic indicators such as career advancement for incubator staff and the generation of new local businesses are ranked lower in significance. The second subproject identifies five essential competency domains for small and medium-sized enterprise entrepreneurs in the Thailand 4.0 era: resource-based view, entrepreneurial orientation, market orientation, learning orientation, and digital orientation. The study concludes that agencies should support digital and collaborative capacities. While findings offer new insights, limitations exist as data are specific to Thailand, suggesting the need for broader future research.

Keywords: Business incubation, business incubator, decision making, sustainability, performance assessment

References:

Journal of Intellectual Capital 26 (2025) 616-643.
Tourism economics Online First (2025)

Funding Source(s): Targeted Research, Chiang Mai University



Immersive Virtual Preservation of Thai Mythical Heritage: The Role of HimmapanVR in Enhancing Cultural Accessibility

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This research presents the development and evaluation of HimmapanVR, a virtual reality museum designed to preserve and promote the cultural legacy of Himmapan creatures—mythical beings rooted in Thai traditions. Addressing the limited and scattered knowledge about these figures, the project integrates 3D modeling, digital artworks, and animations to create an immersive and educational environment. Utilizing VR headsets, users engage with digitized cultural content in a simulated museum setting. A study involving 30 participants assessed the system's usability and effectiveness through measures of effort expectancy, performance expectancy, and perceived authenticity. The findings reveal that the virtual museum significantly enhances user understanding of cultural narratives, fosters a sense of realism, and demonstrates the potential of immersive technologies in safeguarding intangible heritage. This work offers a pioneering approach to digital cultural preservation in the Thai context.

Keywords: Visual museum, Digital Museum, Cultural preservation, Cultural heritage, Immersive systems, Virtual reality, Mythical creatures

References:

TEM Journal 13(4) (2024) 3359-3372.
Heliyon 10(9) (2024) e30052.

Funding Source(s): This research was supported by CMU Junior Research Fellowship Program.



Enhancing the Potential of Learning Managers in Lamphun through the Creation of Learning Innovations for Urban Development

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The implementation of research project "The Enhancement of Lamphun's Young Citizens towards UNESCO Leaning City Citizenship" focused on participatory process of young citizens in Lamphun, through brainstorming, co-designing, and co-implementing, which has been joined by over 100 participants from Lamphun's young citizens network and also related sectors who work in the field of young citizens support. The research has been carried out by using focus group discussions, hands-on workshops, fieldwork study, lessons learned session, and assessment. The data were collected from both primary and secondary sources, which the quantitative data were analyzed by using descriptive statistics and the operational data were examined through inductive analysis. The research project could strengthen the potential of learning managers through learning innovation within the area, such as public space development to reach maximum benefits, board game design named "Lamphun Legends : The Game of Hidden Wonders" that has been integrated with the curriculum in 4 schools within Lamphun Municipality area, and Lamphun tourism promotion by creating video promotion titled "Get to Know Lamphun in 4 Hours". They could conclude the "Young Citizens – Mentors – Communities – Organizations" driving mechanism that encourages learning managers with the sense of citizenship and local development with creativity and sustainability.

Keywords: Lamphun Young Citizens, Learning City, Learning Manager, Citizenship, UNESCO

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UNESCO (2020) The UNESCO Global Network of Learning Cities welcomes 54 new member cities from 27 countries. Search https://uil.unesco.org/lifelong-learning/learning-cities/unesco-global-network-learning-cities-welcomes-54-new-member

Funding Source(s): The Mid-Generation Researcher Development Fund, Chiang Mai University.



Learning Ecosystem Development for Pilot Schools in the Chiang Mai Education Sandbox

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This study investigates the development of learning ecosystems in pilot schools under the Chiang Mai Education Sandbox, an area-based educational reform initiative in Thailand. The research aims to synthesize implementation lessons, examine conditions and challenges, and develop practical guidelines to enhance educational quality through contextual innovation.

Using a mixed-methods approach—including document analysis, interviews, field observations, participatory workshops, and expert validation—the study found that while pilot schools made progress in competency-based curricula, active learning, and professional learning cultures, they continued to face significant barriers. These included weak policy communication, limited and unsustainable funding, teacher workload, inadequate community involvement, and fragmented evaluation systems.

To address these issues, five validated manuals were developed covering school management, curriculum design, learner-centered instruction, authentic assessment, and internal quality assurance. Strategic recommendations were proposed at three levels: (1) national policy—integrated communication and long-term budgeting; (2) innovation area—creation of Learning Innovation Centers and centralized data systems; and (3) school—ecosystem-based strategic planning and capacity building. The study concludes that transforming education in diverse local contexts requires a robust learning ecosystem built on cross-sector collaboration, contextualized curriculum design, and sustained community participation.

Keywords: Learning Ecosystem, Area-Based Education Reform, Pilot Schools, Policy Recommendations

References:

Journal of Community Development Research (Humanities and Social Sciences 17(4) (2024) 95-108.
International Journal of Advanced and Applied Sciences 10(11) (2024) 202-212.

Funding Source(s): This research was partially supported by Chiang Mai University. Grant No. TGCMU2566P030/2566.

Voices and Needs of Gifted Students for Higher Education Admission: Toward Educational Equity in Educational Sandbox Areas

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This study explored the voices and needs of gifted students regarding their admission to higher education within Thailand's Educational Sandbox Areas (ESAs), established under the Educational Sandbox Act of 2019 to reduce educational inequality. The research problem addressed the lack of understanding about gifted students' perspectives on higher education access in these ESAs. A qualitative research approach using Focus Group Discussions (FGDs) was employed to gather in-depth insights from gifted upper secondary school students in Chiang Mai and Mae Hong Son provinces. Purposive sampling was used to select 20 participants from 6 schools who demonstrated exceptional abilities across academic, artistic, athletic, or other specialized domains. The FGDs examined six key themes: current educational management perceptions, understanding of higher education admission channels, preferred evaluation methods, scholarship needs, institutional policies, and additional support requirements. Data were analyzed using inductive content analysis to identify emerging themes and patterns. Major findings revealed that gifted students require diverse and flexible admission pathways emphasizing holistic assessment rather than solely written examinations. Students expressed needs for accurate and timely information about educational opportunities, appropriate financial support, institutional policies responsive to regional contexts, and effective guidance systems understanding local circumstances. Notable differences emerged between urban and rural students, with rural students requiring greater informational and access support, while urban students focused on program quality and diversity. The study concludes that incorporating student voices was crucial for developing effective higher education support mechanisms within ESAs, potentially leading to more responsive educational innovations that promote true educational equity for gifted students.

Keywords: gifted students, educational equity, higher education admission, educational sandbox areas

Funding Source(s): Mid-Career Researchers Scholarship, Chiang Mai University

A study of teachers' problems and needs in teaching communicative English of elementary school in education sandbox in Chiang Mai

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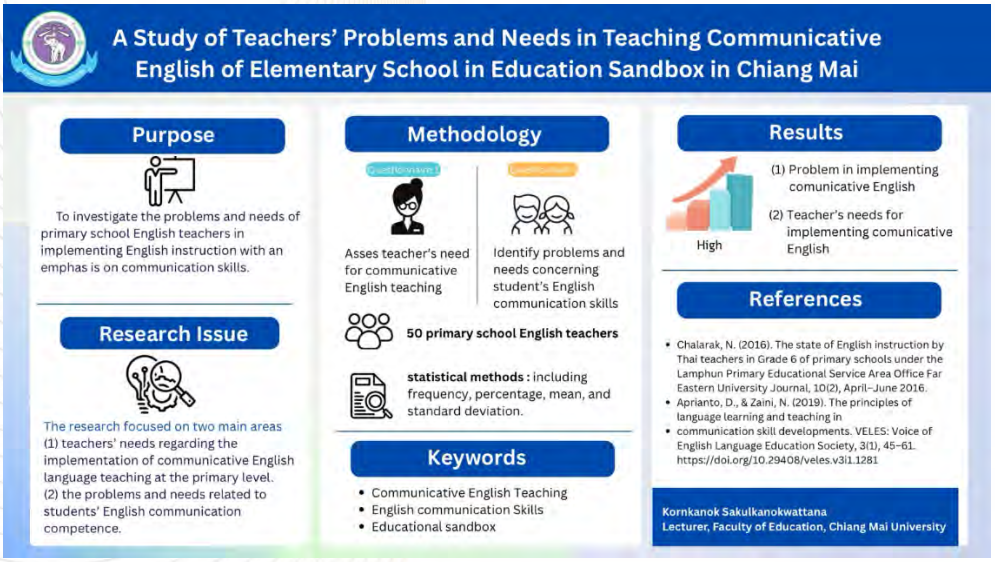
This study aimed to investigate the problems and needs of primary school English teachers in implementing English instruction with an emphasis on communication skills. The research focused on two main areas: (1) teachers' needs regarding the implementation of communicative English language teaching at the primary level, and (2) the problems and needs related to students' English communication competence. Data for the first area were collected using a questionnaire designed to assess teachers' needs for communicative English teaching in primary education. For the second area, a separate questionnaire was used to identify the problems and needs concerning students' English communication skills. The studied sample consisted of 50 primary school English teachers from the 2023 academic year, selected through simple random sampling. These teachers were from schools located in the Educational Innovation Area in Fang District, Chiang Mai Province, under the Office of the Basic Education Commission (OBEC). The data were analyzed using basic statistical methods, including frequency, percentage, mean, and standard deviation. The results revealed that the overall level of problems in implementing communicative English instruction at the primary level was high. Likewise, the overall level of teachers' needs for implementing communicative English instruction was also found to be high.

Keywords: communicative English teaching, English communication skills, educational sandbox

References:

Far Eastern University Journal 10 (2016).
VELES: Voice of English Language Education Society 3 (2019) 45-61.

Funding Source(s): Junior Researchers



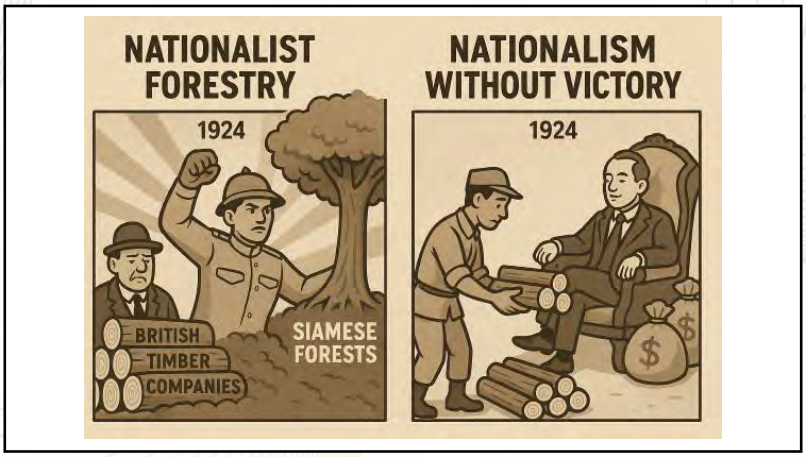
Nature for the Nation? Rethinking the Nationalist Rupture in Thai Forestry History

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This research revisits the history of Siam's Royal Forest Department (RFD) during the early twentieth century, when the RFD implemented two major policies. First, they began replacing British staff with young Siamese officers. Second, they preserved several forest concessions for state logging industry and Siamese timber firms. While "official" narratives of the RFD history tend to frame these changes as a product of royal nationalism during the reign of King Vajiravudh (Rama VI, 1910-1925), this paper sheds light on limitations of the overt emphasis on nationalism as the main driving force of history. By reexamining the "ruptures" supposedly caused by the rise of nationalism, I argue that this period should rather be perceived as a continuity – when many of the tasks planned by the previous regime were finally actualized. Moreover, by situating Siam within the network of the global teak trade, this research shows that "nationalist" attempts did little to change how Siamese forests were understood and extracted. Instead, the RFD ended up normalizing Siam as a mere raw material producer as if it were a colony of European timber consumers.

Keywords: forest department, forestry, nationalism, colonialism, Anglo-Siamese relations

Funding Source: CMU Junior Research Fellowship Program



Balancing Use, Commerce, and Control of E-Cigarette: A Comparative Legal Analysis between the United States, the European Union, and Thailand

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Electronic cigarettes (e-cigarettes) is a major health problem in Thailand that requires ongoing evaluation and revision of public health policy at all levels (from international down to national sectors). After decades of regulation to reduce and control e-cigarettes in the Thailand's jurisdiction, Thai authorities still face public health challenges from all relevant illegal sources of e-cigarettes, that is an unruly or uncontrolled domestic market of illegal e-cigarettes. Identifying efficient solutions to protect people from the use of e-cigarettes requires regulation of electronic cigarettes varies across international and national jurisdictions. Regulatory responses might be able to consider the normative question how legislative responsibilities for controlling such risks, and costs and burdens associated with that regulation of e-cigarettes, should be distributed between all relevant stakeholders. On the other hand, allowances of facilitating the sale or placement of e-cigarette products require smokers, vendors and manufacturers that liable to bear the costs of preventing damage to human health or the environment. The study expounds on the regulation of e-cigarettes across the United States, the European Union, and Thailand and the ways in which they develop the control of E-cigarettes use, exploring the policy landscape of e-cigarettes to further consider the relationship between use, commerce, and control dynamics and regulatory standardization.

Keywords: E-Cigarettes, Comparison, Regulations, United States, European Union, Thailand

References:

E-cigarette regulation: a delicate balance for public health. Addiction (Abingdon, England) 115(12) (2020) 2197–2199.
Tobacco use insights 13 (2020).

Funding Source(s): Chiang Mai University Mid-Career Researcher Grant



Enhancing the Cultural Capital of Communities through the Production of Contemporary Amulets to Stimulate High-Value Creative Economies and Cultural Tourism from the Groundwork Level. (A Case Study of the Sam Phan-ton Giant Spirit Shrine in Srilom-Saengmuangma Community, Mueang District, Lampang Province.)

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This anthropological study explores the worship of the Sam Phan-ton giant spirit, focusing on how cultural capital rooted in local beliefs is transformed within the framework of the high-value creative economy. The study has three main objectives: 1) to examine belief in the Sam Phan-ton giant spirit as a form of religious and spiritual cultural capital; 2) to investigate how the sacredness of the spirit is transformed into cultural value that benefits community development; and 3) to apply anthropological knowledge to create social innovations that enhance cultural capital and generate economic value for the community. Using qualitative methods, including documentary research and ethnographic fieldwork conducted at the Sam Phan-ton Giant Spirit Shrine in Wat Sri Lom, Mueang District, Lampang Province, the study problematizes the state's exclusive focus on official Buddhism that aligns with its ideological framework. In contrast, the Mutelu trend has emerged as a local strategy used by ordinary people to manage everyday uncertainties and challenges. From this perspective, religious and social dimensions are inseparable, resulting in new forms of religious practice among laypeople that have evolved into popular culture. The findings reveal that worship of the Sam Phan-ton giant spirit, deeply rooted in popular Buddhism, has become a form of valuable cultural capital capable of generating a high-value market. Accordingly, this project developed prototypes of modern sacred objects inspired by the giant spirit belief, using locally sourced ceramic materials with contemporary designs. This approach challenges traditional concepts of sacred authority and highlights the creative potential to meet the evolving demands of younger generations.

Keywords: Religion, The Sam Phan-ton giant spirit, Cultural capital, Creative Economies, Modern sacred objects

References:
Journal of Liberal Arts Maejo University 13(1) (2025) 151–171.

Funding Source(s): Grant for Targeted Research, Chiang Mai University / 2023 that support the reported work



The ambivalence of social media roles on election: the evidence from Thailand and Indonesia

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The proliferation of internet accessibility and the growing number of social media users underscore the significant influence social media platforms exert on the political behaviours and global landscape. In regions such as Southeast Asia—where democratisation processes are dynamic, complex and often uneven, the proliferation of false campaign messages, fake news, disinformation and deceptive narratives raise pressing questions about the actual impact of social media on democratic processes. This research examines how political actors leverage these platforms and the extent to which social media contribute to democratic development. The focus is placed upon recent elections in Thailand and Indonesia, which have been at the forefront of democratisation in the region. Drawing on qualitative documentary research and in-depth interviews, the study argues that while social media in Thailand continues to function as a tool of liberation—amplifying marginalised voices and fostering democratic engagement—its impact in Indonesia is more ambivalent. Evidence from the two countries show that the presence of strong pro-democracy networks and the prevalence of reasoned discourse emerge as key conditions for social media to effectively support democratic processes.

Keywords: Democratisation, Election, Social Media, Thailand, Indonesia

Funding Source(s): Chiang Mai University's Targeted Research scheme (ID: R66IN00397)

Digital Transformation in Culturally Rooted Municipalities in Thailand: Balancing Technology and Tradition - A Case Study of Mueang Tonpao Municipality

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This research examines the challenges and opportunities of digital transformation in culturally rooted municipalities in Thailand, focusing on Mueang Tonpao Municipality in San Kam Pang District, Chiang Mai Province. As part of Thailand's ambitious Thailand 4.0 strategy to establish 100 smart cities by 2022, this study investigates how traditional communities navigate the complex process of integrating advanced technologies while preserving their unique cultural heritage. Through a mixed-methods approach combining qualitative case study analysis with quantitative data collection, this research explores the drivers of digital transformation, identifies key challenges in balancing technological advancement with cultural preservation, and proposes a framework for successful smart city development that respects local values. The findings reveal significant obstacles including inadequate digital infrastructure, digital divide issues, organizational culture barriers, and the need for inclusive community participation.

Keywords: Smart City, Digital Transformation, Mueang Topao Municipality

Funding Source(s): Chiang Mai University's Target Research

Policy and Governance Innovation for Multi-Crises

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This project explored and enhanced governance structures in response to multiple, intersecting crises, such as climate change. It focused on five key components: policy labs, digital misinformation, collaborative governance, macro-policy impacts, and international policy networks. Together, these components offered a comprehensive framework for understanding and improving crisis-responsive governance. Our findings underscored the strategic role of policy labs in crafting innovative and adaptive policy solutions. By examining the skills and roles of policy designers, we highlighted the importance of resilience and agility. The study on digital misinformation, focusing on the Thai election campaign, revealed how accurate and trustworthy information is critical for democratic decision-making. Collaborative governance was explored through a case study on food governance in Chiang Mai, showcasing how stakeholder engagement supports effective public goods management. At the macro level, we addressed climate-related policy challenges, particularly within Thailand's coffee sector. Through stakeholder workshops and dialogues, we co-developed a climate adaptation plan to support long-term sustainability. Lastly, we engaged with international policy networks to strengthen the national and global policy ecosystem. This project provides valuable insights and practical strategies for building governance systems capable of responding to complex, overlapping crises.

Keywords: multicrises, food governance, policy lab, digital misinformation, climate adaptation

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Funding Source(s): Targeted Research, Chiang Mai University



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Poster Presentation



Frontier/ Deep Tech

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Integrated Design of IronQ-Embedded Nanofibers and MSC Secretomes for Enhanced Bioactivity in Wound Healing and Regeneration

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The objective of this study was to develop and optimize a bio-nanofiber scaffold incorporating IronQ for potential application in regenerative medicine and wound healing. The research addresses the challenge of creating a nanofibrous material that combines mechanical integrity with biological functionality to support cell growth and tissue regeneration. Polycaprolactone (PCL) and polyethylene oxide (PEO) were blended in varying ratios, and the 3:1 PCL/PEO formulation produced the most uniform and mechanically stable film. Electrospinning was used to fabricate nanofibers, with a 10% w/v polymer concentration yielding fibers with a diameter of 82 ± 8.2 nm. IronQ was incorporated into the optimized nanofibers at various concentrations, and the composite containing 400 µg/mL of IronQ exhibited the best mechanical properties while supporting mesenchymal stem cell (MSC) proliferation over a 10-day culture period.

To evaluate bioactivity, MSCs were preconditioned with IronQ and cultured in 2D and 3D systems. The secretomes obtained were tested on Human Umbilical Vein Endothelial Cells (HUVECs), fibroblasts, and macrophages. The 3D-derived secretome significantly enhanced angiogenesis,

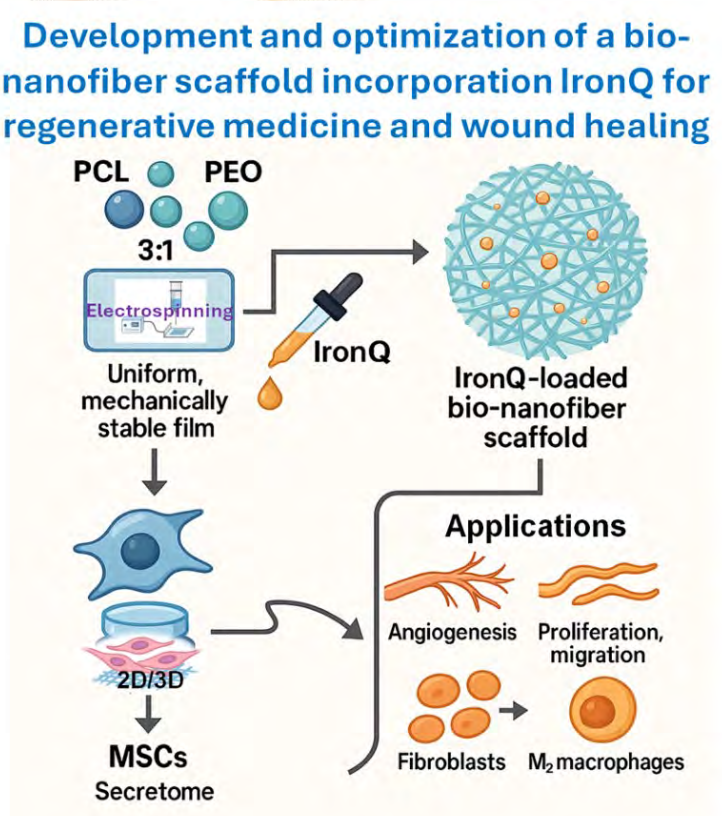
fibroblast proliferation, migration, and collagen production, and promoted the polarization of M2 macrophages.

These findings demonstrate that IronQ-loaded PCL/PEO nanofibers, combined with MSC-derived secretomes, offer a promising biomaterial platform for regenerative therapies and wound healing applications.

Keywords: Electrospun nanofibers, Polycaprolactone (PCL)/Polyethylene oxide (PEO), IronQ, Mesenchymal stem cell (MSC) secretome, Regenerative medicine

References: *Scientific Reports* 14 (2024) page 9441.
Burns & Trauma 13 (2025) page tkae078.

Funding Source(s): Thailand Science Research and Innovation



Evaluation of Hydraulic Conductivity and Stormwater Runoff Quality Improvement for Bioretention System Design in Thailand

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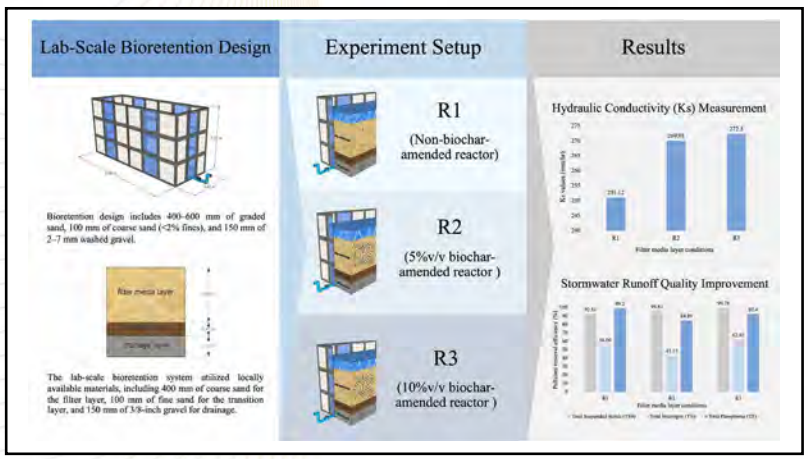
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This study evaluated the performance of bioretention systems in terms of stormwater runoff quality improvement and hydraulic conductivity (Ks) efficiency. Three alternative bioretention designs were conducted under controlled conditions to compare between non-biochar-amended and biochar-amended reactors. Results demonstrated that the non-biochar-amended reactor (R1) showed Ks values with an average of 251.12 mm/hr., compared to 269.98 mm/hr. in the 5% biochar-amended reactor (R2) and 272.30 mm/hr. in the 10% biochar-amended reactor (R3). Pollutant removal efficiencies varied significantly across designs. For R1, total suspended solids (TSS), total nitrogen (TN), and total phosphorus (TP) were retained at 92.51%, 56.09%, and 99.20%, respectively. R2 demonstrated reductions of 95.81% for TSS, 43.13% for TN, and 84.89% for TP. R3 exhibited reductions of 99.78% for TSS, 62.05% for TN, and 92.40% for TP. These findings highlight that bioretention systems can effectively improve stormwater runoff quality, while biochar plays an important role in enhancing hydraulic conductivity. The results offer valuable insights for the design and optimization of bioretention prototypes, presenting scalable solutions for sustainable urban water management in Thailand.

Keywords: Bioretention system, Hydraulic conductivity, Stormwater runoff, Pollution reduction, Biochar

References: *Journal of Environmental Management* 292 (2021) 112766.
Journal of Sustainable Water in the Built Environment 8(3) (2022) 04022003.

Funding Source(s): the CMU Junior Research Fellowship Program



Effect of space weather and cosmic ray on earth's atmosphere

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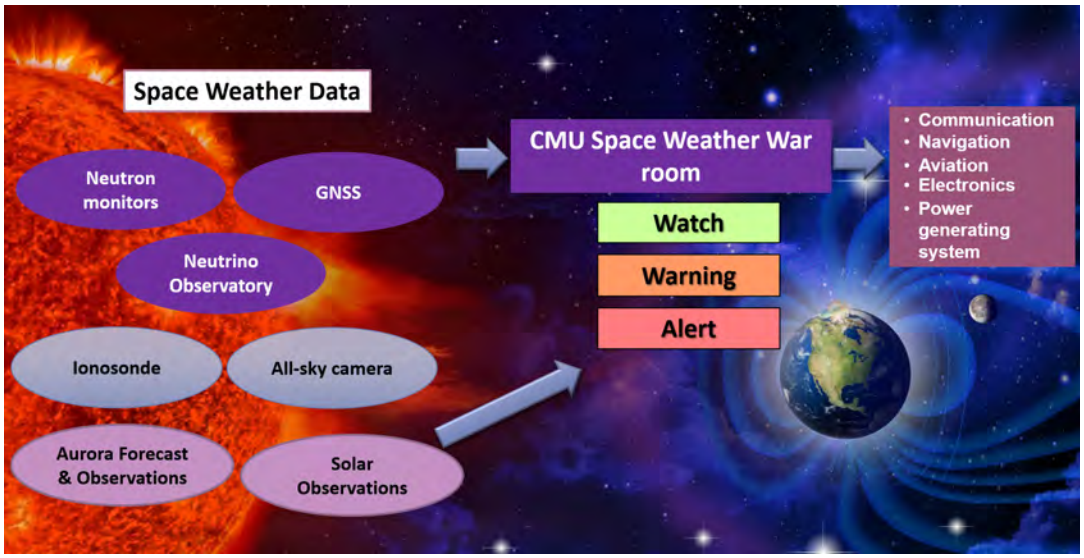
Research on space weather employs diverse data sources, including auroral studies, ionospheric variations, and cosmic ray measurements. Space-based platforms monitor auroral observations and ionospheric responses to substorms, while the Global Ultraviolet Imager (GUVI) instrument aboard the Thermosphere Ionosphere Mesosphere Energetics and Dynamics (TIMED) spacecraft analyzes how geomagnetic storms affect ionospheric density. In Thailand, complementary observations are conducted through a monitoring network coordinated by the Thai GNSS and Space Weather Information Center at King Mongkut's Institute of Technology Ladkrabang (KMITL). Ground-based neutron monitors detect cosmic radiation by measuring space-originated particles as they interact with Earth's atmosphere at various locations. At equatorial regions such as Thailand, Earth's magnetic field configuration allows high-energy primary cosmic rays to reach the atmosphere with distinct characteristics compared to higher latitudes. This research analyzes variations in primary cosmic ray spectra using specialized techniques that enable efficient spectral analysis within short observation periods. These complementary research approaches aim to establish correlations between geomagnetic storms, space weather conditions, and their cascading effects on both the ionosphere and Earth's surface environment. Understanding these relationships will enhance our ability to predict space weather impacts on technological systems and biological processes, including potential effects on human health and safety.

Keywords: space weather, aurora, cosmic rays, ionosphere, magnetosphere

References: *Kittiya, A., Nuntiyakul, W., Seripienlert, A., et al., 2024, The Astrophysical Journal, 975:274, DOI:10.3847/1538-4357/ad843d*

Jamlongkul, P., Wannawichian, S., Paxton, L. P., et al., 2025, JGR: Space Physics, under revision

Funding Source(s): Fundamental Fund 195928 (NRIIS) 67A104000069



Establishment of an Efficient Plasmid Transfection for Genetic Engineering and Gene Therapy in Human Cell model using Particle Accelerator

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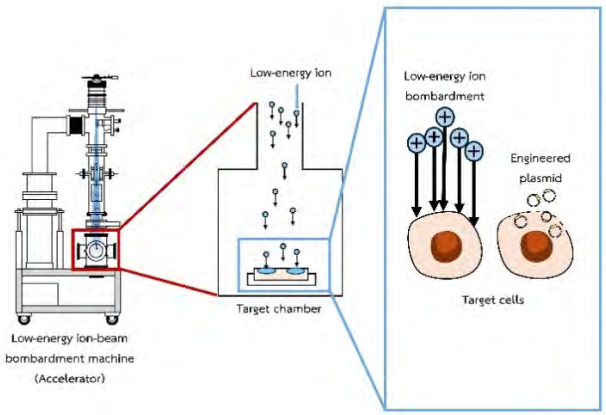
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Successful gene therapy relies on effective genetic engineering techniques and gene-delivery systems, both of which have seen significant advancements over time to overcome previous limitations. This project aimed to develop three types of plasmids based on CRISPR/Cas9 technique and lentiviral transduction to enhance gene-editing efficiency and safety, while also optimizing low-energy ion beam-assisted transfection in human cells. Plasmid design was carried out using Benchling software, including: (1) a packaging plasmid with defective integrase to prevent viral integration into the host cell genome; (2) a self-targeting lentiCRISPR v2 plasmid to reduce off-target effects and byproducts; and (3) an HDR-template plasmid enabling excision of antibiotic resistance genes after cell selection. The first two plasmids were successfully constructed, while the HDR-template plasmid is currently undergoing cloning. These plasmids will be used to evaluate integrase functionality through various analytical techniques. For the optimization of low-energy ion beam-assisted transfection, HeLa cells were utilized as a model to establish optimal conditions balancing viability and transfection efficiency. Parameters such as sample preparation, ion-beam settings, and plasmid concentration were optimized. Under optimal conditions (0.18 ml freezing medium, 30 keV nitrogen ion beam, 6×1016 ions/cm2 fluence, and 400 ng plasmid per 1×105 cells), the cell viability reached 37.5±4.4% with marker expression of plasmid at 17.1±5.6%.

Keywords: Gene therapy, Gene delivery system, Genetic engineering techniques, Low-energy ion beam assisted transfection, CRISPR/Cas9 technique

References: *Recent advances in the development of gene delivery systems* 23 (2019). *Integrase deficient lentiviral vector: prospects for safe clinical applications* 10 (2022) e13704.

Funding Source(s): The Fundamental Fund 2024, Grant No. FF094/2024, IAEA Technical Cooperation Programme 2022-2025, Enhancing Industrial and Research Utilization of Ion Beam Facilities (THA1016)



Performance enhancement of large-scale perovskite solar cells via carbon dots/polymer composites and organic fluorescent materials to reach the carbon footprint limit (PLCAR)

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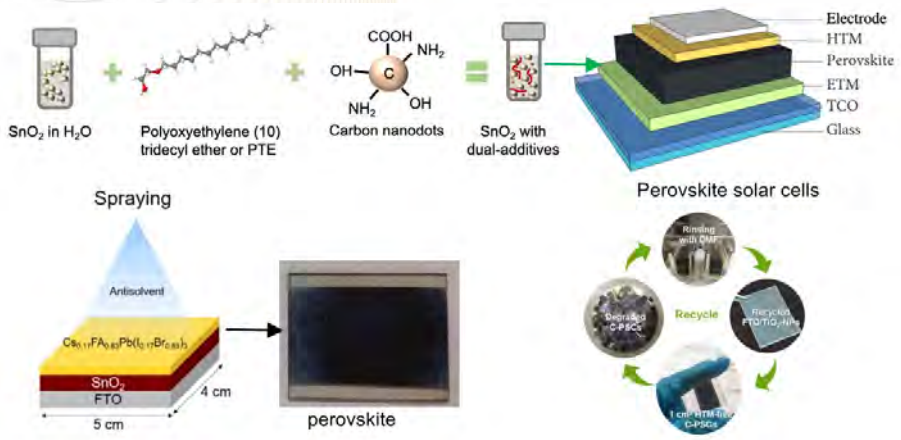
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This research aims to develop high-performance, stable, and scalable perovskite solar cells (PSCs) through nanomaterial engineering and practical film formation techniques. It consists of two sub-projects. The first enhances the electron transport layer (ETL) by incorporating carbon quantum dots (CQDs) and polyoxyethylene tridecyl ether (PTE) into colloidal SnO_2, achieving a power conversion efficiency (PCE) of 16.33% and 86% stability over 1,200 hours (ISOS-D1, unencapsulated). Fluorine-doped SnO_2 nanoparticles were also synthesized via a pH-controlled hydrothermal method, although further optimization is needed for device-quality films. The second sub-project develops a spray-assisted antisolvent technique for large-area perovskite film deposition (4×5 cm^2). Smooth films were obtained using anisole or ethyl acetate as antisolvents, with a maximum PCE of 14.53% in 0.09 cm^2 devices. Moreover, hole-transport-material-free PSCs with carbon electrodes and 1 cm^2 active areas were fabricated, showing promising performance. Recycled FTO/ETL substrates performed comparably to new ones, highlighting potential for sustainable applications.

Keywords: perovskite solar cells, SDG7, renewable energy

References: *ACS Applied Energy Materials,* 7 (2024), 6972-6985.
Journal of Colloid and Interface Science, 700 (2025), 138436.

Funding Source(s): Fundamental Fund 2567



Luteolin-Rich Extract from *Harrisonia perforata* (Blanco) Merr. Root Attenuates SARS-CoV-2 Spike S1 Glycoprotein-Induced Inflammation in A549 and THP-1 Cells via MAPK Pathway Inhibition

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[4]*Akkhraratchakumari Veterinary College, Walailak University, Nakhon Si Thammarat 80160, Thailand*

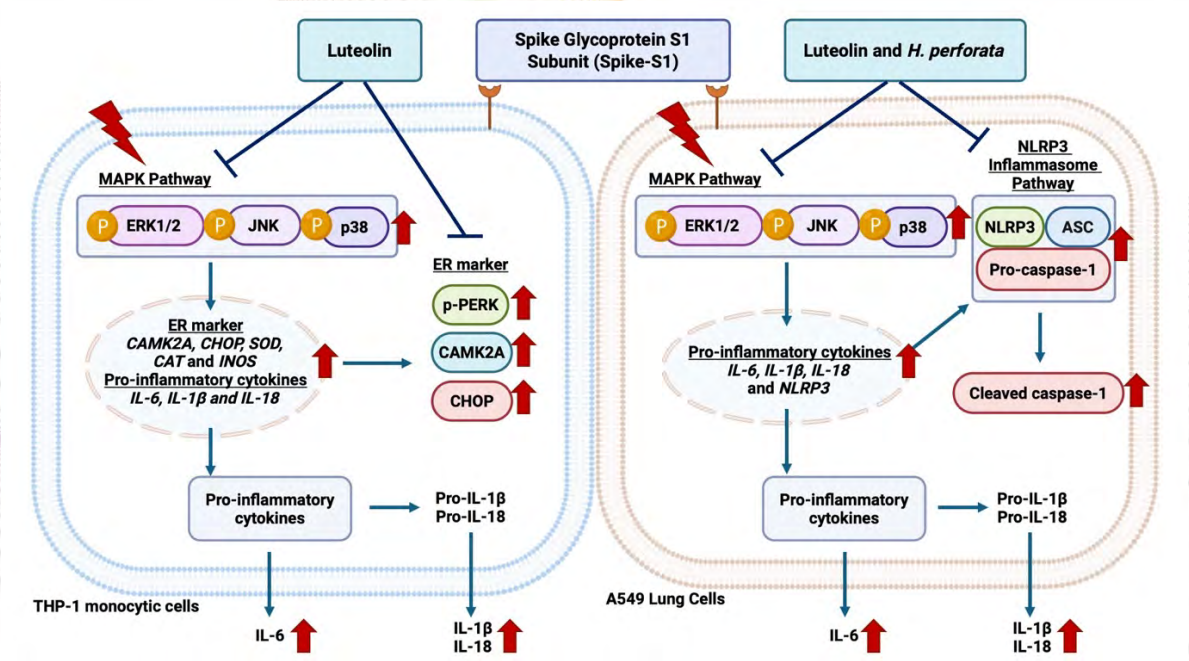
[5]*Center of Multidisciplinary Technology for Advanced Medicine (CMU-TEAM), Faculty of Medicine, Chiang Mai University, Chiang Mai 50200, Thailand*
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The global outbreak of SARS-CoV-2 has led to a major public health crisis, with the spike glycoprotein S1 subunit (spike-S1) identified as a key contributor to inflammatory responses in lung tissue and immune cells. *Harrisonia perforata*, a key component of Thai traditional medicine, is commonly used for its antipyretic and anti-allergic properties. However, evidence supporting its effectiveness against spike-S1-induced inflammation remains limited. This study investigated the anti-inflammatory effects of *H. perforata* root ethanol extract (HPEE) and its major active compound, luteolin, in A549 lung epithelial cells and THP-1 monocytic cells. Spike-S1 protein significantly induced inflammation in both cell lines, marked by increased secretion and mRNA expression of IL-6, IL-1β, and IL-18 ($p < 0.01$). In A549 cells, HPEE and luteolin significantly attenuated this response in A549 cells in a dose-dependent manner ($p < 0.05$). Underlying mechanism revealed that HPEE and luteolin suppressed activation of the NLRP3 inflammasome pathway by downregulating the expression of key inflammasome components. Transcriptomic profiling in THP-1 cells identified CAMK2A as a key molecule involved in spike-S1-induced inflammation. Spike-S1 also upregulated ER stress markers at both gene and protein levels, which were significantly reduced by luteolin treatment ($p < 0.01$). Additionally, luteolin suppressed the secretion of IL-6, IL-8, and IL-1β in a dose-dependent manner in THP-1 cells ($p < 0.05$). Furthermore, our findings revealed that luteolin, the major active compound in HPEE, downregulated the MAPK signaling pathway by reducing phosphorylation of p-ERK1/2, p-JNK, and p-p38 proteins ($p < 0.05$) in both A549 and THP-1 cells. These results suggest that *H. perforata* root extract and its major flavonoid, luteolin, possess strong anti-inflammatory properties and may hold therapeutic potential for mitigating spike-S1 protein-induced lung inflammation.

Keywords: SARS-CoV-2, *Harrisonia perforata*, luteolin, inflammatory cytokines, MAPK Signaling Pathways

References: *Pharmaceuticals (Basel)*. 2024 Oct 20;17(10):1402. doi: 10.3390/ph17101402. *Life (Basel)*. 2025 July 5;15:1077. https://doi.org/10.3390/life15071077.

Funding Source(s): Fundamental Fund 2024, Chiang Mai University and also Thailand Science Research and Innovation (TSRI).



Analysis of a ZVDS Class-DE current-driven full- bridge rectifier to compensation network capacitance design for WPT system

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The accurate, systematic, and effective design method of compensation network capacitance based on the series-series resonant topology is presented for reducing the reactive power of the wireless power transfer system. The design procedure uses a principle of a current-driven Class-DE full-bridge zero-voltage and zero-derivative-switching rectifier, a Class-D full-bridge zero-voltage-switching inverter, and a tightly coupled transformer. The key parameters of the Class-DE current-driven full-bridge zero-voltage and zero-derivative-switching rectifier as a function of diode conduction duty ratio are derived from the time-domain analysis with Fourier series, such as the normalized input resistance, the normalized input reactance, and the relationship of the input current and output voltage. Moreover, the advantages of the Class-DE current-driven full-bridge rectifier are that the diodes turn ON with zero-voltage-switching at low dv/dt, turn OFF with zero-current switching and zero-voltage and zero-derivative switching at low di/dt. As a result, the switching losses and the switching noise considerably reduced. The simulation and experimental results were in good agreement with those predicted theoretically, and the maximum transfer power and the system efficiency at a transfer distance of 50 mm are 1.8 kW and 93.38%, respectively. Therefore, the rectifier is especially suitable for high-frequency and high-efficiency resonant DC/DC converters in wireless power transfer applications.

Keywords: Wireless power transfer, Compensation network, High-frequency and high-efficiency rectifier, Class-DE rectifier.

References: *IEEE Transactions on Power Electronics* vol. 37 no. 12 (2022) pp. 15693-15705.
IEEE Journal of Emerging and Selected Topics in Power Electronics vol. 11 no. 3 (2023) pp. 3574-3585.

Funding Source(s): The King Mongkut's University of Technology North Bangkok, the National Research Council of Thailand (No. N42A650320), and the Fundamental Fund 2024, Chiang Mai University.

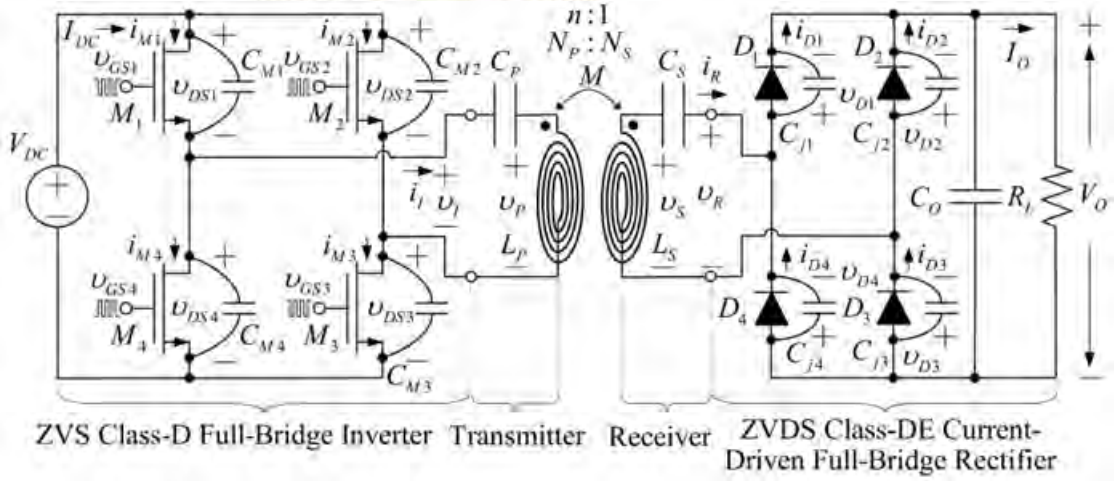


Fig. 1. Topology of WPT system based on ZVDS Class-DE current-driven full-bridge rectifier with ZVS Class-D full-bridge inverter.

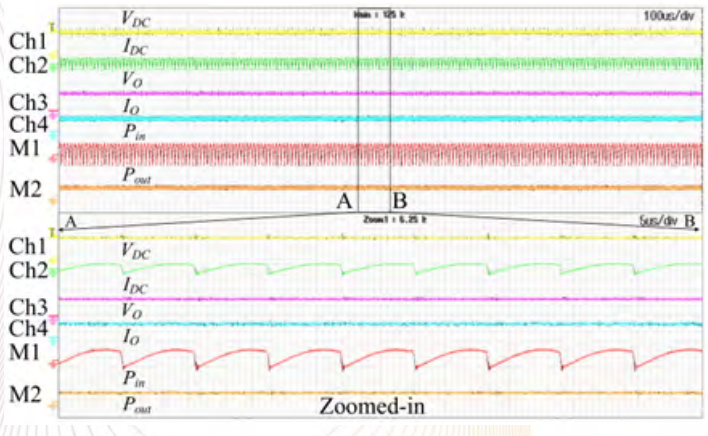


Fig. 2. Experimental input voltage V_{DC}, input current I_{DC}, output voltage V_O, output current I_O, input power P_{in}, and output power P_{out} waveforms, lower six waveform is zoomed-in view of top six waveform. Ch1 and Ch3: 500 V/div, Ch2: 50 A/div, Ch4:10 A/div, M1 and M2: 10 kW/div, and time: 50 μs/div.


International Journal of Electronics and Communications

Regular paper

Analysis of a ZVDS Class-DE current-driven full- bridge rectifier to compensation network capacitance design for WPT system

Fig. 3. Published journal.

Mathematical modeling and intelligence algorithms development using machine learning for non-communicable disease prevention and screening

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The government currently incurs healthcare expenses of approximately 400 billion baht per year, or about 13% of the national expenditure, and this trend is expected to rise. Should Thailand enter an aging society within the next 15 years, healthcare costs could increase to around 480 billion baht, and further to 1.4 trillion baht as the aging population grows. Meanwhile, the World Health Organization (WHO) has identified Non-Communicable Diseases (NCDs) as a significant and escalating issue, particularly in developing countries. In Thailand, over 14 million people suffer from NCDs, and more than 300,000 people die from these diseases annually, accounting for 73% of all deaths. The economic impact is substantial, estimated at 25.2 billion baht per year, with the primary causes linked to lifestyle behaviors, especially among urban populations who exhibit higher NCD rates than rural residents. The highest incidences and mortality rates among NCDs are seen in obesity, hypertension, chronic obstructive pulmonary disease (COPD), cancer, stroke, heart disease, and diabetes.

This research program aims to develop comprehensive knowledge, technology, and innovation for the prevention and screening of NCDs, integrating mathematics, statistics, computer science, and medical science. This includes the development of mathematical models and algorithms to solve optimization problems and to create tools for the detection and screening of chronic NCDs using machine learning. The insights gained from this research can be further applied to prototype technologies for developing software applications and computer systems dedicated to NCD prevention and screening.

Ultimately, the project aims to facilitate the application of diverse innovations for area-based and localized disease prevention and screening, promoting area-based and local economic development. This development approach is designed to enhance public health and well-being by providing accessible healthcare services, thereby improving the quality of life and environmental standards to foster a high-quality society, including readiness for an aging society.

Keywords: Efficient algorithms, machine learning, optimization problems, non - communicable disease prevention and screening, predictive modeling

Funding Source(s): Fundamental Fund 2024

Electrochemical Sensor for Rapid Detection of Alpha S1-Casein in Non-Dairy Milk Using Epitope-Imprinted Polydopamine

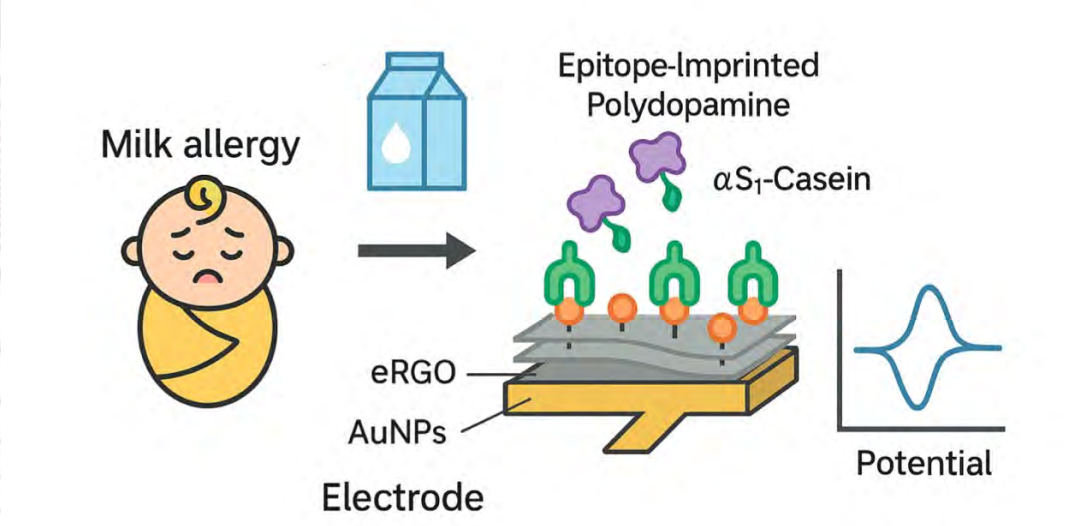
Achirapon Puttawong[1] and Tabkrich Khumsap[1,*]

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Milk allergy in infants and young children is often linked to alpha S1-casein, a major milk allergen. To address the need for a faster and more affordable detection method, we developed an electrochemical sensor based on gold nanoparticles (AuNPs) and electrochemically reduced graphene oxide (eRGO). The sensor uses an epitope-imprinted polydopamine layer, created via electropolymerization using a short peptide sequence ("ISSSEEIVPN") as a selective recognition element. Key fabrication parameters include template concentration, polymerization cycles, and template removal time were optimized to enhance sensor performance. The resulting sensor achieved a detection range of 0.1–1 ppm, with a detection limit as low as 0.04 ppm. It demonstrated high selectivity against non-target proteins and provided reliable recovery in spiked non-dairy milk samples (83–129%), with good repeatability. This approach offers a promising platform for allergen screening in food products and contributes to improved food safety surveillance.

Keywords: Casein; Electrode; Polydopamine; Epitope; Sensor

Funding Source(s): Junior Research Felllowship Program 2023, Chiang Mai University



Optimizing Parameters of Friction Stir Spot Welding of Aluminium Alloy for Automation Manufacturing

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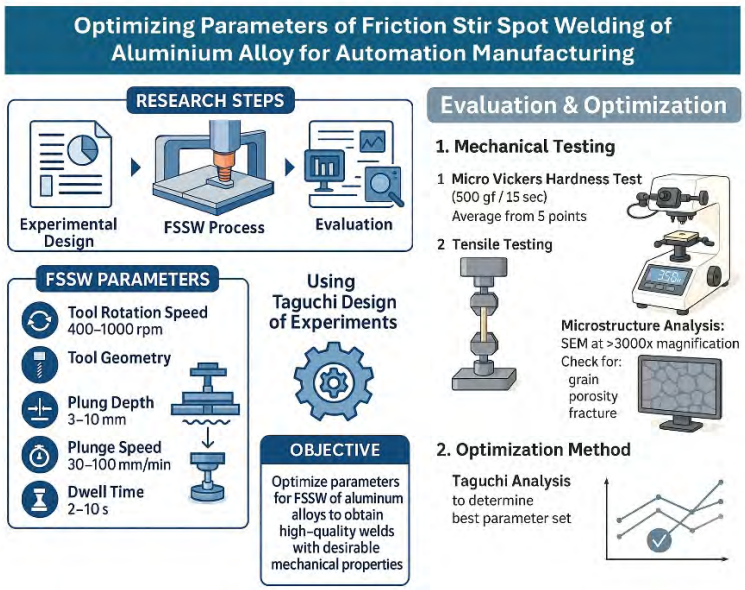
[1]*Department of Industrial Engineering, Faculty of Engineering, Chiang Mai University, Thailand*
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Friction Stir Spot Welding (FSSW) is a solid-state joining technique that fastens overlapped metal sheets by generating localized heat through friction and mechanical stirring. This emerging welding method offers potential for producing high-quality spot joints without melting the material. However, information regarding the influence of process parameters on the mechanical properties of aluminum alloy joints remains limited. Therefore, this study aims to identify the optimal welding parameters for FSSW in aluminum alloys to achieve high-strength, reliable joints. A Taguchi design of experiments was employed to systematically investigate the effects of six key parameters: (1) tool rotation speed, (2) tool geometry, (3) axial load, (4) plunge depth, (5) plunge speed, and (6) dwell time. Based on literature review, these factors significantly affect the mechanical behavior of the weld. The objective is to determine the most effective combination of these parameters to enhance weld quality and strength. The results are expected to support the integration of FSSW into automated systems and contribute to the advancement of smart manufacturing technologies.

Keywords: Optimizing Parameters, Friction Stir Spot Welding, Aluminium Alloy, Automation Manufacturing, Industry Innovation and Infrastructure

References: *Journal of Advanced Joining Processes*, Vols. 9 (2024), 100223
Materials, Vols. 14 (2021), 1157

Funding Source(s): Funded by CMU Junior Research Fellowship Program, Grant Agreement No. JRCMU2567_028



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Deep Learning-Based Pneumonia Identification Using 3D Gradient-Weighted Class Activation Mapping Visualization

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3 Information Technology Service Center, Chiang Mai University, Chiang Mai, Thailand
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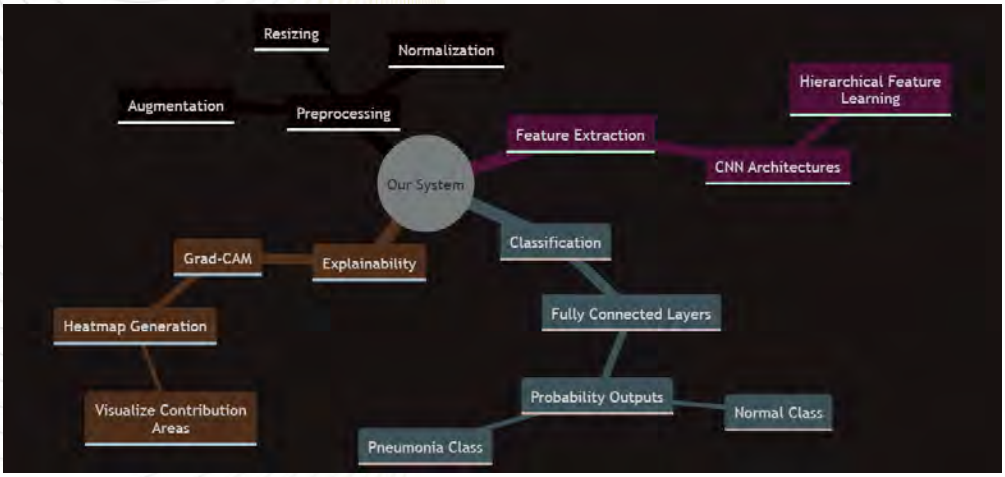
The issue of pneumonia remains a topic of concern globally, and consequently, proper diagnosis is extremely critical to improving the prognosis of patients suffering from it. This work evaluates the use of deep learning models, ResNet-50, EfficientNet, and MobileNet, for the class of pneumonia from chest X-ray images. We employed a dataset of about 8,000 images and performed experiments to determine the extent to which model performance depended on data augmentation and the chosen network architecture. The experimental results showed that MobileNet achieved the highest accuracy (97.51%) without the use of augmentations, whereas EfficientNet attained peak accuracy (97.12%) with the use of augmentations. Furthermore, we applied Gradient-Weighted Class Activation Maps, which added value to the model's ability to be understood by the users. The results showed that with the aid of Explainable Artificial Intelligence (XAI) techniques, deep learning automation of pneumonia detection holds great promise. Further work should be conducted on multi-class classification and external validation, and it is generally more useful to employ sophisticated means of explanation to ensure the model is more useful and reliable in a clinical setting.

Keywords: Deep learning, Gradient-Weighted Class Activation Mapping, Identification, Pneumonia, Visualization

References:

Lecture Notes in Networks and Systems 1416 (2025) 1-8.
IEEE Access 8 (2020) 119951-119960.

Funding Source(s): This research received partial funding from the CMU Junior Research Fellowship Program. The authors sincerely acknowledge the unwavering and substantial support from the Doi Suthep Nature Center, the Department of Computer Science, and the Faculty of Science, Chiang Mai University. Ethical approval for this study, which involved human subjects, was obtained from the Faculty of Medicine's Local Ethics Committee at Thammasat University in compliance with ICH-GCP: E6(R2) guidelines.



Secured Wireless Communications Using Multiple Active and Passive Intelligent Reflecting Surfaces

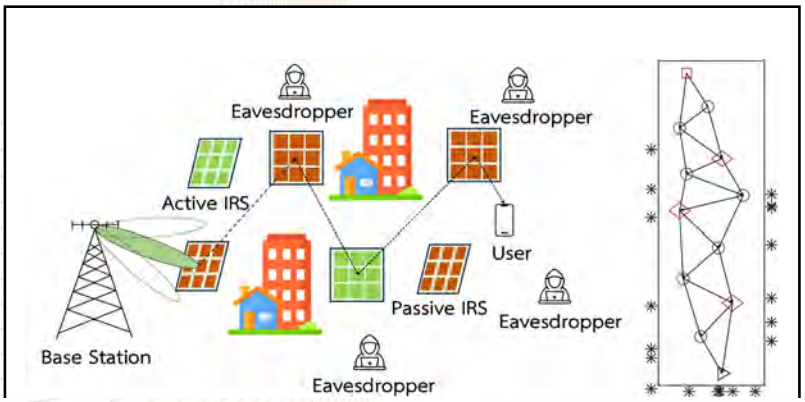
Apichart Nutchanat, Kampol Woradit*, Paskorn Champrasert
Optimized AI Systems for Energy and Environmental Sustainability Research Group, Department of Computer Engineering, Faculty of Engineering, Chiang Mai University
E-mail: kampol.w@cmu.ac.th

This paper presents a novel approach to secure wireless communications by integrating multiple Active and Passive Intelligent Reflecting Surfaces (MAMP-IRSs). We propose a multi-hop beam routing mechanism that leverages active and passive IRSs to establish a secure communication link between a base station and a user to minimize the risk of eavesdropping. Our methodology involves optimizing the beamforming vectors at the base station and the reflection coefficients of the IRSs to maximize the secrecy rate against potential eavesdroppers. This optimization problem exhibits non-convexity, necessitating a computationally Full Search of the solution space. Therefore, we propose two heuristic algorithms:
i) Skewed Dijkstra's Algorithm and ii) Myopic Algorithm. Skewed Dijkstra's Algorithm utilizes path decomposition and graph theory to identify optimal multi-reflection paths. The Myopic Algorithm looks up only adjacent nodes with a single hop. Numerical simulations demonstrate that Skewed Dijkstra's Algorithm typically gives a secrecy rate close to the Full Search algorithm, and the Myopic Algorithm gives a narrower performance gap when the number of elements at each passive IRS becomes large.

Keywords: intelligent reflecting surface (IRS), active IRS, passive IRS, cooperative passive/active beamforming, multi-hop beam routing, physical layer security

References:
Secured Wireless Communications Using Multiple Active and Passive Intelligent Reflecting Surfaces , IEEE Open Journal of the Communications Society, A. Nutchanat Volume 6 (2025) page 1763-1779.

Funding Source(s): Research Group Development Grant



การพัฒนาแบบจำลองเสมือนจริงของการจราจรเขตเมือง กรณีการออกแบบทางแยกที่มีพื้นที่จอดรถจักรยานยนต์

Digital Twin Model for Urban Traffic Conditions A Case Study of Motorcycle Box Intersection Design

ผศ.ดร. นพดล กรประเสริฐ
ศูนย์วิจัยทางวิศวกรรมขนส่งและเทคโนโลยีโครงสร้างพื้นฐาน คณะวิศวกรรมศาสตร์

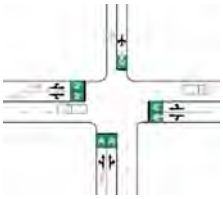
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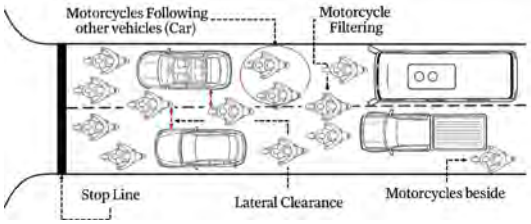
เทคโนโลยีแบบจำลองเสมือนจริง (Digital Twin) มีบทบาทสำคัญในการออกแบบและดำเนินการของระบบต่าง ๆ ให้มีประสิทธิภาพ โดยอาศัยการสร้างโมเดลสะท้อนในโลกดิจิทัลช่วยวิเคราะห์ ติดตาม และประเมินประสิทธิผลของระบบ

แบบจำลองเสมือนจริงในงานด้านวิศวกรรมขนส่งและจราจร เป็นเครื่องมือที่สำคัญที่จะช่วยศึกษาความเหมาะสม ออกแบบ และประเมินประสิทธิภาพด้านการจัดการจราจรและความปลอดภัย ของโครงสร้างพื้นฐานด้านการขนส่งและจราจร เพื่อให้เข้าใจและวิเคราะห์ถึงสภาพการจราจรที่ซับซ้อนได้

งานวิจัยนี้ประยุกต์แบบจำลองเสมือนจริง เพื่อออกแบบและประเมินประสิทธิภาพของทางแยกสัญญาณไฟที่มีพื้นที่จอดรถจักรยานยนต์อยู่ด้านหน้า (Motorcycle Box) ซึ่งใช้อย่างแพร่หลายในปัจจุบัน โดยเฉพาะอย่างยิ่งในเขตเมือง เพื่อเป็นพื้นที่สำหรับรถจักรยานยนต์หยุดจอดรอสัญญาณไฟอยู่ด้านหน้ายานพาหนะอื่น ๆ

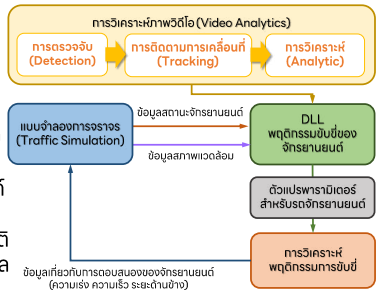




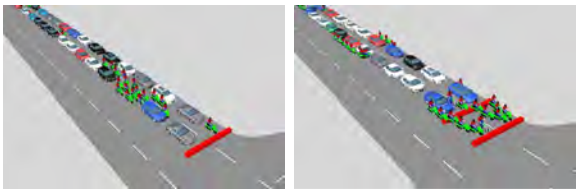


การพัฒนาแบบจำลองเสมือนจริง

เครื่องมือที่ใช้วิจัย
- YOLOV8 model สำหรับวิเคราะห์ข้อมูล
- External Driver Model (EDM) ด้วย C++ และ API สำหรับสร้างพฤติกรรมการขับขี่ของจักรยานยนต์
- PTV Vissim สำหรับสร้างภาพจำลอง 3 มิติ และประเมินประสิทธิผล







พื้นที่ศึกษาทางแยกในเขตเมือง

งานวิจัยศึกษาและสำรวจข้อมูลพฤติกรรมการขับขี่รถจักรยานยนต์บริเวณทางแยกในจังหวัดเชียงใหม่ด้วยเทคโนโลยีการวิเคราะห์ภาพถ่ายวิดีโอ (Video Analytics) เพื่อบันทึกข้อมูลการวางตำแหน่ง แนวการเคลื่อนที่ของยานพาหนะ การเร่งออกตัว ความเร็ว ปริมาณจราจร ความล่าช้า และความยาวแถวคอย



สรุปผลการศึกษา

งานวิจัยพัฒนาแบบจำลองการจราจรเสมือนจริงของพฤติกรรมการขับขี่และการหยุดจอดของรถจักรยานยนต์บริเวณทางแยก และประยุกต์ใช้แบบจำลองในการออกแบบทางแยกที่มีพื้นที่จอดรถจักรยานยนต์ด้านหน้า และศึกษาผลกระทบของ Motorcycle Box ต่อประสิทธิภาพการให้บริการและความปลอดภัยของทางแยก

แบบจำลองการจราจรเสมือนจริงที่พัฒนาขึ้นมีลักษณะกายภาพทางแยกต่าง ๆ มีความถูกต้องแม่นยำในด้านการวางตัวตำแหน่งยานพาหนะ และอัตราการแทรกตัว ที่ระดับความเชื่อมั่นที่ 95%

ผลการศึกษา พบว่า การออกแบบ Motorcycle Box เป็นแนวคิดการแยกการจราจรของกลุ่มผู้ใช้ถนนที่ประเภทบางกับยานพาหนะอื่น ช่วยเพิ่มประสิทธิภาพการจราจรของทางแยก โดยให้สิทธิแก่จักรยานยนต์ที่มีความปราดเปรียว ไม่เกิดความล่าช้าแก่ยานพาหนะอื่น และส่งผลต่อกระแสจราจรที่คล่องตัวขึ้น แต่อย่างไรก็ตาม Motorcycle Box ส่งผลต่อพฤติกรรมการแทรกตัวของจักรยานยนต์มากขึ้น ซึ่งอาจเป็นอันตรายระหว่างจักรยานยนต์และยานพาหนะอื่น

Deep Rolling Process Modeling Using Finite Element Analysis in Residual Stress Measurement on Rail Head UIC860 Surface

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This study investigates the effects of deep rolling parameters, pressure, speed, and offset, on the residual stress distribution and material deformation in UIC 860 Grade 900A railway rails. We will model deep rolling to simulate the process and predict the residual stress profile in railway rails. Subsequently, we will rigorously compare and analyze the FEM simulation results with experimental data to optimize deep rolling parameters for improved residual stress distribution. Using both experimental methods and finite element analysis via ANSYS 2023 R1, the study varied deep rolling parameters. Experimental deep rolling pressure was set at 150 bar, speed at 1800 mm/min, and offset at 0.1 mm, while FEA simulations predicted corresponding pressures of 157 bar and speed of 1796.52 mm/min. These parameter settings were chosen to induce significant surface compressive stresses that could enhance the material's mechanical performance. The experimental results showed an average compressive residual stress of 498.9 MPa, closely aligning with the FEA-predicted value of 502.5 MPa. A paired *t*-test revealed no statistically significant difference between the two results, with a T-value of −0.22 and a *p*-value of 0.833, validating the reliability of the FEA model. The consistent deformation observed in both experimental and FEA simulations, especially with a 0.1 mm offset, confirmed that the rolling parameters were effective in producing uniform stress distribution, albeit with a slightly extended processing time due to the small offset. Overall, the findings confirm that optimizing the deep rolling parameters of pressure, speed, and offset leads to favorable residual stress distributions and improved material properties. The results indicate that FEA is a reliable tool for predicting the outcomes of deep rolling, and this study provides a strong foundation for further refinement of the process to enhance performance in practical applications, such as railway rail treatments.

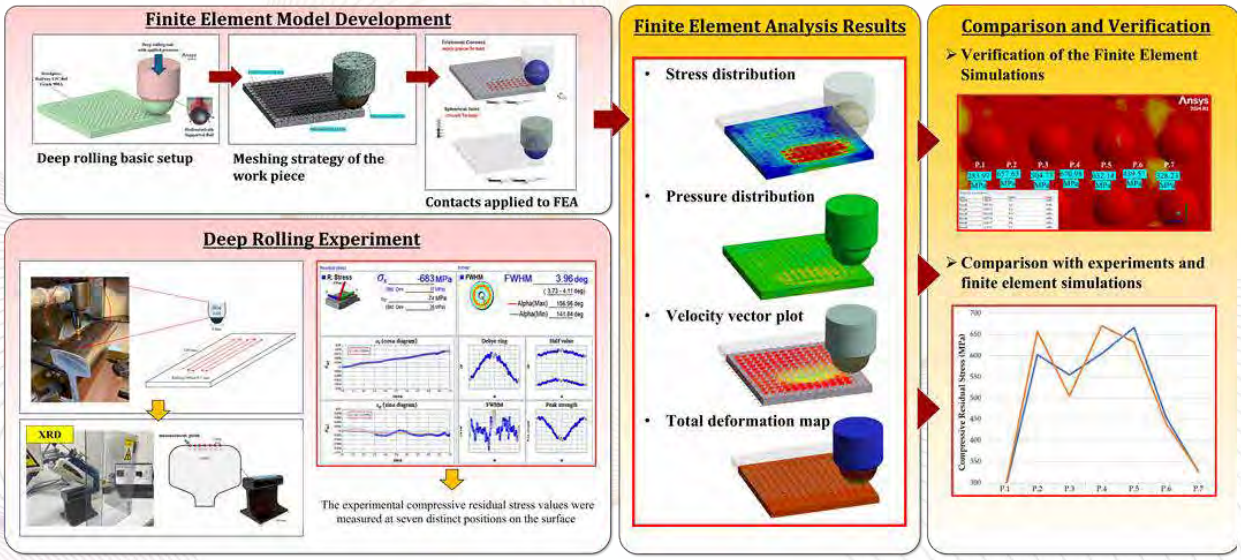
Keywords: deep rolling, residual stresses, finite element analysis, UIC 860 grade 900A, railway infrastructure

References:

Applied Sciences, Vol. 14(23) (2024) 11222.
Results in Engineering, Vol. 25 (2025), 103894.

Funding Source(s): Fundamental Fund-2024 Chiang Mai University

Graphical Abstract



Integrating Digital Innovation and Ethnic Identity in Tai Lue Craftsmanship: A Co-Creation Approach for Cultural Preservation and Tourism

Somkeit Noamna and Manissaward Jintapitak*

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**E-mail: manissaward.j@cmu.ac.th*

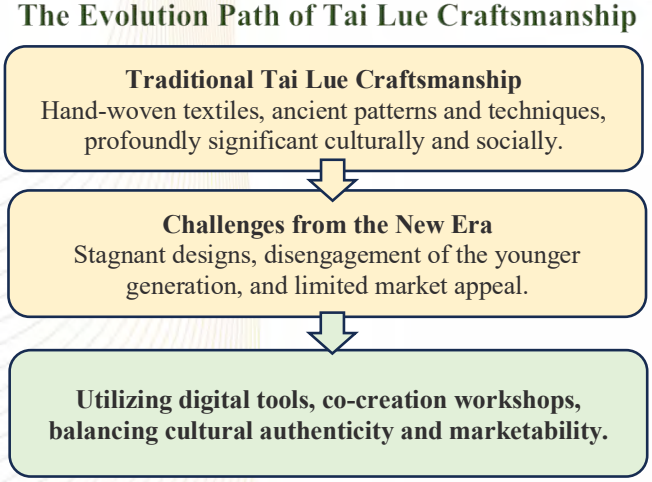
This study investigates the integration of digital innovation and co-creation approaches to transform Tai Lue craftsmanship, focusing on cultural preservation, ethnic identity expression, and economic sustainability. Using qualitative research methodology, the project engaged the Tai Lue community of Ban Luang Nuea, Doi Saket, Chiang Mai, through participatory design thinking workshops. Artisans collaborated with designers to create modern lifestyle products, including fashion accessories and home décor, by incorporating traditional Tai Lue cultural motifs enhanced through digital design and printing technologies. The study addressed the challenges of appealing to younger and international markets while empowering aging artisans to develop value-added products for the tourism sector. Findings reveal that blending modern digital tools with traditional craftsmanship can effectively preserve cultural heritage, stimulate community pride, and generate new economic opportunities. The research demonstrates that co-creation not only sustains cultural authenticity but also enhances the commercial viability of traditional crafts, contributing significantly to the development of creative economies.

Keywords: Digital Innovation, Co-creation, Cultural Preservation, Tai Lue Craftsmanship, Design Thinking, Community Participation, Tourism Souvenirs

References:

Journal of Community Development Research (Humanities and Social Sciences) 2025; 18(2)

Funding Source(s): The Office of Research Administration, Chiang Mai University, for their financial support through the research grant No. TGCMU2566P037 / 2566



Weaving Heritage into the Metaverse: A VR-Based Approach to Cultural Preservation and Economic Empowerment

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This research proposes a novel approach that combines local knowledge with immersive technology to promote sustainable cultural and economic development. The study aims to address the reduction in traditional weaving processes and limited market access for local craftsmen by creating the "Metaverse System," a virtual reality-based 3D simulation of the Lamphun brocade fabric-making process. An engaging educational experience based on Lanna heritage delivered via interactive digital storytelling. The project implements collaborative design and iterative testing to assure cultural authenticity and user involvement. The findings show that the approach efficiently improves cultural knowledge, promotes intergenerational learning, and encourages interest in traditional crafts. Additionally, integration with the SMENORTHERN e-commerce platform allows for direct online sales of GI-certified fabrics, empowering elder craftsmen and enhancing market reach. The research demonstrated that combining digital innovation with cultural heritage protects intangible traditions while also revitalizing local economy. By leveraging soft power, the initiative exemplifies how virtual tools can transform heritage into a sustainable, globally accessible, and economically viable asset.

Keywords: Metaverse, Tourism, Creative Lanna Platform, Visual Reality

References:

Tongpaeng, Y., Nobnop, R., Wongwan, N., Homla, P., Intawong, K., & Puritat, K. (2024). Comparison of gamified and non-gamified mixed reality in enhancing museum visitor engagement, motivation, and learning outcome. Journal of Heritage Tourism, 19(6), 919–948. https://doi.org/10.1080/1743873X.2024.2351852

Funding Source(s): Fundamental Fund (2567) that support the reported work



Development of Optimization Models and Intelligent Algorithms for Machine Learning and Applications to Image Segmentation Methods for Angiograms of Coronary Artery Stenosis

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Narawadee Phudolsitthiphat, Somchai Sriyab, Wannasiri Wannasit
Ekkachai Thawinan, Attapol Kaewkhao, Teerapong Suksumran,

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Optimization is a mathematical method that can be used to solve problems and develop knowledge in science and technology effectively. Optimization has been studied and developed extensively through an important tool known as fixed point theory. The purpose of this research project is to develop a fixed point theory algorithm to find the solution of the energy function optimization problem to facilitate accurate coronary angiography, which will result in efficient prediction and diagnosis of coronary artery disease.

Keywords: Optimization model, fixed point theory, coronary artery stenosis, image segmentation, energy function

References:

Journal of Nonlinear and Convex Analysis, 24:12 (2023) 2643-2655.
Journal of Nonlinear and Convex Analysis, 25:11 (2024) 2767-2777.

Funding Source(s): This research project was supported by Fundamental Fund 2024, Chiang Mai University.

Numerical Modeling of Solid Particles Reduction in Water Clarifiers Using Lattice Boltzmann Method

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Suspended solids in water are detrimental to power plant production. Statistical data from the field turbidity monitoring states different solid particle reduction performance between two existing solid contact clarifiers. This study compares their turbidity reduction efficiencies and discusses treatment characteristics of these clarifiers. The clarifiers feature circular basins with a dual layer of baffles and different internal mixing agitation. The first clarifier (CLR47) has the inner baffle as a truncated polygon with a lateral inlet. The second clarifier (CLR89) has a 30-degree tangential inlet attached to a small circular inner baffle. The Lattice Boltzmann Method (LBM) computational method was employed for fluid flow computation. Particles with 13 different diameter sizes ranged from 20 μm to 850 μm were accounted for suspended solid modeling via discrete phase model (DPM). The numerical model presents the overall solid settling efficiency as 46% and 78% for CLR47 and CLR89 respectively. The low recirculation within the mixing region and effluent high contamination of 20 μm size class particles of design CLR89 were noticed. While the CLR47 model has greater turbidity reduction despite greater maintain mixing efficiency for a higher flocculation rate expectation.

Keywords: Solid contact clarifier, Water treatment, Computational Fluid Dynamics, Lattice Boltzmann Method, Discrete Phase Model

References:
Alexandria Engineering Journal 127 (2025) 251-264.

Funding Source(s): OASYS Research Group

Automated Detection of Diabetes From Exhaled Human Breath Using Deep Hybrid Architecture

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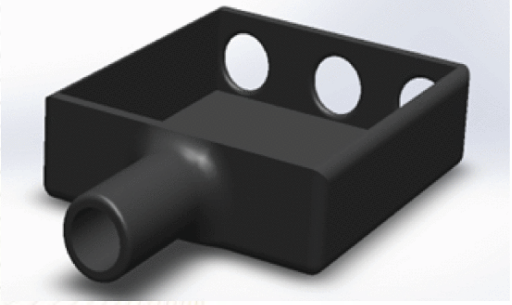
We have proposed an automated medical system for detecting type 2 diabetes from exhaled breath. Human breath can be used as a diagnostic sample for detecting many diseases as it contains many gases that are dissolved in the blood. Breath-based analysis stands out among the different non-invasive ways of detection as it provides more accurate predictions and offers many advantages. In this work, the concentration of acetone in the exhaled breath is analyzed to detect type 2 diabetes. A new sensing module consisting of an array of sensors is implemented for monitoring the acetone concentration to detect the disease. Deep learning algorithms like Convolutional Neural Networks (CNN) are normally used to automatically analyze medical data to make predictions. Even though the CNN performs well, a few modifications to the network layout can further improve the classification accuracy of the learning model. To analyze the sensor signals to generate predictions, a new deep hybrid Correlational Neural Network (CORNN) is designed and implemented in this research. The proposed detection approach and deep learning algorithm offer improved accuracy when compared to other non-invasive techniques.

Keywords: Acetone, breath, convolutional neural network, correlation, deep learning, diabetes, neural network

References:

Journal Name1 Volume number (Published year) page x-page y.
M. K. Hasan, M. A. Alam, D. Das, E. Hossain, and M. Hasan, "Diabetes prediction using ensembling of different machine learning classifiers," *IEEE Access*, vol. 8, pp. 76516–76531, 2020.
K. Ogurtsova, L. Guariguata, N. C. Barengo, P. L.-D. Ruiz, J. W. Sacre, S. Karuranga, H. Sun, E. J. Boyko, and D. J. Magliano, "IDF diabetes atlas: Global estimates of undiagnosed diabetes in adults for 2021," *Diabetes Res. Clin. Pract.*, vol. 183, Jan. 2022, Art. no. 109118.

Funding Source(s): Artificial Intelligent in Health Informatics Research Group



Machine Learning Models for Frailty Classification of Older Adults in Northern Thailand: Model Development and Validation Study

JMIR Publications JMIR Aging

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Introduction

- The age-related decline of an individual's physical function causes frailty, which increases morbidity and mortality when exposed to acute stressors.
- Frail people can become healthy again with early detection and treatment.
- There are no studies in Thailand that use ML tools for frailty screening and surveillance.

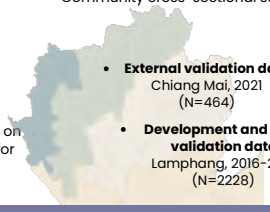
Objective

- To develop and externally validate ML models based on individual characteristics and anthropometric data for frailty screening.

Method

Sources of data

- Community cross-sectional surveys



- **External validation dataset** Chiang Mai, 2021 (N=464)
- **Development and internal validation dataset** Lamphang, 2016-2017 (N=2228)

Predictors

- **Characteristics**: age, household living, gender, education level, self-reported medical diagnoses, level of physical activity per week, and exhaustion
- **Anthropometric measures:** BMI, waist circumference, and calf circumference
- **Selection:** domain experts & a multivariable logistic regression ($p < 0.200$)

Models

LR: Logistic Regression
KNN: k-nearest neighbors
RF: Random Forest
MLP: Multilayer Perceptrons
GBC: Gradient Boosting Classifier
SVM: Support Vector Machine

ML models using simple characteristics and questions **can** effectively **identify** Thai community-dwelling **older adults** who are **at risk for physical frailty.**

Try this

More Information

Model Discrimination

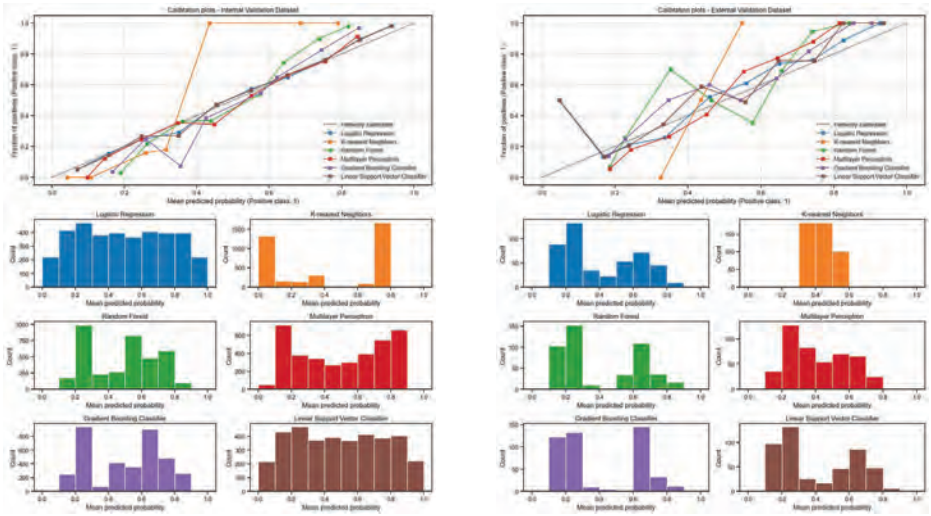
Development and internal validation

Models	AUC Mean (95% CI)	Predictive values Positive	Predictive values Negative	Sensitivity	Specificity
LR	0.81 (0.75-0.86)	0.74 (0.68-0.80)	0.74 (0.69-0.78)	0.74 (0.69-0.79)	0.73 (0.65-0.81)
KNN	0.85 (0.82–0.88)	0.79 (0.76-0.82)	0.88 (0.86-0.90)	0.89 (0.87-0.91)	0.76 (0.71-0.81)
RF	0.70 (0.60–0.79)	0.65 (0.58-0.73)	0.70 (0.63-0.76)	0.79 (0.74-0.83)	0.55 (0.39-0.71)
MLP	0.81 (0.72–0.89)	0.73 (0.64-0.81)	0.75 (0.68-0.81)	0.78 (0.71-0.84)	0.69 (0.57-0.81)
GBC	0.74 (0.72–0.89)	0.68 (0.59-0.74)	0.70 (0.63-0.78)	0.78 (0.73-0.83)	0.58 (0.43-0.73)
SVM	0.75 (0.75–0.86)	0.74 (0.68-0.80)	0.73 (0.69-0.78)	0.74 (0.69-0.79)	0.73 (0.65-0.81)

External validation

Model prediction	True label (Frailty/ Non-frailty)	AUC mean	AUC 95% CI	Predictive values Positive	Predictive values Negative	Sensitivity	Specificity
Frailty	140/65	0.75	(0.71-0.78)	0.68	0.80	0.73	0.76
Non-frailty	52/207						
Frailty	41/35	0.54	(0.51 - 0.57)	0.54	0.61	0.21	0.87
Non-frailty	151/237						
Frailty	137/63	0.75	(0.71 - 0.78)	0.69	0.79	0.71	0.77
Non-frailty	55/209						
Frailty	98/38	0.68	(0.65 - 0.72)	0.72	0.71	0.51	0.86
Non-frailty	94/234						
Frailty	89/31	0.69	(0.65 – 0.72)	0.74	0.70	0.46	0.89
Non-frailty	103/241						
Frailty	131/60	0.73	(0.70 – 0.77)	0.69	0.78	0.68	0.78
Non-frailty	61/212						

Model Calibration



Enhancing Learners' Digital Literacy Skills in the Education Sandbox

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Faculty of Education, Chiang Mai University

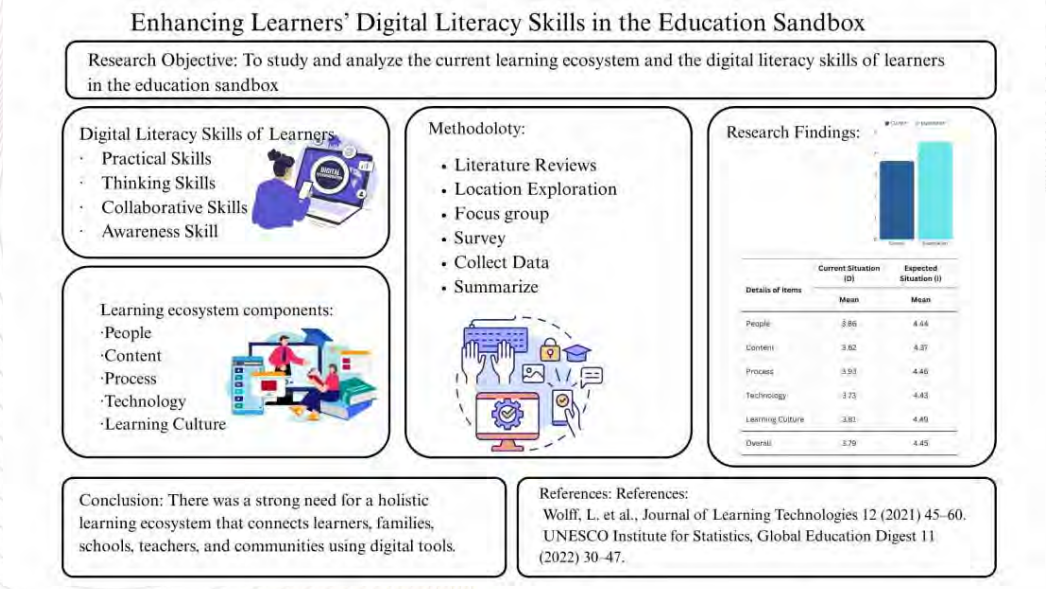
This research aimed to investigate and analyze the current learning ecosystem and the digital literacy skills of students in the Educational Innovation Sandbox in Fang District, Chiang Mai Province. This was a part of the first phase research that using a research and development (R&D) design. The first phase involved assessing the existing learning environment and the needs of stakeholders. The study collected data from around 250 students from 3 schools through surveys. The findings revealed the average scores for the current state ranged from 3.62 to 3.93, stakeholders' expectations were significantly higher, with means ranging from 4.37 to 4.4 showing that the current learning ecosystem lacked sufficient access to technology and digital learning resources. Students demonstrated uneven digital literacy skills, particularly in the dimensions of digital content creation and information evaluation. There was a strong need for a holistic learning ecosystem that connects learners, families, schools, teachers, and communities using digital tools. This initial analysis provided the foundation for developing a contextualized digital learning ecosystem model in subsequent phases.

Keywords: digital literacy, learning ecosystem, digital skills, secondary education

References:

Wolff, L. et al., Journal of Learning Technologies 12 (2021) 45–60.
UNESCO Institute for Statistics, Global Education Digest 11 (2022) 30–47.

Funding Source(s): Chiang Mai University Research Grant FY2023



Exploring the dynamic relationship between stock market indices and exchange rates: During and after the crises—Insights from G20 and Asian countries

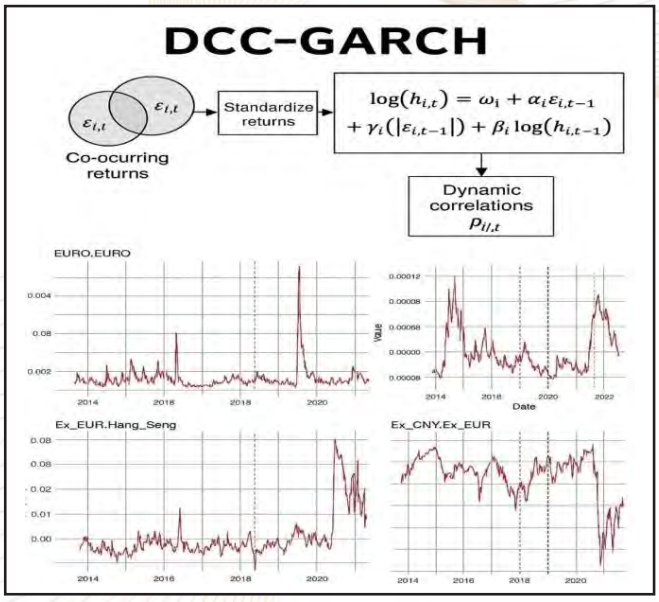
Worrawat Saijai[1,*], Kansuda Pankwaen[2], Sukrit Thongkairat[3]
[1] *Faculty of Economics, Chiang Mai University, Chiang Mai, Thailand,* [2] *Faculty of Economics, Chiang Mai University, Chiang Mai, Thailand,* [3] *Department of Statistics, Faculty of Science, Chiang Mai University, Chiang Mai, Thailand.*
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The global financial landscape has been profoundly affected by crises such as the COVID-19 pandemic, the Russia-Ukraine war, and geopolitical trade disputes, leading to heightened volatility in stock and foreign exchange markets. This study examines the dynamic spillovers between stock indices and exchange rates across G20 countries and key Asian economies, including Thailand and China, from January 2012 to June 2023. Employing the DCC GJR-GARCH(1,1) model with one-step estimation, which efficiently captures time-varying correlations in high-dimensional datasets, the study provides a comprehensive analysis of crisis-induced market fluctuations. Findings reveal significant shifts in correlation structures, volatility persistence, and spillover effects, particularly during major crises, emphasizing the role of economic uncertainty indicators such as the VIX. These insights are critical for policymakers, investors, and financial analysts, offering a deeper understanding of risk transmission and aiding in strategic decision-making for market stability, portfolio diversification, and crisis preparedness.

Keywords: stock market index, exchange rate, economic crisis, G20 countries, SDG

References: *Southeast Asian Journal of Economics* Vol.13 (2025) page 200 - page 231.

Funding Source(s): CMU Junior Research Fellowship Program



Identifying Influential Hubs in Transportation Networks: A Gravity Centrality Approach Using the ThaiNet Dataset

Worawit Tepsan[1,*], Aniwat Phaphuangwittayakul[1], Saronsad Sokantika[1], Napat Harnpornchai[2]
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2. Faculty of Economics, Chiang Mai University, Thailand
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Identifying influential nodes is essential for analyzing and optimizing spatial networks, especially within urban and transportation systems. While traditional centrality-based methods remain prevalent, they frequently produce low-variance node scores and may not sufficiently capture the multi-scale complexity of real-world transport networks. To address these limitations, this study introduces the Hybrid Community-based Gravity Centrality (HCGC) method, which integrates local centrality metrics, gravity-based spatial modeling, and community detection to facilitate the identification and ranking of hubs in complex networks. Additionally, this work presents ThaiNet, a newly constructed transportation network dataset for Thailand encompassing 77 provinces and 928 districts, with adjacency defined by regional boundaries. The HCGC method is evaluated through experiments and comparative analyses on nine public benchmark networks and the ThaiNet dataset. The results indicate that HCGC provides increased variance in node importance scores, which can improve the differentiation and ranking of influential nodes compared to conventional techniques. HCGC offers insights that could support urban planning, logistics optimization, and regional development, particularly in contexts where effective hub identification is critical for economic growth.

Keywords: hub identification, transportation networks; influential nodes; geospatial dataset

Funding Source(s): Chiang Mai University Junior Research Fellowship Program

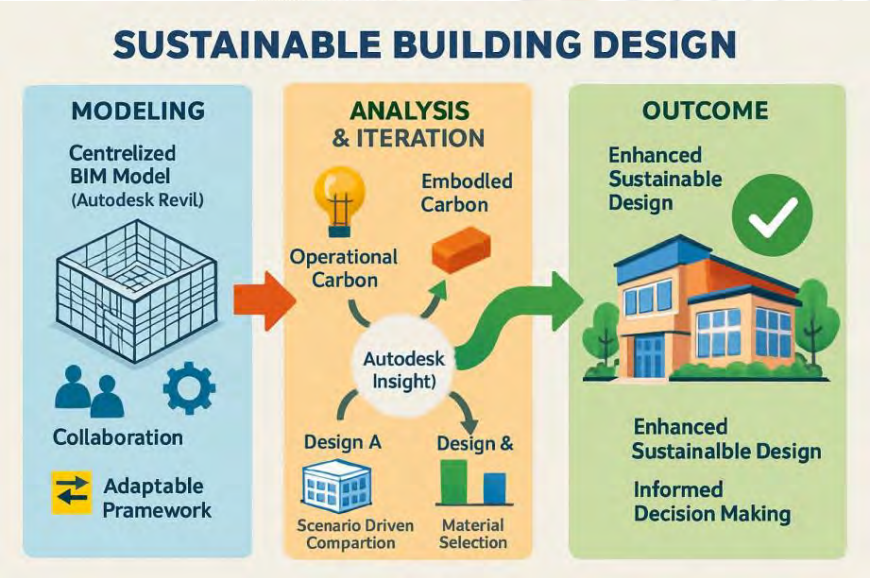
Integrating BIM and Cloud-Based Software for Embodied Carbon Analysis in the Early Design Stage of the Construction Project

Somjintana Kanangkaew[1,*], Damrongsak Rinchumphu[2]
[1,2]*Department of Civil Engineering, Faculty of Engineering, Chiang Mai University*
[*]*E-mail: Somjintana.ka@cmu.ac.th*

This research establishes a methodology for integrating Building Information Modeling (BIM) with advanced sustainability analyses to enhance the design of educational buildings. By employing a centralized Autodesk Revit model for performance simulations in Autodesk Insight, the approach enables immediate carbon analysis of the operational and embodied carbon impacts of design decisions in the early design stage. This seamless integration with Revit workflows facilitates a more intuitive process for design iteration, scenario-driven comparison, and collaboration. Furthermore, the analytical framework is designed for adaptability, allowing for customization to accommodate diverse standards, calculation factors, and carbon accounting methodologies. The findings suggest that this system establishes a practical framework for decision-making during the preliminary design phase, facilitating material selection. Ultimately, the study evaluates the capabilities and limitations of this integrated approach, offering valuable insights for its future application in construction projects.

Keywords: Building Information Modeling, Autodesk Revit, Autodesk Insight, Embodied Carbon

Funding Source(s): CMU Junior Research Fellowship Program



CMU

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Poster Presentation



Materials Innovation

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Effect of Pt doping on the electronic structure, magnetic, and valley properties of 2H-VSe_2, and Janus 2H-VSeTe monolayer

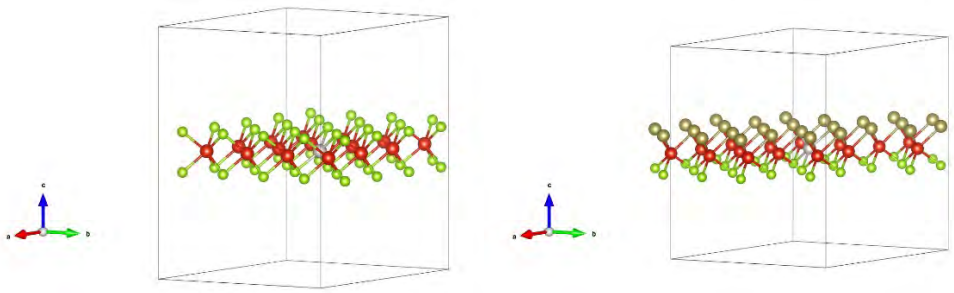
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The high-Curie-temperature two-dimensional (2D) intrinsic ferromagnetic semiconductor 2H-VSe_2, along with its Janus counterpart 2H-VSeTe [1], where valley polarization can be controlled via electric fields or circularly polarized light, have shown great potential for application in low-power nanoelectronic, photonic, and valleytronic devices. In this study, we investigate the feasibility of simultaneous control of spin and valley polarization within a single structure. Specifically, we explore the effect of Pt doping on the electronic structure, magnetic behavior, and valley properties of 2H-VSe_2 and Janus 2H-VSeTe using first-principles calculations based on density functional theory (DFT). A Pt concentration of 6.25% is considered by substituting a vanadium atom with a platinum atom in a 4×4 supercell for both structures. Our results reveal that Pt doping drives the systems from semiconducting to semimetallic, and importantly, leads to the coexistence of spin and valley polarization. In addition, the topological features of the doped systems are discussed. These findings suggest that Pt-doped VSe_2-based Janus structures could serve as promising candidates for future low-power, high-speed spintronic and valleytronic devices.

Keywords: 2H-VSe_2, Janus 2H-VSeTe, Pt doping, electronic structure, magnetic properties

References:
[1] *ACS Nano* 16 (2022) 6960−7079.

Funding Source: Supported by CMU Junior Research Fellowship Program (R66IN00347)



Pt doped VSe_2 Pt doped VSeTe

The red, green, brown, and gray (in the middle) represent V, Se, Te, and Pt, respectively.

Extreme value assessment of ice loading on sloping structures based on ice property distributions

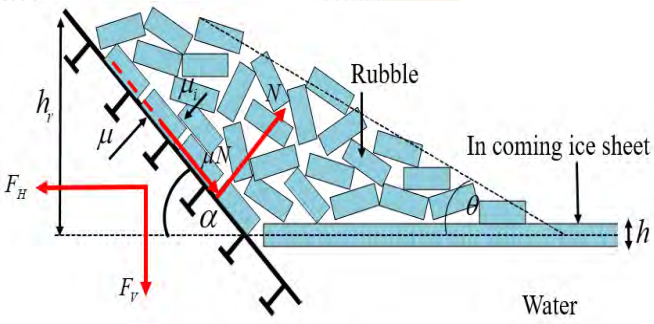
Chana Sinsabvarodom[1], Bernt J. Leira[2], Knut V. Høyland[3,*]
Affiliation (Times New Roman, 10 points, italicized, centered, include country name, use a number in superscript for affiliation index at the beginning of each affiliation)
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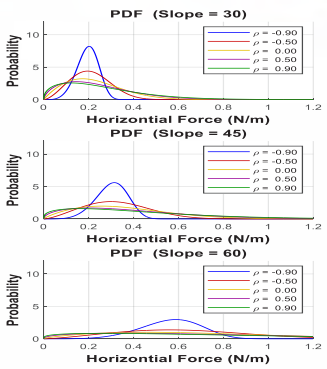
This study aims to conduct a comprehensive extreme value assessment of ice loading on sloping structures, focusing specifically on precise estimations of extreme ice load conditions. By examining the variations in ice properties, such as flexural strength and thickness, in relation to sloping structures, the study analyzes the sensitivity of extreme ice loading. The investigation examines upward-sloping configurations, which reflect realistic structural conditions. A Nataf transform is applied to establish correlations among the primary parameters influencing ice loading, allowing for a more robust and accurate analysis. Furthermore, the sampling of ice properties is performed through Monte Carlo simulation, which facilitates the generation of diverse ice load scenarios across a range of conditions. The analytical framework for estimating ice loading is based on ISO standards, widely accepted in the Arctic offshore industry for their reliability and consistency, thereby enhancing the study's methodological rigor. As a result, stronger correlations among ice loading parameters increase uncertainty in load estimations, resulting in elevated extreme load values on sloping structures, regardless of their orientation. This heightened sensitivity highlights the crucial importance of accounting for correlations among ice properties when evaluating extreme load conditions on inclined surfaces, thereby contributing to safer, more resilient engineering practices in Arctic environment.

Keywords: Extreme Value Analysis, Ice Loading, Sloping Structures, Fixed Structures

References: *Journal of Ocean Engineering*, 2020, Volume 198: 106935
Offshore Mechanic and Arctic Engineering, OMAE2025-155964, ASME

Funding Source(s): Supported by the CMU Junior Research Fellowship Program and the Sustainable Development Goals (SDGs). This work is also supported by department of civil engineering, faculty of engineering, Chiang Mai University.





Development of solid metal-air battery technology and design for next-generation energy storage based on frontier research in materials innovation

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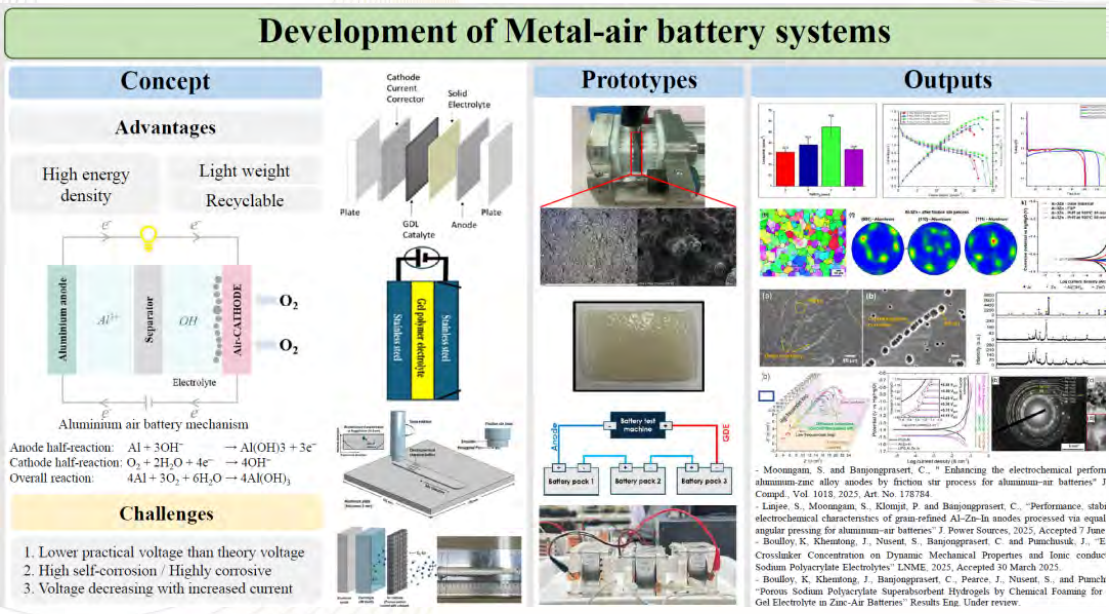
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Metal-air batteries generate electricity through a chemical reaction between a metal anode—such as aluminum, zinc, or magnesium—and oxygen from the air, which interacts at the surface of a catalyst-based cathode. These batteries are known for their high energy and current densities relative to their weight and volume, making them suitable for compact applications. They are already commercially available in small cells, such as button cells used in hearing aids. One key advantage is their long shelf life when stored without contact with the electrolyte.

This research project aims to develop a prototype metal-air battery using a solid or semi-solid electrolyte, enhancing both safety and ease of assembly. Traditional liquid electrolytes can cause issues such as leakage and the formation of carbonate compounds, which reduce performance and durability. By incorporating advanced materials from a related sub-project, this work will produce what is termed a "solid-state metal-air battery." The project will begin with the development of a single-cell prototype and progress to a multi-cell configuration. These prototypes are intended to improve the battery's overall performance, particularly in terms of power output and stability, making them suitable for a broader range of practical applications, including future integration into energy storage systems.

Keywords: Metal-air battery, Solid electrolyte, Next-generation Energy Storage, Materials Innovation

Funding Source(s): Fundamental Fund 2025, Chiang Mai University and Thailand Science Research and Innovation (TSRI) (FRB680102/0162).



Inverse analysis of planar beams with Euler-Bernoulli beam model and neural networks

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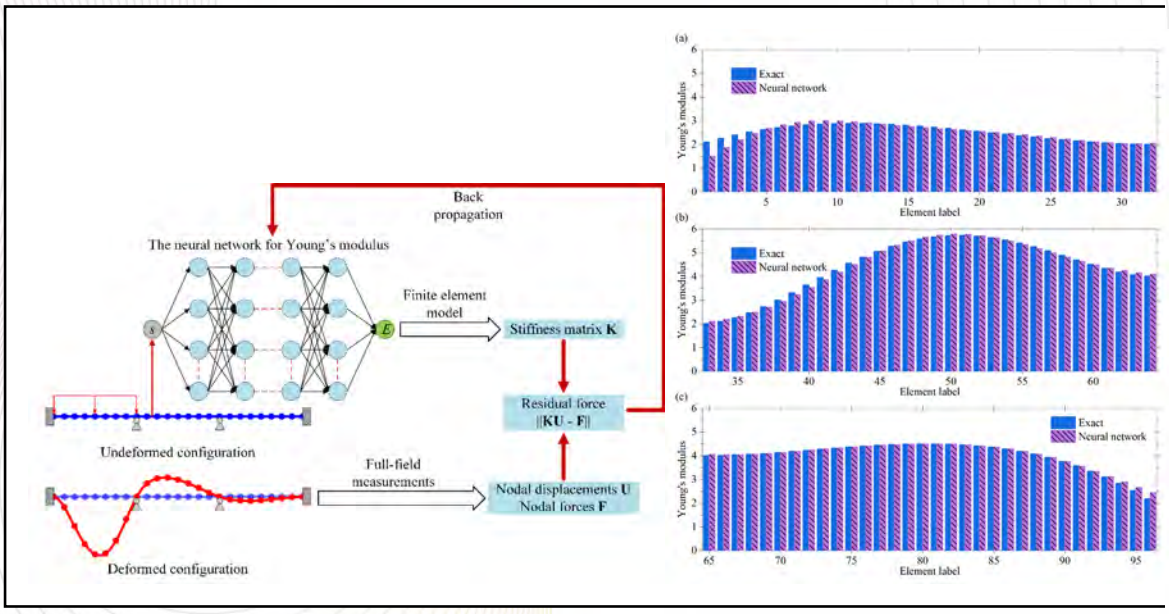
This paper presents a process for the inverse analysis of planar beam structures using the finite element method and neural networks. The Euler-Bernoulli beam model and the assumption of linear analysis are considered for the finite element method. The inverse analysis involves determination of the unknown variation of Young's modulus. A neural network is constructed receiving the axial coordinate of a point as input and returning the output as the value of Young's modulus at the point. Then, the neural network is trained by minimizing the imbalance of the equilibrium conditions. The accuracy of the presented process is validated by an example.

Keywords: Inverse Analysis, Planar Beam Structures, Euler-Bernoulli Beam Model, Neural Networks, Technological Innovation

References:

Engineering with Computers, 36 (1) (2020) 239-250.
Structural Control and Health Monitoring, 26 (10) (2019) e2425.

Funding Source(s): The CMU Junior Research Fellowship Program, Chiang Mai University, Thailand.



Screening rice straw fiber quality in Northern Lanna rice varieties for biodegradable 3D printing filament production

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Thailand's northern region is an important rice cultivation area, home to numerous high-yielding rice varieties. However, because of its excessive demand for usage, rice growing produces a lot of rice straw, a large agricultural waste that contributes to environmental issues, especially PM 2.5, when it burns. Therefore, this research aims to screen and classify the Lanna rice varieties that have appropriate fiber morphology and chemical properties for producing biodegradable 3D printing filament. The results showed that San Patong 1, SPT1 rice straw has longer, stiffer fiber with a high cellulose and lignin content, with averages of 1.91±0.81 mm, 64.02±0.16%, and 31.01±0.55%, respectively. In addition, SPT1 rice straw had the highest pulped yield of all the rice varieties, reporting around 42%, as well as high mechanical strength fiber, such as tensile, tear, and burst strengths. They were 6.43±0.23 N.m/g, 5.14±0.10 mN.m²/g, and 0.42±0.12 kPa.m²/g, respectively. By combining PLA, PBS, and rice straw fiber (5–10% w/w), they demonstrate the potential of SPT1 rice straw to create biodegradable 3D printing filament while maintaining good processability and printability.

Keywords: Rice straw, biodegradable filament, 3D printing, fiber, pulp

Reference:

Patent Title: Production of agricultural wastes biodegradable pellet and 3D printing filament blended plastics by multi-mixing plasticizer
Application number: 2301007109 Received: 30 October 2023

Funding Source(s): Fundamental Fund 2024, Grant Number FF67/ 195867, Chiang Mai University, Thailand.


1 Rice straw characterization
2 Pulping process and pulp characterization
3 Conductive polymer compounding process
Polymer resin
Rice straw pulp
Plasticizer & Additive
New plastic compound
4 Compound characterization & properties test
5 3D filament process
3D filament printing test
6
TRL 4
7 Scale up and tested in relevant environments

In vitro bioactivity, mechanical, and cell interaction of sodium chloride-added calcium sulfate–hydroxyapatite composite bone cements

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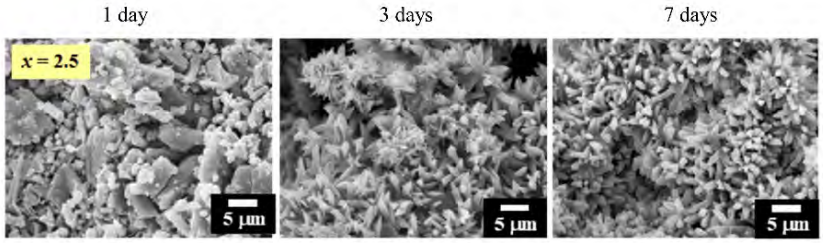
Sodium chloride-added calcium sulfate–hydroxyapatite composite bone cements (0.70CaS–0.30HAP)/xNaCl were studied. Different wt% of NaCl (0, 1.5, and 2.5) were added to 0.70CaS–0.30HAP bone cement to investigate the setting time, injectability, washout resistance, phase evolution, physical properties, water absorption, microstructural, chemical analysis, mechanical strength, statistical analysis, *in vitro* apatite-forming ability, and *in vitro* cytotoxicity. With increasing NaCl, the initial setting time decreased to around 3.18 min. X-ray pattern revealed that all composite bone cement samples had mixed phases of CaS, HAP, brushite, gypsum, and NaCl. The densification and mechanical performances, including σ_c, σ_f, and *E* values, slightly decreased with increasing NaCl content, correlated with the increasing porosity value. This resulted in the production of a porous structure, which caused an excellent *in vitro* apatite-forming ability. The x = 2.5 sample showed good bioactivity, inducing the highest apatite mineralization ability in the SBF solution. Additionally, *in vitro* cell culture analysis showed above 94.12% cell viability against a high concentration (@ 200 mg mL^{-1}) for the x = 2.5 sample, revealing cytocompatibility. The obtained results indicated that the (0.70CaS–0.30HAP)/2.5NaCl composite bone cement, with good injectability, bioactivity, and cytocompatibility, are promising candidates for biomedical applications.

Keywords: bone cements, hydroxyapatite, biomaterial, SBF

References:

Acta Biomaterialia 21 (2015) 217– 227.
Ceramics International 43 (2017) 16196 – 16203.

Funding Source(s): Fundamental Fund 2024, Chiang Mai University.



Bone cements after being soaked in SBF solution

Research group:
Advanced prosthodontic and dental material research for oral rehabilitation

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The Advanced Prosthodontic and Dental Material Research for Oral Rehabilitation group focuses on translational research aimed at creating innovative prosthetic devices and biomaterials to restore oral and facial functions, especially in elderly populations. The research is organized into three main domains. In Dental Implantology, the team designs porous and customized implant abutments optimized for mechanical strength and biological performance to enhance osseointegration. Surface modifications, including gold nanoparticle coatings, are investigated to improve biocompatibility and facilitate both bone and gingival regeneration in compromised situations. In Removable Prosthodontics, the group aims to improve the material wear resistance and utilize digital technology to produce dentures that reduce wear on both prosthetic and natural teeth. Fixed Prosthodontics research focuses on the development of ultra-thin lithium disilicate restorations characterized by great fracture resistance, facilitating minimum tooth alterations. The research approach integrates computer-aided design, mechanical and biological testing, clinical validation, and artificial intelligence applications. Collaborations with leading international universities, such as the University of Sydney and Tohoku University, and partnerships with dental industry stakeholders support the development of novel clinical protocols, materials, and instruments consistent with Thailand's BCG economy model and the United Nations Sustainable Development Goals (SDGs). Within a three-year timeframe, the group targets high-impact publications, patented results, and professional training initiatives that connect innovation with practical clinical application.

Keywords: Prosthodontics, dental biomaterials, dental implantology, biomechanics, bone and tissue regeneration

References:
Scientific Reports 2024; 9: 14(1): 15867.
Journal of Clinical Medicine 2024; 2; 13(3): 886.

Funding Source(s): This research group is funded by Chiang Mai University.

Development of high quality materials for radiation detection in medical applications

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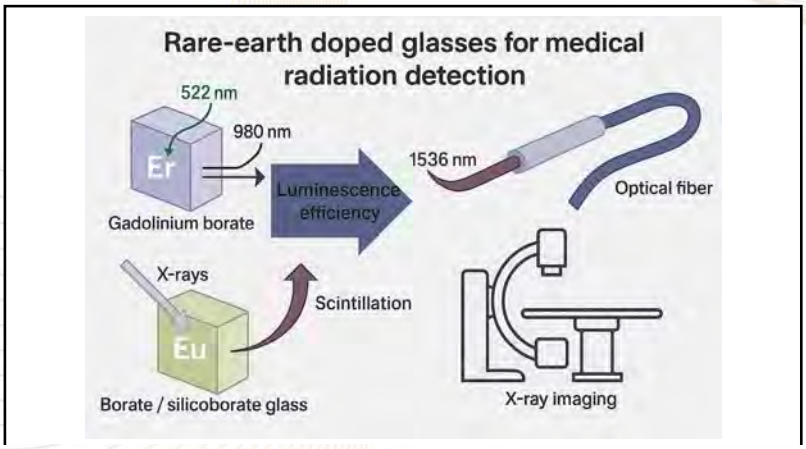
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This research focuses on the preparation and investigation of the optical properties of rare-earth-doped glasses for medical radiation detection applications. Gadolinium borate glasses doped with erbium were studied, and it was found that the glass doped with 20 mol% erbium exhibited the highest luminescence efficiency. When excited at wavelengths of 522 nm and 980 nm, this glass emitted light in the near-infrared (NIR) region at 1536 nm, making it suitable for use as an optical fiber for signal transmission. Borosilicate glasses doped with europium were also investigated, and the glass doped with 2 mol% europium showed the highest luminescence efficiency under X-ray excitation. The scintillation efficiency of this glass was 8.78% relative to that of the BGO crystal. In addition, europium-doped silicoborate glasses were studied, and the sample doped with 3 mol% europium exhibited the best luminescence efficiency, with a scintillation efficiency of 17.51% compared to the BGO crystal. This research successfully demonstrated that these glasses can serve as scintillator materials for X-ray imaging in optoelectronic and medical devices.

Keywords: Rare-earth-doped glass, Luminescence efficiency, Scintillation, X-ray imaging, Medical radiation detection, Erbium, Europium, Optical fiber

References: *Radiation Physics and Chemistry,* DOI: 10.1016/j.radphyschem.2024.112062

Funding Source(s): This research was partially supported by Chiang Mai University.



Development of silica aerogel-filled expanded perlite and energy harvesting properties of aerogel-embedded biocomposite floor tiles

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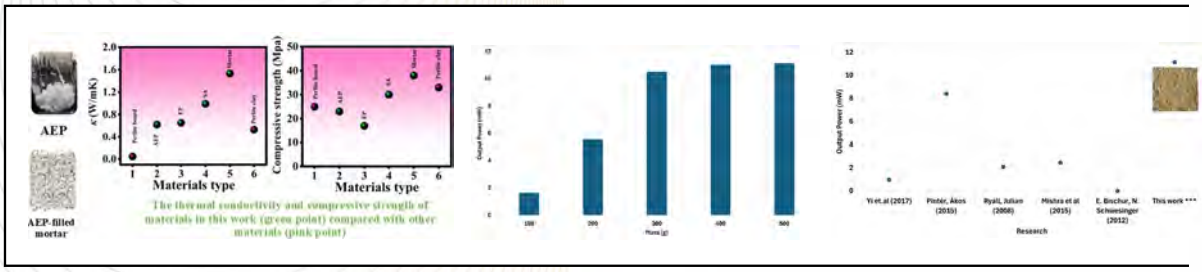
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[2]*Deptartment of Physics and Materials Science, Faculty of Science, Chiang Mai University, Chiang Mai 50200, Thailand*
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In this study, the silica aerogel (SA) was synthesized by a typical sol-gel method. The product was used to prepare the aerogel-filled expanded perlite (AEP) via the vacuum-assisted process. The mortar samples with various concentrations of AEP were prepared and investigated for their physical, microstructural and thermal properties. The aerogel-embedded biocomposite floor tiles were also fabricated and studied for their energy-harvesting properties. The results showed that the sand replacement by AEP significantly reduced the density of mortar due to the lightweight and high porosity of AEP. Although the thermal conductivity values of the mortar with addition of expanded perlite (EP) and AEP were comparable and lower than that of typical mortar, the enhancement in compressive strength was apparent in AEP-added mortar. In SA-embedded piezoelectric biocomposite, which was fabricated from rubber matrix and bamboo fiber filler, possessed lighter weight and better thermal and mechanical protection. The measured output power, voltage, and current were all influenced by the mass loading. While the voltage and current increased slowly for lower mass loading (< 300 g), above which the values increased more rapidly. At 500-g loading, the biocomposite floor tile could harvest ~11 mW of output power energy which was comparable to those of earlier studies.

Keywords: expanded perlite, silica aerogel, biocomposite, thermal insulation, energy-harvesting

References: *International Journal of Thermophysics* 46 (2025) 31.
E3S Web of Conferences 10 (2016) 00082.

Funding Source(s): This research project was supported by the Fundamental Fund 2024 (Grant Number 4709883)



Phase formations, compressive strength and microstructure of environmentally friendly Thai Lopburi calcined clay limestone cement mixes

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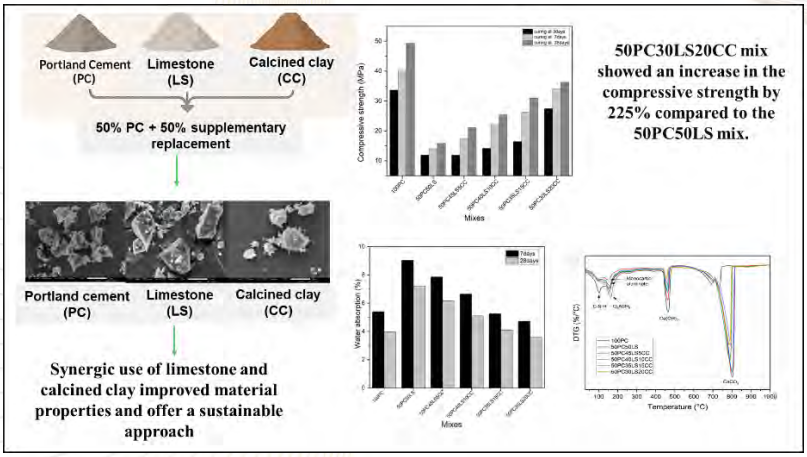
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Limestone and calcined clay, due to their abundance and sustainability, are seen as feasible materials to replace Portland cement. In this work, Portland cement was replaced with calcined clay and limestone at 50% by weight. In addition to compressive strength, the microstructure and phase characterizations were investigated at 7 and 28 days to determine hydration and pozzolanic reaction using thermogravimetric analysis, X-ray diffraction and scanning electron microscopy. When using 20% calcined clay, the 50PC30LS20CC mix showed an increase in compressive strength by 225% compared to the 50PC50LS mix. Although the compressive strength was still lower than 100PC control mix, using calcined clay and limestone together led to a significant reduction in water absorption compared to 50% LS mix due to the phases formed and the filling effects, and comparable result to 100PC mix was found when calcined clay was used at 20%. In addition to calcium carbonate detected in mixes with limestone, monocarboaluminate was also found at 7 days and became clearer at 28 days, especially when calcined clay and limestone were combined. Moreover, pozzolanic reaction from calcined clay increased C–S–H and C_2ASH_8, corresponding with a reduction in calcium hydroxide and increase in compressive strength.

Keywords: Cement, limestone, calcined clay, compressive strength, phase characterizations

Reference:
Chiang Mai Journal of Science 51 (2024) e2024089.

Funding Source(s): This project is funded by the National Research Council of Thailand (NRCT) and Chiang Mai University/N42A660441.



Innovative learning management using community-based and constructivism learning for sustainable development of Thai language competencies in Pre-service Teachers

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This research objectives were: 1) To assess pre-service teachers' needs in enhancing Thai language learning competence; 2) To develop an innovative learning management model that utilizes community-based approaches along with self-directed learning to sustainably enhance Thai language learning competence; 3) To study the outcomes of using this innovative learning management model; and 4) To survey the opinions of students regarding the use of the innovative learning model. The population consisted of 243 second-year pre-service teachers in the Faculty of Education, Chiang Mai University. The sample comprised 61 pre-service teachers enrolled in the course 067311 Thai Language Fundamentals in the Basic Education curriculum by using namely five learning units (totaling 40 hours) comprising the Thai language learning management model, speaking competency assessments and listening-viewing competency tests (multiple choice). The statistical methods used for data analysis included percentages, means, standard deviations. The research findings revealed that: Pre-service teachers expressed the greatest need to enhance Thai language learning competence in speaking, followed by listening-viewing. The innovative learning management model were assessed at a highly suitable level consists of 5-step process, reviewing language fundamentals, researching from the community, synthesizing knowledge from listening, viewing, and speaking, presenting work, and reflecting on outcomes for sustainability over five learning units. Pre-service teachers' mean scores in listening-viewing and speaking competencies were statistically higher than before, at the 0.05 level. Overall, students expressed their opinion of the innovative learning management model in highest level and can be used as an innovation to enhance sustainable Thai language learning competencies for pre-service teacher.

Keywords: innovative learning management, community-based learning, constructivism learning, Thai language competencies, pre-service teachers

References:

Social Sciences, Humanities, and Art 5 (2025) accepted.

Funding Source(s): Junior Researcher 2023 CMU Research

Paint based on natural rubber latex for radon mitigation from building material

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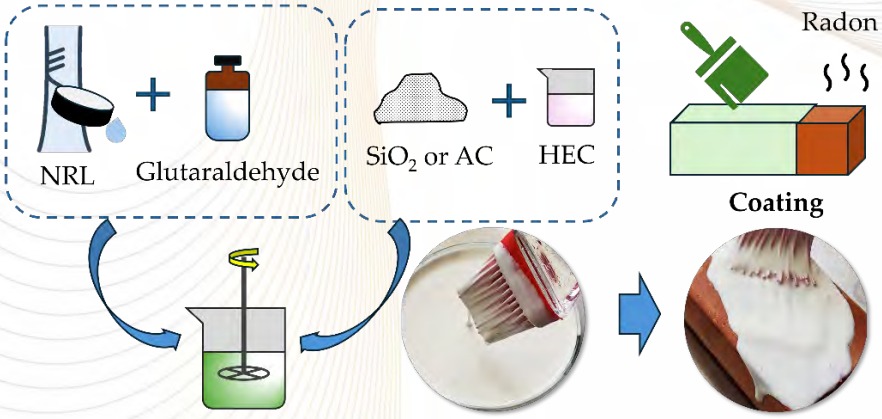
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The release of radon from building materials poses a significant indoor radiation hazard, raising long-term health concerns. To address this issue, this study developed a sustainable, cost-effective radon barrier using natural rubber latex (NRL) emulsion paint. The paint was crosslinked with glutaraldehyde and incorporated fillers, silicon dioxide (SiO_2) or activated carbon (AC), at varying contents. Applied to clay bricks, the coatings were evaluated for their ability to suppress radon exhalation. The formulation of 10 parts per hundred parts of rubber by dry weight (phr) SiO_2 achieved the highest radon mitigation efficiency of 60.3%, which outperforms general commercial paint. In addition to barrier performance, SiO_2 notably enhanced mechanical strength, drying time, and scrub resistance. However, filler dispersion became problematic at higher loadings, limiting further performance gains. Overall, the study demonstrates that ambient-curable NRL coatings, particularly those filled with SiO_2, hold promise as practical, durable, and eco-friendly solutions for reducing indoor radon emissions in green building applications.

Keywords: radon mitigation, natural rubber latex, paint, building material, indoor air quality

Funding Source(s): This research was supported by CMU Junior Research Fellowship Program.



A formalin-free cadaveric preserving solution for veterinary clinical practices

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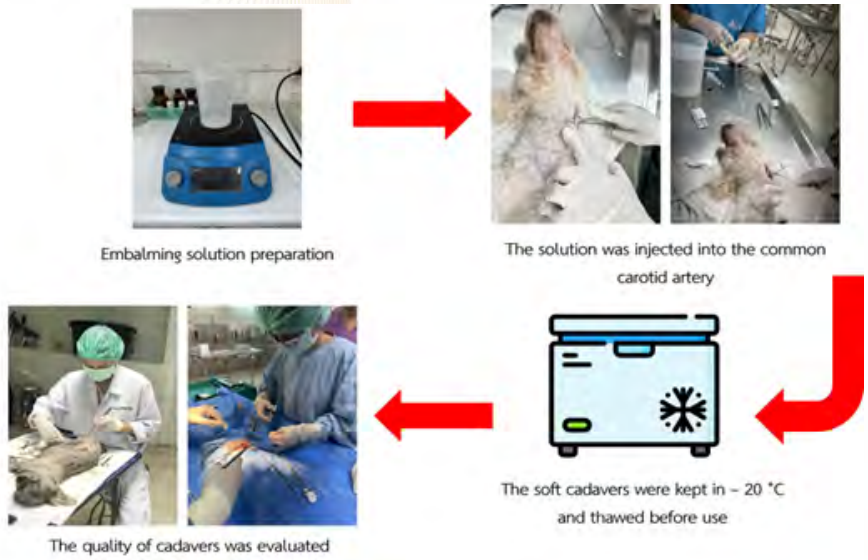
Clinical skill mastery is paramount in veterinary education, particularly for therapeutic and surgical interventions. The integration of canine and feline cadaveric models into various skills training enhances confidence in veterinary students before confronting live-patient interactions. Formaldehyde has been conventionally used as a primary agent for cadaver preservation; however, its toxicity presents a significant health and safety concern. This study aimed to develop a formalin-free embalming solution as a safer alternative for cadaver preservation. The proposed solution was designed to maintain anatomical integrity, closely mimicking live animals suitable for veterinary skill practice. A water-based embalming solution was prepared, administered via the carotid artery injection, and subsequently soaked into the gauze-wrapped bodies. A questionnaire was administered to assess cadaveric quality (skin, muscle, and soft tissue characteristics) and user satisfaction (odor perception, ocular irritation, and overall satisfaction). The results demonstrated that the soft embalmed cadavers closely approximated live animals, and the majority of users reported moderate to high satisfaction with the cadaver quality. In conclusion, the formalin-free embalming solution effectively preserves cadaver quality for use in veterinary skill practice. However, its efficacy in preserving internal organs requires improvement, warranting further investigation.

Keywords: Embalming, preservation, skill practice, soft cadaver, veterinary

References:

[1] *Frontiers in Veterinary Science* 8 (2021) 1-5.
[2] *Anatomy & Cell Biology* 52 (2019) 419-425.

Funding Source: CMU Junior Research Fellowship Program (Year 2023)



Development of training curriculum to enhance 21st century competencies for in-service caregivers

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The objectives of this research were 1) conduct a needs assessment for child caregivers, 2) develop a training curriculum, and 3) evaluate the effectiveness of the developed training curriculum to enhance the 21st century competencies of child caregivers. The sample group for the needs assessment consisted of 220 child caregivers in Chiang Mai Province, selected through multi-stage sampling. The sample group for evaluating the curriculum's effectiveness comprised 30 child caregivers who volunteered and met the inclusion criteria. Data were collected 2 times, before and after the experiment, and were analyzed by means, standard deviation, t-test, and Modified Priority Needs Index (PNI Modified). The research findings were as follows: 1) The competency of child caregivers in the 21st century consisting of 3 competencies: knowledge, skills and attribute. The highest need was with PNI Modified value of .115. 2) The training curriculum consisted of 8 elements: (1) principles (2) training curriculum objectives (3) five learning units (4) training duration (5) activities used in training curriculum (6) media used in training curriculum (7) evaluation of training curriculum, and (8) training plans for each learning unit. 3) The effectiveness of training curriculum results in the experimental group acquiring in higher 21st century competencies after experiment with a statistical significance of .05 level.

Keywords: In-service caregivers, competencies for in-service caregivers, training curriculum, early childhood education, twenty-first century.

Funding Source: Junior researcher

Technological and human resource development in thermal spray coating for Thai rail maintenance system

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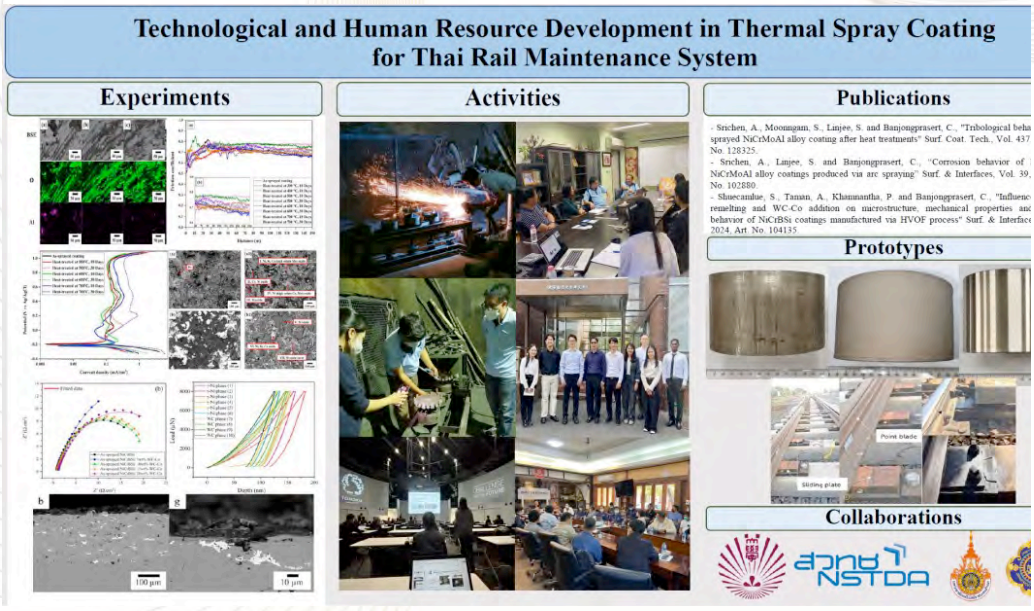
The Thai government's logistics development action plan (2023–2027) aims to expand the national railway network from 4,044 to nearly 7,000 kilometers. With this growth, conventional low-speed trains will be insufficient, necessitating the adoption of medium-speed trains operating at 80–120 km/h. This shift increases wear on critical components, particularly trestles—key points where wheel-track interactions are intense. These components face high friction, leading to accelerated wear, corrosion, and increased risk of accidents and unplanned maintenance.

This research project focuses on advancing maintenance technology and workforce capabilities for Thailand's railway system. Specifically, it aims to develop and implement thermal coating technologies to protect rail components from wear and corrosion. The research is structured into three phases: (1) generating new knowledge through field data and laboratory testing, (2) transferring technology to domestic and international institutions, and (3) applying thermal coating technologies in collaboration with private sector partners to real-world railway systems, particularly within the State Railway of Thailand.

The key objective is to compare thermal coating with existing maintenance welding techniques to establish Thailand's first standard for thermal coating-based rail maintenance. This project will enhance damage prediction, improve component longevity, and strengthen the country's technological capability in rail system.

Keywords: Rail components, Thermal spraying, Wear resistance, Failure analysis, Maintenance

Funding Source(s): Targeted research, Chiang Mai University



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Climate Crisis, Carbon Neutrality

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Development of WRF-Chem Regional Air Quality Model to Simulate, Forecast, and Analyze PM2.5 situations in Upper Northern Thailand

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Office of Research Administration, Chiang Mai University[3]
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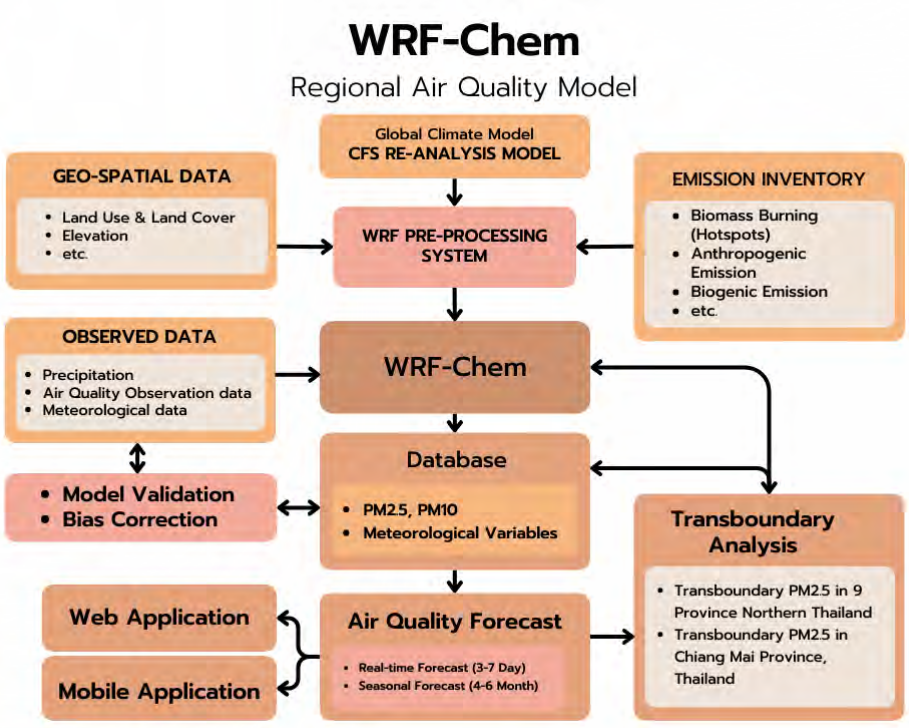
This project aims to develop a regional air quality modeling system using WRF-Chem for simulating, forecasting, and analyzing PM2.5 in upper northern Thailand. Model performance was evaluated against ground-based observations from 20 stations, showing good temporal trend agreement (average correlation coefficient r = 0.6), though with a general underestimation (average Bias = -26). The system was used for both real-time (3–7 days ahead) and seasonal (4–6 months ahead) forecasts, with outputs disseminated via the AirVista web and mobile applications to support public awareness and decision-making. The project also initiated transboundary haze analysis to assess the contribution of biomass burning outside the region. A fully operational forecast system (TRL 7) has been developed, providing critical support for air quality management in the region. The outcomes contribute to sustainable solutions for haze pollution and align with SDG 11 (Sustainable Cities) and SDG 13 (Climate Action).

Keywords: Transboundary, PM2.5, Air Quality Model, Air Quality Forecast

References:

Atmospheric Science Letters, 12(2)(2011), 213–219
Climatic Change, 102(1–2)(2010), 51–75

Funding Source(s): ทุนสนับสนุนโครงการ PM2.5 และมลพิษอื่น ๆ ที่สัมพันธ์กับโรคไม่ติดต่อเรื้อรัง จากพื้นที่สู่ห้องปฏิบัติการสู่การวิจัยทางคลินิก / มหาวิทยาลัยเชียงใหม่



Performance Improvements of Fire Decision Support System (FireD)

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[2]*Office of Strategy Management, Office of University*
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[*]*E-mail: Chotamonsak@gmail.com*

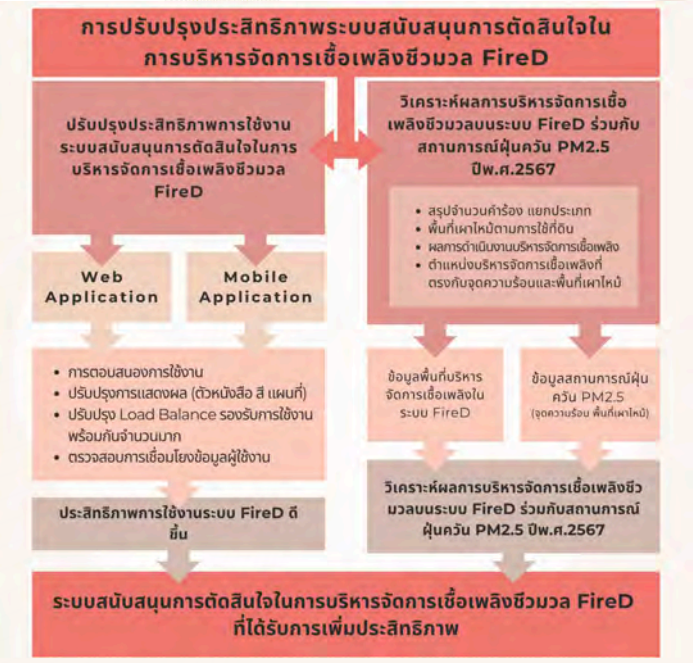
This project aims primarily to improve the effectiveness of biomass fuel management in order to mitigate the impacts of haze and PM2.5 pollution in Northern Thailand. The project focuses on the development and enhancement of the FireD system, including both the web and mobile applications, as well as the analysis of actual operational outcomes in conjunction with the PM2.5 pollution situation in 2024. The implementation consists of three core activities: (1) Improving the FireD system for better usability and scalability, including enhancements to the database, map interface, and functions for submitting and approving biomass fuel management requests; (2) Upgrading the FireD mobile application for both iOS and Android platforms to ensure greater stability and functionality; and (3) Analyzing biomass fuel management requests in relation to hotspot occurrences and PM2.5 levels. The findings reveal that biomass fuel was managed most intensively in the early months of the year, but the rate of reporting back into the system declined in subsequent months, while the number of hotspots and PM2.5 concentrations increased during March–April, indicating a temporal mismatch. The project outcomes can be utilized to inform policy planning, evaluate biomass fuel management efforts, and support systematic preparedness for haze events.

Keywords: Forest Fire, PM2.5, Decision Support System, Smog, FireD

References:

Atmospheric Science Letters, 12(2)(2011), 213–219
Climatic Change, 102(1–2)(2010), 51–75

Funding Source(s): ทุนสนับสนุนโครงการ PM2.5 และมลพิษอื่น ๆ ที่สัมพันธ์กับโรคไม่ติดต่อเรื้อรัง จากพื้นที่สู่ห้องปฏิบัติการสู่การวิจัยทางคลินิก / มหาวิทยาลัยเชียงใหม่



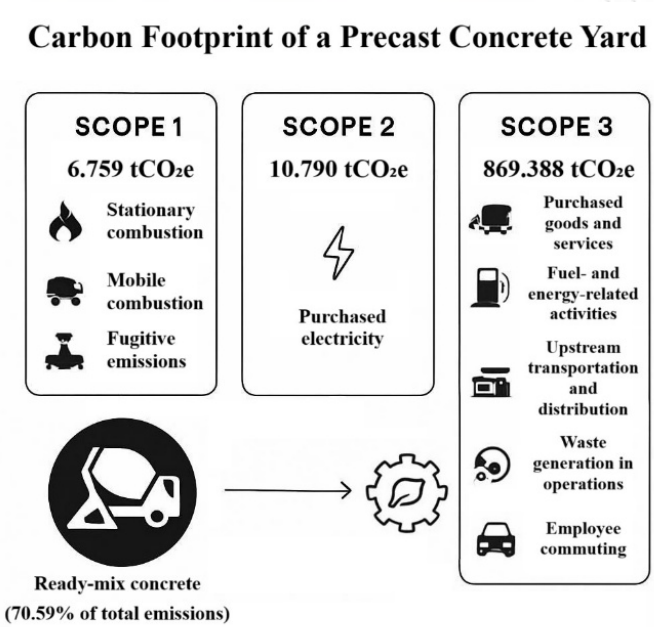
A Preliminary Study on the Carbon Footprint of a Precast Concrete Yard

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[*]*E-mail: natee.suriyanon@cmu.ac.th*

This study presents the preliminary results of a carbon footprint assessment conducted for a precast concrete yard in accordance with the guidelines of the Thailand Greenhouse Gas Management Organization. The assessment revealed that Scope 1 emissions, consisting of stationary combustion (1.785 tCO_2e), mobile combustion (2.604 tCO_2e), and fugitive emissions (2.370 tCO_2e), totaled 6.759 tCO_2e. Scope 2 emissions, resulting from purchased electricity, accounted for 10.790 tCO_2e. Scope 3 emissions, primarily originating from purchased goods and services (869.388 tCO_2e), fuel- and energy-related activities (2.544 tCO_2e), upstream transportation and distribution (18.643 tCO_2e), waste generation (0.775 tCO_2e), and employee commuting (6.590 tCO_2e), amounted to 897.940 tCO_2e. Notably, the consumption of ready-mix concrete was identified as the predominant emission source, underscoring the importance of optimizing concrete usage and selecting environmentally responsible suppliers to enhance emission management at the facility.

Keywords: Carbon footprint, Concrete yard, Greenhouse gas emission, Precast concrete, Sustainability

Funding Source: The CMU Junior Research Fellowship Program.



Development of Real-World Energy Consumption and Carbon Emission Prediction Models for Electric, Hybrid, and Internal Combustion Vehicles Using Machine Learning

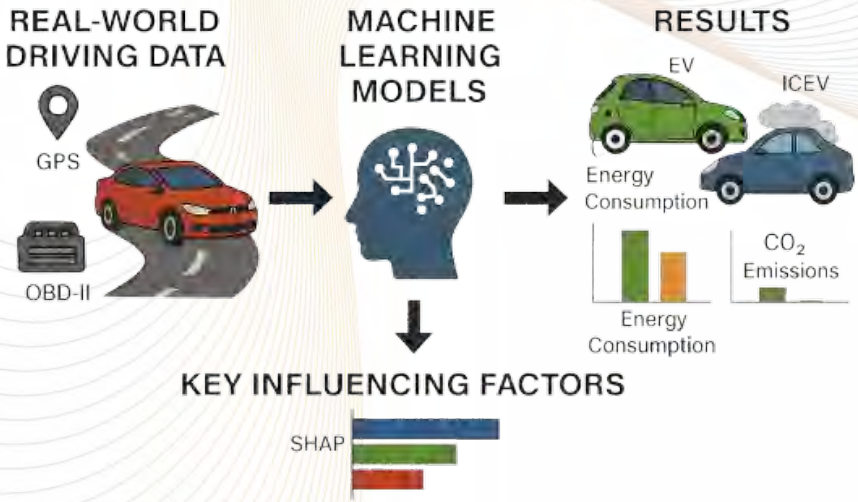
Witsarut Achariyaviriya[1], Damrongsak Rinchumphu[1],*
[1] *Faculty of Engineering, Chiang Mai University, Thailand*
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This study aims to develop accurate machine learning-based models for predicting real-world energy consumption and carbon emissions of Battery Electric Vehicles (BEVs), Hybrid Electric Vehicles (HEVs), and Internal Combustion Engine Vehicles (ICEVs) under both urban and rural driving conditions in Thailand. Using onboard diagnostics (OBD-II) and GPS sensors, over 9,000 km of real driving data were collected. The models—XGBoost, Random Forest, MLP, and KRR—were trained on sensor data including speed, acceleration, gradient, current, and air flow rate. Results show that BEVs have significantly lower energy consumption and CO_2 emissions than HEVs and ICEVs, especially in congested urban areas. SHAP analysis identifies battery current and vehicle speed as key influencing factors for BEVs, while mass air flow dominates for ICEVs. The study highlights the feasibility of using machine learning for policy-oriented decision support and proposes targeted strategies to promote EV adoption in Thailand's urban traffic zones.

Keywords: Real-world driving emissions, Electric vehicles (EVs), Machine learning (ML), Energy consumption modeling, Carbon emission reduction

References:
Global Journal of Environmental Science and Management, 11(2025), 897-914.
Transportation Engineering, 18(2024), 100286.

Funding Source(s): Fundamental Fund 2567, Chiangmai University (R66EX01091)



Model Prediction of Land Surface Temperature from Satellite Data with Machine Learning for Chiang Mai

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Urban sprawl contributes to increased built-up areas and a reduction in green spaces, intensifying the Urban Heat Island (UHI) effect. This phenomenon is evident in cities worldwide and results in elevated urban temperatures. UHI can be monitored using satellite-based remote sensing, particularly through Landsat 8 (thermal data) and Sentinel-2 (high-resolution imagery). The Land Surface Temperature (LST), derived from Landsat 8, serves as a key indicator of UHI. Predictive modeling using machine learning, especially the Random Forest (RF) algorithm, has proven effective in analyzing the factors influencing LST. Important predictors include Land Use/Land Cover (LULC), the Normalized Difference Water Index (NDWI), the Normalized Difference Vegetation Index (NDVI), the Normalized Difference Built-up Index (NDBI), the Digital Elevation Model (DEM), and the Enhanced Vegetation Index (EVI). Among these, NDVI is negatively correlated with LST, meaning higher vegetation reduces surface temperature. Conversely, NDBI is positively correlated, as more built-up areas lead to greater heat accumulation. The study emphasizes the importance of urban vegetation in mitigating UHI. A projected increase in vegetation cover would significantly lower urban temperatures, while continued expansion of built-up areas and loss of green spaces would intensify heat stress in urban environments.

Keywords: Land Surface Temperature, Remote Sensing, Urban Heat Island, Machine Learning, Climate Action

References:

Future Cities and Environment, 11(2025)
Global Journal of Environmental Science and Management, 11(2025), 57-76.

Funding Source(s): This research project was supported by Chiang Mai University (R68IN00113).

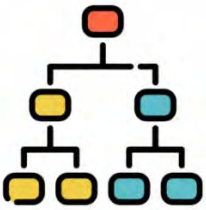


Satellite

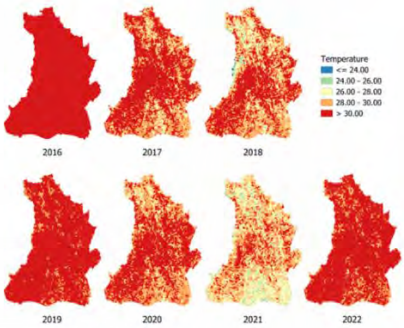
- Sentinel-2
- Landsat 8



Parameter from Satellite



Machine learning
Random Forest



Map Land Surface Temperature
in Chiang Mai area

Correction of Humidity and Sensor Aging Effects in Low-Cost PM2.5 Light Scattering Sensors for Improved Measurement Accuracy

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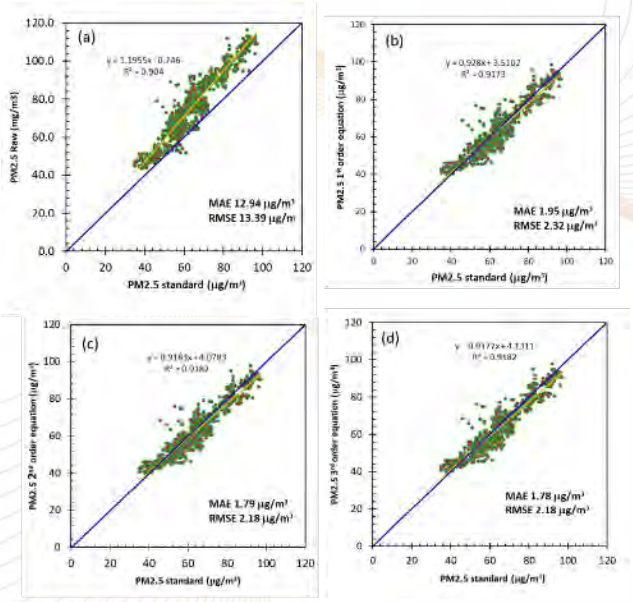
Accurate monitoring of particulate matter with a diameter of 2.5 micrometers or less (PM2.5) is crucial for assessing air quality and understanding its health impacts. This study investigates the effects of environmental factors, specifically relative humidity and working hours, on the accuracy of PM2.5 measurements obtained through low-cost light scattering sensor. Relative humidity can significantly influence particle size due to hygroscopic growth, thereby affecting the scattering properties and leading to potential inaccuracies in PM2.5 concentration data [1]. Moreover, diurnal variations in particle emissions and environmental conditions necessitate accounting for working hours to ensure representative data collection. This research explores the extent to which these factors impact measurement accuracy and develops correction methodologies to enhance the reliability of PM2.5 data.

Keywords: PM2.5, low-cost light scattering sensors, hygroscopic growth, working hour, accuracy

References:

Sensors 20(2020),5175

Funding Source(s): ทุนสนับสนุนโครงการ PM2.5 และมลพิษอื่นๆ ที่สัมพันธ์กับโรคไม่ติดต่อเรื้อรัง จากพื้นที่สู่ห้องปฏิบัติการสู่การวิจัยทางคลินิค



Comparison of PM2.5 measurements from a low-cost sensor with standard values across four calibration models: (a) raw data, (b) first order, (c) second order, and (d) third order correction.

Self-Management During PM2.5 Air Pollution Problems in Chiang Dao District, Chiang Mai Province: A Qualitative Study

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PM2.5 air pollution is a significant issue in the upper northern region of Thailand, especially in the high areas where there are open burning sources[1]. This study aims to analyze the situation for self-management during PM2.5 air pollution problems in Chiang Dao District, Chiang Mai Province. It was based on qualitative research: data were collected through semi-structured interviews and focus group guidelines. The participants consist of vulnerable groups and caregivers aged ≥20 years (n=24) purposively sampled with criteria from Chiang Dao District. Data were analyzed using thematic analysis guided by self-management theory frameworks. The results show that six major themes emerged from the data analysis: (1) awareness about PM2.5; (2) reduction of burning activities (wood chips, garbage). (3) indoor and outdoor environmental management (home sealing, cooking with firewood); (4) behavior modification (limiting outdoor activities, mask-wearing); (5) medication used (regular inhaler use, emergency medication); and (6) PM2.5 monitoring (following news, community announcements). However, self-management (e.g., awareness, self-care, medication use) was found to be especially important to both environmental factors and PM2.5 air pollution[2]. Targeted interventions to strengthen self-management capacity, environmental modifications, and support policy implementation contribute to reducing PM2.5 air pollution in the area.

Keywords: Self-Management, PM2.5, Awareness, Environmental Management

References:
Ministry of Natural Resources and Environment (2024) [cited 2025 May 22]
Am J Prev Med. 35(5)(2008), 501–7.

Funding Source(s): PM 2.5 and other Pollutants Related NCDs from Field-to-Cellto-Bedside (FCB)



Development of Local-level Fine Particle Information System using Ground-based Sensor, Satellite and Intelligence Forecasting Model

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[1]*Department of Industrial Engineering, Faculty of Engineering, Chiang Mai University, Chiang Mai, Thailand*
[2]*Department of Geography, Faculties of Social Sciences, Chiang Mai University, Chiang Mai, Thailand*
[3]*Research Unit for Energy, Economic and Ecological Management, Multidisciplinary Research Institute, Chiang Mai University, Chiang Mai, Thailand*
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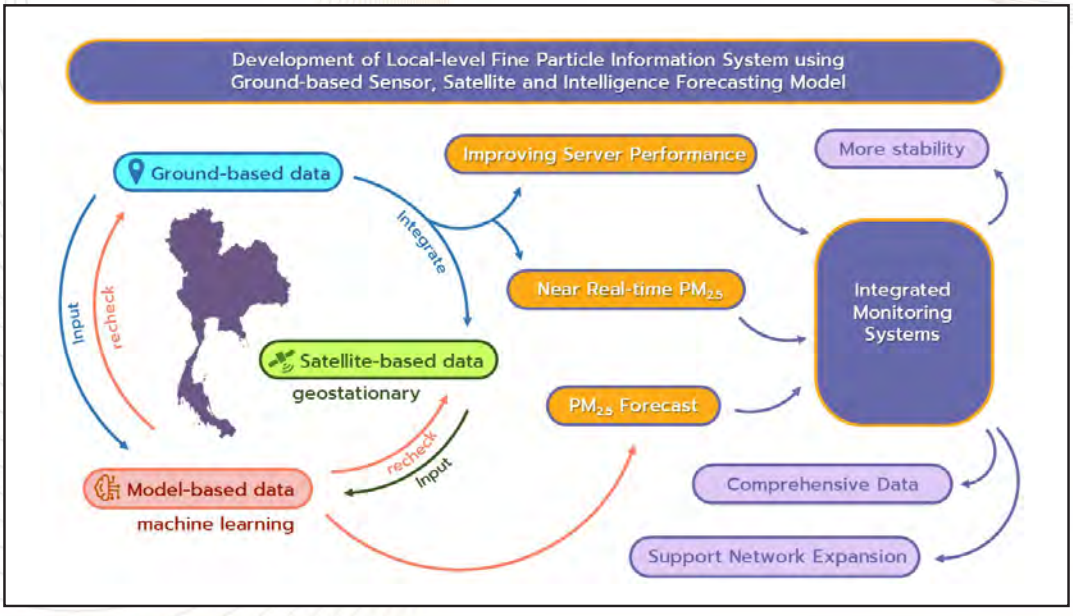
Chiang Mai University operates an air quality database that shares data with the public and supports various stakeholders in the region by increasing user engagement and technological advancements. This research aims to significantly enhance this platform using advanced machine learning. This research aims to enhance the air quality database by using machine learning. Specifically, the project will combine $PM_{2.5}$ monitoring data from ground-based sensors, satellites, and predictive models. Another goal of this research is to create a smart system that tracks sensor accuracy. A core innovation is the creation of a smart system designed to continuously track sensor accuracy. This system will leverage data from the extensive DustBoy air quality monitor network to refine estimation algorithms, particularly for improving coverage in locations where deploying real device sensors is challenging. This technical integration will produce more precise nationwide $PM_{2.5}$ estimations and more reliable forecasting models. Consequently, the improved database will make monitoring and early warnings more effective. It will localize decision-making for haze management and encourage new research. Ultimately, sharing accurate data will increase public awareness, allowing people to better protect themselves. This contributes to higher quality of life for Thai citizens by providing concrete ways to address $PM_{2.5}$ pollution.

Keywords: $PM_{2.5}$, Haze, Particulate matter, Air quality database, Monitoring system

References:

*Leuser Journal of Environmental Studies,*1(2), 2023 page 62- page 68.
International Journal on Robotics, Automation and Sciences, 6(2), 2024 page 37 – page 41.

Funding Source(s): Chiang Mai University



Air Quality by CMU: A Digital Platform Integrating Real-Time and Forecast $PM_{2.5}$ for Public Engagement and Awareness

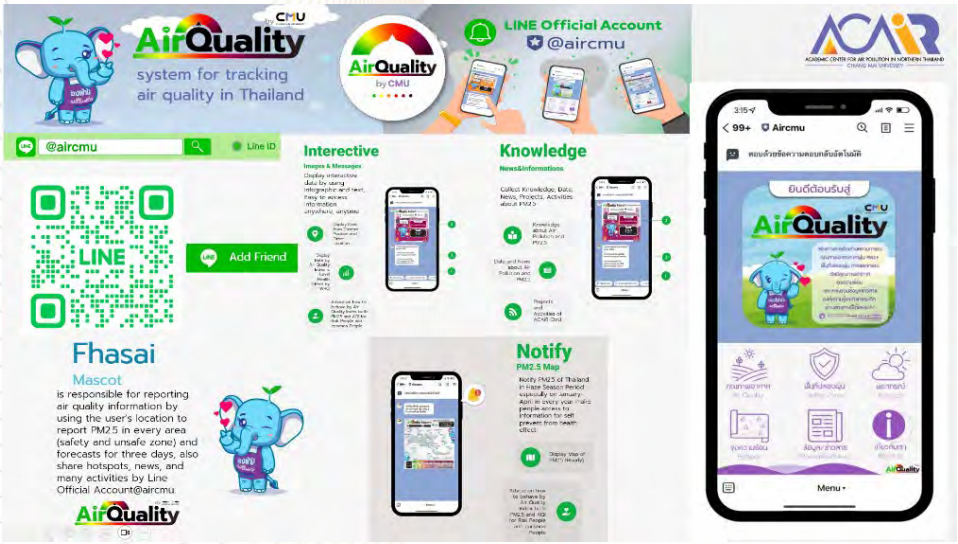
Pichamon Sudecha[1], Pimjutha Winyarath[2], Sasipat Deemak[2], Orawee Lawhana[2], Wan Wiriya[3,4], Somporn Chantara[3,4*]

[1]*Office of Management, Office of University, Chiang Mai University, Muang, Chiang Mai 50200, Thailand*
[2]*Office of Strategy Management, Office of University, Chiang Mai University, Muang, Chiang Mai 50200, Thailand*
[3]*Environmental Science Research Center, Faculty of Science, Chiang Mai University, Chiang Mai, 50200, Thailand*
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The Academic Center for Clean Air in Northern Thailand, Chiang Mai University, has developed the "Air Quality by CMU" platform, accessible via the Line Official Account (@aircmu), to improve public access to accurate and timely $PM_{2.5}$ and air quality information. The platform integrates multiple datasets through Application Programming Interfaces (APIs), including low-cost sensor networks, Pollution Control Department (PCD) monitoring stations, clean room data from the Department of Health, three-day forecasts generated by the WRF-Chem model, and fire hotspot data from NASA's FIRMS. In addition to real-time monitoring, the system disseminates educational content, news, and community-based activities to enhance public awareness and engagement in air pollution management. Key features include interactive map-based $PM_{2.5}$ alerts, color-coded health advisories aligned with the U.S. Environmental Protection Agency Air Quality Index (AQI), and six functional modules covering air quality, clean spaces, forecasts, hotspots, and knowledge sharing. Designed with a user-friendly interface, the platform supports risk communication and encourages self-protective behaviors, particularly among vulnerable populations during haze episodes. Since its launch in 2023, the platform has reached over 10,000 users nationwide and demonstrates the potential of integrated digital technologies to bridge scientific data, public communication, and sustainable air quality management, with prospects for expansion across Southeast Asia.

Keywords: Air quality, PM2.5, Digital platform, Forecast, Line official

Funding Source(s): This research project was supported by Fundamental Fund 2023, Chiang Mai University and also Thailand Science Research and Innovation (TSRI).



Sedimentology and Diagenetic History of the Phra That and Pha Daeng Formations: A Preliminary Evaluation of Geological CO_2 Storage Potential in the Lampang Basin, Thailand

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The increasing levels of CO_2 emissions have become a major concern for scientists and policymakers worldwide. As a result, they have been exploring various potential solutions to reduce CO_2 levels, and one such solution is carbon capture and storage. Field observations, sedimentological analyses, diagenesis, and petrography were performed in a preliminary evaluation to assess the reservoir potential for geological CO_2 storage in the Phra That and Pha Daeng Formations, Lampang Group. Ten lithofacies types (Gmm, Gm, Sc, Smp, Smm, Sml, Smt, Sfr, Sfl, and Fl) are characterized based on grain sizes, bed thickness, and sedimentary structures. The succession can be grouped into three distinct depositional units, corresponding to a fluvial environment, influenced by continuous water flow and historical changes in water levels and river position. The outcrop and subsurface core samples underwent distinct diagenetic processes that markedly influenced their reservoir properties. Primary porosity in outcrop samples has been reduced by iron oxide cements, followed by calcite cements and quartz overgrowth cements. The core samples reveal a considerable compaction, iron oxide, quartz overgrowth cementation, authigenic clay, and calcite, which ultimately reduced the porosity of the potential reservoir. Thus, the Phra That Formation is not suitable as CO_2 storage reservoir.

Keywords: Carbon Storage, Lampang Basin, Phra That, Pha Daeng, Sedimentology

References:
Open Geosciences (Accepted June 2025)

Funding Source(s): CMU Junior Research Fellowship Program, Chiang Mai University (R66IN00450)

What National Circumstances Explain the Choice of Carbon Pricing Instruments

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This research examines the factors influencing a country's decision to adopt a compulsory carbon pricing instrument. It estimates the likelihood of choosing carbon taxes and emissions trading systems using cross-sectional data from 160 observations analyzed via multinomial logistic regression. The findings suggest that the odds of adopting a carbon pricing instrument increases with greenhouse gas emissions, environmental performance, and emission reduction target while it decreases with higher degree of vulnerability. Regarding the choice of pricing instruments, countries with ambitious mitigation targets tend to adopt at least one mechanism, regardless of the type. Emissions trading is more likely to be selected over carbon taxes in countries that are large emitters, exhibit strong political stability, and already implement environmental taxes. The first two factors also raise the likelihood of progressing from merely considering to actively implementing carbon tax policies. Based on these results, the research offers three key policy implications. First, mitigation policies should be accompanied by adaptation measures. Reducing vulnerability is recommended to enhance the widespread adoption of carbon pricing instruments. Second, promoting political commitment to elevating mitigation targets could accelerate the implementation of carbon pricing mechanisms. Lastly, fostering political stability may generate co-benefits that support climate actions.

Keywords: Carbon pricing, Carbon taxes, Emission trading, Multinomial logit,

Funding Source(s): CMU Junior Research Fellowship Program

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Variables	Mlogit		Ologit
	Implement	Consider	Odd ratio
GDPPC	1.0058	0.9968	1.0142
p-value	0.754	0.893	0.284
GHGE	**1.0019**	1.0015	**1.0011**
p-value	**0.055**	0.115	**0.006**
EPI	**1.1405**	0.9450	**1.0542**
p-value	**0.004**	0.172	**0.044**
VI	**0.786**	0.9414	**0.8845**
p-value	**0.002**	0.188	**0.002**
TG30	**1.0156**	1.0050	**1.0113**
p-value	0.098	0.493	**0.034**
_cons	5.2572	15.8551	5.2572
p-value	0.665	0.359	0.665

Number of Obs= 158
LR Chi2 (20) = 134.02
Prob > chi2 =0

Pseudo R2 = 0.4667
Log likelihood = -76.627
Non = base outcome

Predicted probability of "implement" a CPP

Scenario		Vulnerability (VI) Mean (43.26)	1 Std.Dev lower (33.9)	2 Std.Dev lower (24.54)
TG30	Mean (24.78)	**0.2268**	**0.4495**	**0.7204**
	50	**0.2757**	**0.5145**	**0.7698**
	100	**0.4000**	**0.6498**	**0.8541**

Note: 1. All other variables were set at mean value
2. All p-values equals zero

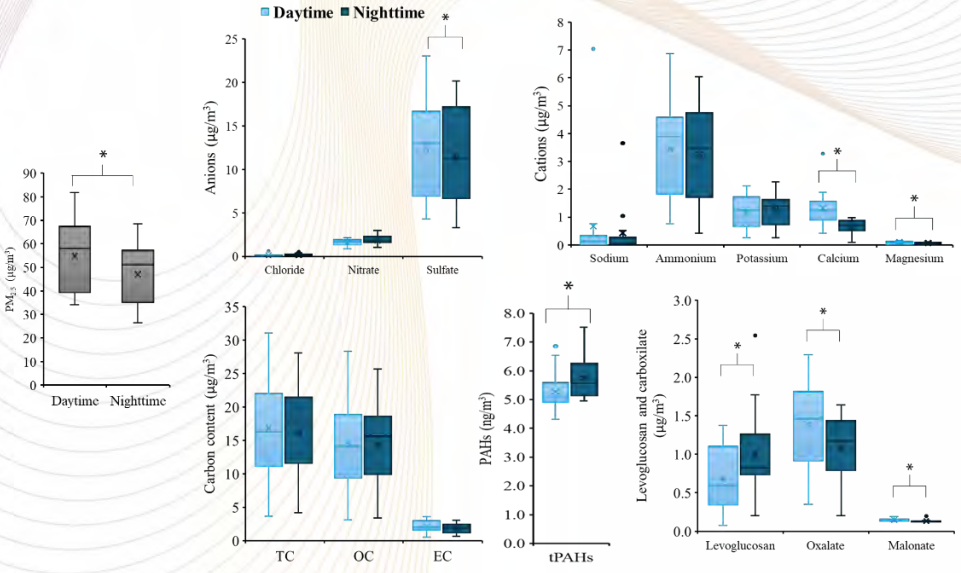
Day and Night Variations in $PM_{2.5}$ Chemical Composition During Smoke Haze in Urban Chiang Mai

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While the characteristics and sources of ambient $PM_{2.5}$ have been widely studied, the influence of diurnal variation on $PM_{2.5}$ composition remains limited, particularly in Northern Thailand. This study compared the chemical composition of $PM_{2.5}$ collected during daytime and nighttime in urban Chiang Mai during the 2022 smoke haze period. Samples were collected using a high-volume air sampler (1,000 L/min) on the rooftop of a 9-story building at Chiang Mai University, from February to June 2022. Daytime (7 a.m.–7 p.m.) $PM_{2.5}$ concentrations (55 ± 15 µg/m³) were significantly higher than nighttime (47 ± 13 µg/m³). Conversely, total PAHs were higher at night (5.77 ± 0.77 ng/m³), likely due to lower temperatures and absence of sunlight. Carbon fractions showed no diurnal differences. Levoglucosan was higher at night, while oxalate and malonate were higher during the day. Sulfate, calcium, and magnesium peaked during the daytime. Oxalate correlated strongly with $PM_{2.5}$, nitrate, sulfate, and potassium, indicating both primary and secondary sources, including biomass burning and traffic. The correlation between oxalate and potassium supports biomass combustion as a key source, especially during the day. These findings highlight the diurnal variability of $PM_{2.5}$ and its chemical markers during the haze period in Chiang Mai.

Keywords: $PM_{2.5}$, Diurnal variation, Oxalate, secondary pollution, primary pollution

Funding Source: This work was supported by the CMU Junior Research Fellowship Program (JRCMU2566R_105), Chiang Mai University, Thailand



Diurnal Variation of Volatile Organic Compounds Using Real-Time Online Monitoring

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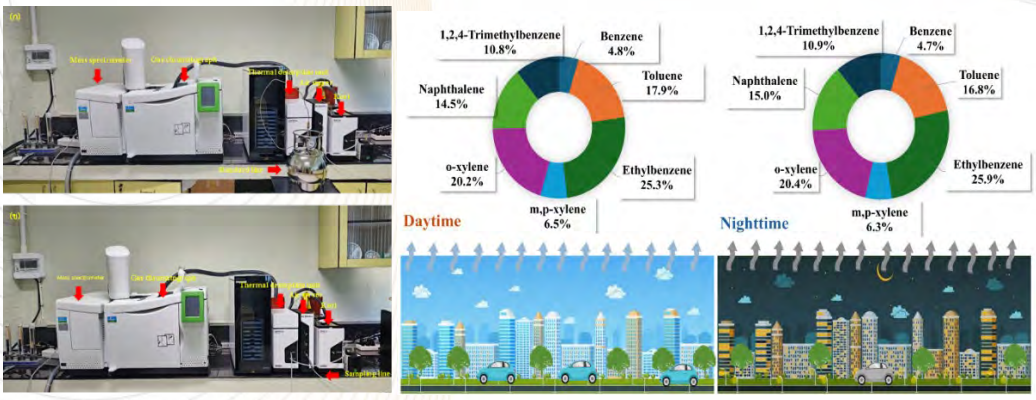
Volatile organic compounds (VOCs) play a crucial role in atmospheric chemistry as precursors secondary air pollutants, including ozone and secondary organic aerosols. This study aims to monitor the variation of VOCs concentration under different conditions throughout the day. VOC levels were measured using GC-MS with real-time sampling over a 24-hour period. The results showed that the concentrations of VOCs, particularly toluene and m,p-xylene, were higher during the daytime (64.5 ± 33.1 ng/m³ and 23.5 ± 4.8 ng/m³, respectively) compared to nighttime (59.3 ± 20.1 ng/m³ and 22.3 ± 2.7 ng/m³, respectively), likely due to increased vehicular emissions and enhanced photochemical activity. In contrast, naphthalene, primarily emitted from combustion sources, exhibited higher concentrations at night, possibly due to reduced photodegradation in the absence of solar radiation. No significant differences between daytime and nighttime concentrations were observed for benzene, ethylbenzene, and 1,2,4-trimethylbenzene, suggesting relatively stable emission sources. These findings underscore the combined influence of emission patterns and atmospheric processes on VOC behavior throughout the day and provide valuable insights into their temporal variations, supporting the development of effective air quality management strategies and aiding in the identification of potential emission sources for regulatory and mitigation efforts.

Keywords: Air pollution, Diurnal variation, Online VOCs, Real-time measurement

References:

Atmospheric Environment 359 (2025) 1213689
Atmospheric Chemistry and Physics 22 (2022) 4853–4866

Funding Source(s): This work was supported by the Chiang Mai University (grant number: PM23/2566)



The study of CO_2 capture and reducing heat entering buildings using small-sized algae

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Microalgae show significant potential in decreasing the CO_2 emissions associated with buildings throughout their life cycle by both enhancing energy efficiency and actively capturing CO_2[1]. The use of microalgae photobioreactor façade as integral building components provides several advantages, such as serving as an efficient insulation system, shading, solar collection and light-to-biomass conversion. Photobioreactor facade-integrated building components have the potential to reduce energy consumption by up to 30%.

The objectives of this study were to investigate the cultivation of microalgae in vertical flat-panel photobioreactors (PBRs) under real environmental conditions, and to study the feasibility of integrating microalgae-cultivating photobioreactor panels into building façades. Two species of microalgae: *Chlorella* sp. AARL G049 and *Leptolyngbya* sp. AARL KC45 were chosen according to their heat tolerance. Optical Density (OD), Cell Dry Weight (CDW), Medium and PBR temperatures as well as organics carbon of biomass were measured to compare the two microalgae species.

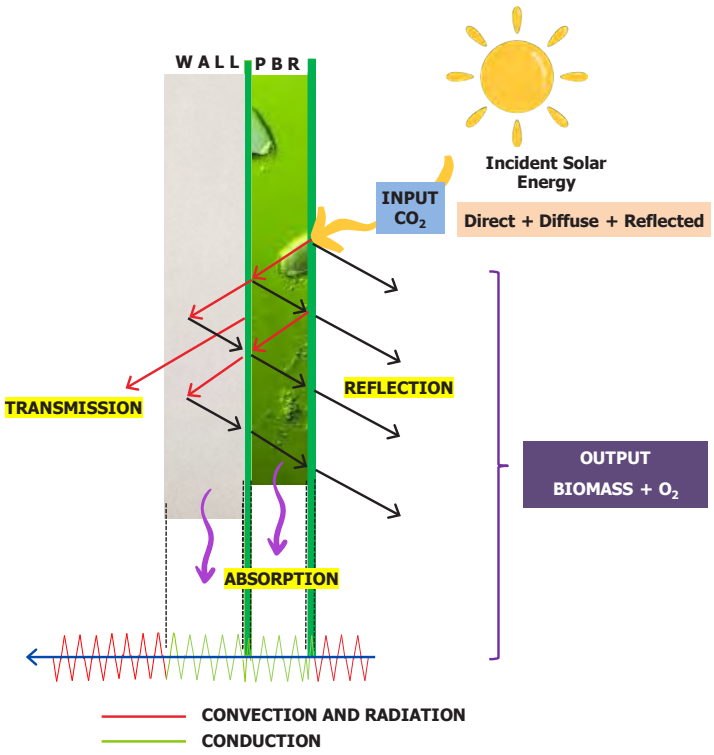
The results indicate the both microalgae species were able to grow and tolerate high environmental temperatures. In addition, their abilities to absorb light and thermal energy from sunlight were not significantly different. However, the organic carbon content of *Chlorella* sp. AARL G049 was 8% higher than that of *Leptolyngbya* sp. AARL KC45, indicating its greater potential for building applications and its capacity for carbon dioxide sequestration in the future.

Keywords: Microalgae, Building façade, Photobioreactor, CO_2 capture

References:

Fozer, D., Volanti, M., Passarini, F., Varbanov, P. S., Klemeš, J. J., & Mizsey, P. (2020). Bioenergy with carbon emissions capture and utilisation towards GHG neutrality: Power-to-Gas storage via hydrothermal gasification. Applied Energy, 280, 115923.

Funding Source(s): CMU Junior Researchers



Schematic section of microalgae PBR facade

Understanding Indoor Air Quality Perception in Airport Terminals: A Case Study of Chiang Mai International Airport

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Seasonal PM2.5 pollution in Northern Thailand poses challenges for public health and infrastructure resilience. This study investigates the perception of indoor air quality (IAQ) and satisfaction levels among building users at the domestic terminal of Chiang Mai International Airport (CNX) during two seasonal periods: haze (on-peak) and post-haze (off-peak). A mixed-methods approach was adopted, integrating user perception surveys and real-time PM2.5 monitoring data collected from strategically installed IoT-based sensors.

A total of 127 survey responses were clustered based on perceived pollution and perceived protection. Findings indicate that visible protective measures (e.g., air purifiers, ventilation systems) significantly influence users' perceived safety and satisfaction. Notably, domestic departure waiting area consistently demonstrated the highest levels of user satisfaction and protection perception in both periods, while Assembly zone reflected greater sensitivity to pollution and lower satisfaction levels, especially during the haze season.

The study offers evidence of a statistically significant one-tailed difference in satisfaction across seasons, reinforcing the influence of PM2.5 intensity on users' comfort and cognitive safety. These results contribute to facility management strategies tailored for high-density public buildings under climate-related air quality challenges.

Keywords: indoor air quality, PM2.5, haze season, Chiang Mai International Airport, cognitive safety

Funding Source(s): Chiang Mai University/Junior Research Grant

Policy Recommendations for Implementing Carbon Mineralization in Thailand: Enhancing CO_2 Capture in the Cement Industry

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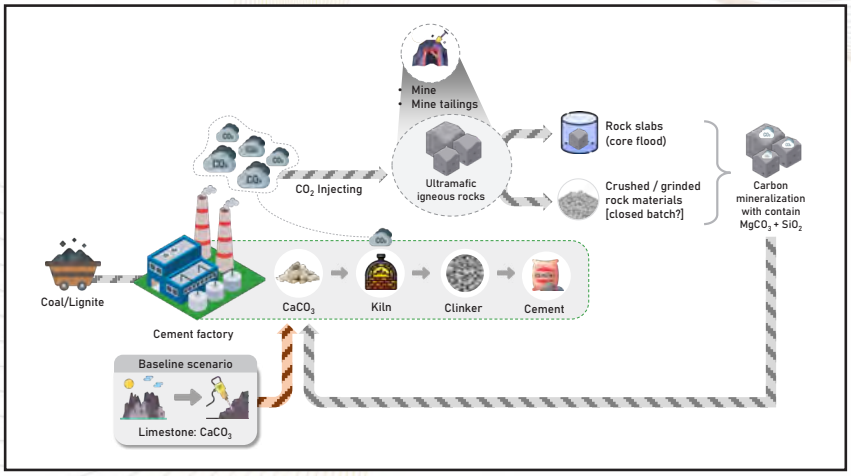
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This project aims to provide policy recommendations for the implementation of Carbon Mineralization in Thailand as a greenhouse gas reduction method, part of the broader CCUS (Carbon Capture, Utilization, and Storage) technology framework. Carbon Mineralization involves capturing CO_2 by reacting it with mineral rocks, forming carbonates such as limestone. In Thailand, suitable rocks for this process are found across all regions, although in limited quantities. The theoretical byproducts of this process are promising, particularly in the cement industry, where these byproducts could be used as raw materials in cement production. This project focuses on gathering data on Carbon Mineralization methods and examining the theoretical byproducts. Additionally, it evaluates the potential of Thailand's reactive rock sources for CO_2 capture and validates the principles of Carbon Mineralization through experimental research. The findings will contribute to policy recommendations for stakeholders and inform future efforts to integrate Carbon Mineralization technologies within Thailand's industrial sector, particularly in cement production, thereby advancing sustainable practices in carbon management.

Keywords: Climate Change, Carbon Capture Utilization and Storage, Carbon Mineralization, Ultramafic Rock, Cement Industry

Funding Source(s): Targeted Research, Chiang Mai University, grant number TGCMU2566P026/2566



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Poster Presentation



Agriculture, Biodiversity

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Production of high-quality local Lanna rice to produce high value extracts for medical and healthy food purposes

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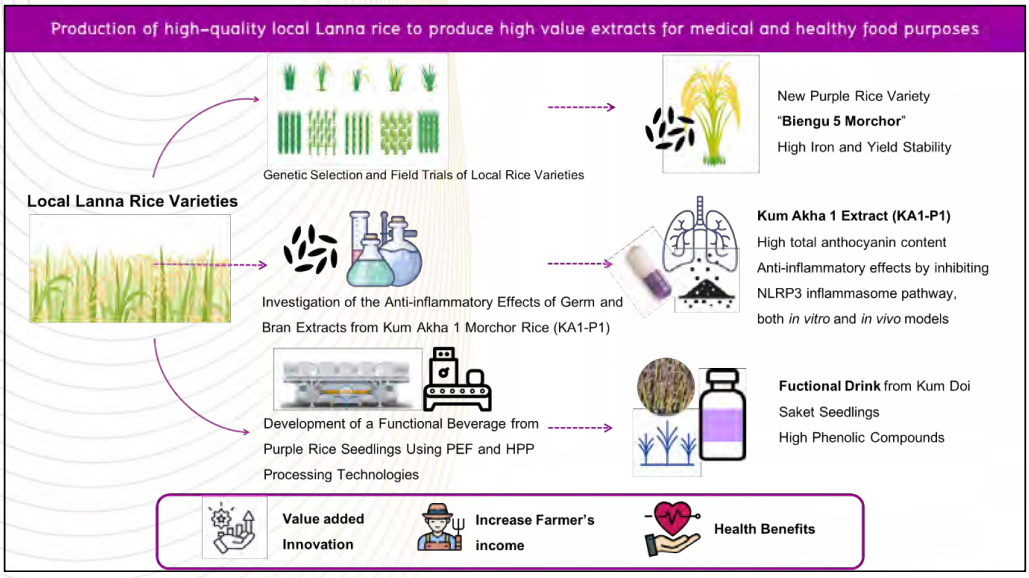
Rice is a major economic crop in Thailand, particularly local Lanna rice rich in bioactive compounds, which align with global trends in health-conscious food consumption. This study aimed to develop high-quality traditional rice lines and study their applications in medical and healthy food purposes. Field trials and selection were conducted to identify genetically pure lines with stable yields and bioactive compound. Germ and bran extract from Kum Akha 1 Morchor (KA1-P1) were investigated for anti-inflammatory properties. In addition, a functional beverage was developed from Kum Doi Saket seedlings using pulsed electric field (PEF) and high-pressure processing (HPP). Main findings include the development of Biengu 5 Morchor, a high-iron rice variety suitable as a genetic resource for future breeding. KA1-P1, which contains high levels of total anthocyanins, exhibited anti-inflammatory effects by suppressing the secretion of inflammatory cytokines IL-6, IL-1β, and IL-18 through inhibition of NLRP3 inflammasome pathway in both *in vitro* and *in vivo* models. The optimized PEF and HPP process also improved bioactive compound retention and extended the beverage's shelf life. This project generated novel knowledge and prototype products, contributing to agricultural value addition, farmer's income, and long-term public health benefits.

Keywords: rice breeding, colored rice extract, nutraceuticals, colored rice sprout

References:

Nutrients 17(7) (2025) 1186.
Foods 13(18) (2024) 2995.

Funding Source(s): Fundamental Fund 2024, Chiang Mai University (Grant No. FF059/2567)



Physicochemical Characterization of Coffee Pulp-Derived Biochar and Its Effects on Soil Abiotic and Biotic Properties

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This study aims to assess the effectiveness of locally sourced waste-derived biochar on agricultural soil health by examining its influence on several soil parameters, including nutrient content, physicochemical properties, and microbial activity. The experimental design was a Completely Randomized Design, consisting of five treatments. The approaches entailed incorporating coffee pulp-derived biochar into soil at proportions of 0, 2.50, 3.75, 5.00, and 7.50% of the soil's weight. The characterization of biochar was analyzed by scanning electron microscope (SEM), Energy Dispersive X-Ray Spectroscopy (EDS), and Fourier-transform infrared spectroscopy (FTIR). Results showed the coffee pulp biochar contains various pore's structure and high spectra of -C-O stretching functional group. High carbon (C) content (66.60%) and abundant of exchangeable K were detected in as-made biochar. The analysis of basic soil nutrients after treatment with coffee biochar revealed statistically significant differences ($P \leq 0.05$) in available P exchangeable K, exchangeable Mg (highest at 7.5%), exchangeable Ca (highest at 5%), and %SOM (increased at 3.75%). Notably, soil microbial respiration (SMR) and dissolved organic carbon (DOC) increased proportionally with the percentage of coffee biochar used. Conversely, microbial biomass carbon (MBC) decreased as the dosage of coffee biochar increased. Microbial analysis revealed reduced fungal counts (max 68% at 5% biochar) and increased cellulase-producing (39%) and phosphate-solubilizing (14%) microorganisms at 2.5% biochar compared to control. The correlation matrix has evidenced significant exchangeable K content in coffee pulp biochar demonstrating the positive correlation with soil biological improvement. Coffee pulp biochar produced from traditional kiln considerably enhances soil characteristics and modifies microbial populations.

Keywords: Agricultural Waste, Coffee Biochar, Microbial Populations, Soil Properties

References: -

Funding Source(s): -

Evaluation of Rocket (*Eruca sativa*) Cultivation Potential in an A-Frame Vertical Farming System under Evaporative Cooling Greenhouse Conditions

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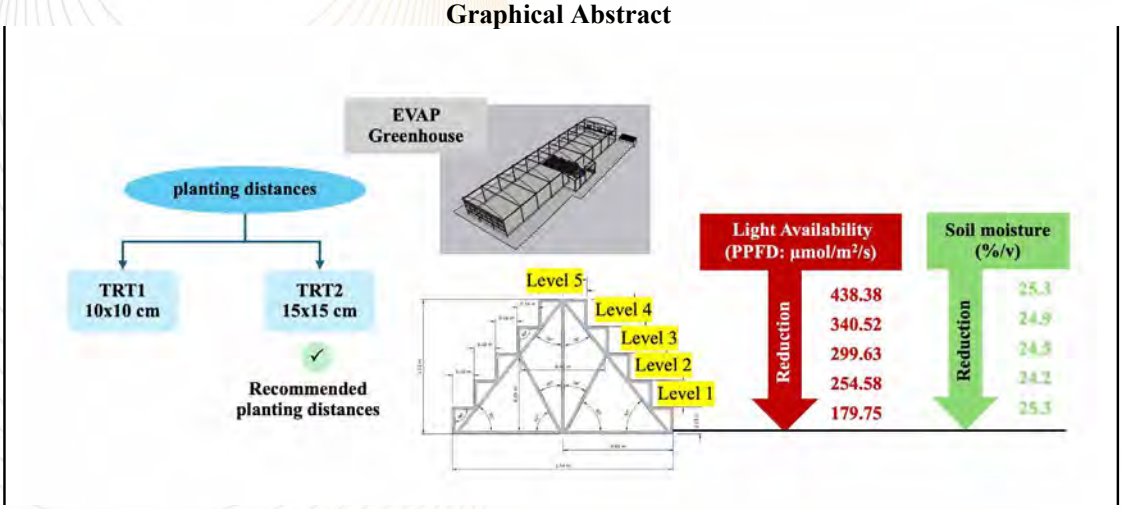
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This study evaluated the potential of cultivating rocket (*Eruca sativa*) in an A-frame vertical farming system within an evaporative greenhouse at the Faculty of Agriculture, Chiang Mai University, Thailand. The experiment utilized four A-frame shelves (1.0 m high, 1.6 m long) with five vertical planting levels on each side. A 2 × 5 factorial arrangement in a randomized complete block design (RCBD) tested two planting spacings (10 × 10 cm and 15 × 15 cm) across five vertical levels. Parameters measured included photosynthetic photon flux density (PPFD), soil moisture content, plant height, and total fresh yield. PPFD progressively declined from level 5 (438.38 µmol m^{-2} s^{-1}) to level 1 (179.75 µmol m^{-2} s^{-1}), while soil moisture remained stable (24.2–25.3% v/v). No interaction was observed between spacing and level. At five weeks after transplanting, the 15 × 15 cm spacing produced significantly higher yields than the 10 × 10 cm spacing, though plant height showed no significant difference. Vertical level had no significant effect on either height or yield. The findings suggest that the light intensity within the A-frame system is sufficient for rocket production, and a 15 × 15 cm spacing is optimal for maximizing yield under these conditions.

Keywords: vertical farming, A-frame shelves, rocket cultivation, evaporative greenhouse

Funding Source(s): Fundamental Fund (Grant No. FF064/2567) that support the reported work

Graphical Abstract



Mitochondrial DNA Analysis of Fraser's (*Lagenodelphis hosei*) and Rough-toothed (*Steno bredanensis*) Dolphins in the Thai Andaman Sea: Evidence for Distinct Subpopulations

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Fraser's dolphin (*Lagenodelphis hosei*) and rough-toothed dolphin (*Steno bredanensis*) are offshore species occurring pantropically in all three major oceans. Stranding events of these two species along the Andaman coastline have been recorded since 2006; however, little is known about these cetaceans in Thai waters. Here, we used mtDNA control region analyses to investigate the diversity of maternal lineages and examine population connectivity throughout their distribution range. A total of six and seven sequences of Fraser's and rough-toothed dolphins, respectively, from our study were compared with data retrieved from an online database (NCBI). We used two datasets: 400 bp for Fraser's dolphins (n=128) and 319 bp for rough-toothed dolphins (n=74). The results revealed a total of 53 and 54 haplotypes for each species worldwide. Among these, three unique haplotypes of each species were found exclusively in the Thai Andaman Sea with the haplotype diversity of 0.933 ± 0.122 and 0.857 ± 0.137 for Fraser's and rough-toothed dolphins, respectively. These haplotypes have not been identified in other databases, suggesting they may represent distinct populations inhabiting this area within the Indo-Pacific region. Shared haplotypes were found between the Thai Andaman Sea and other areas within the Indian and Pacific Oceans, but not the Atlantic Ocean. Genetic information for both species remains scarce for other areas around the Thai Andaman Sea. Further observation of genetic diversity and population dynamics coupled with our findings will be vital for informing future cetacean management policies in Thailand.

Keywords: Cetacean, Delphinidae, Genetic diversity, Haplotype, Population structure

References:

Marine Ecology Progress 643 (2020) 183-195
Marine Mammal Science 38 (2022) 1371-1397

Funding Source(s): This project is funded by CMU Junior Research Fellowship Program (JRCMU2566R_068).

Development of Anthocyanin-Based Indicator Films for Intelligent Packaging

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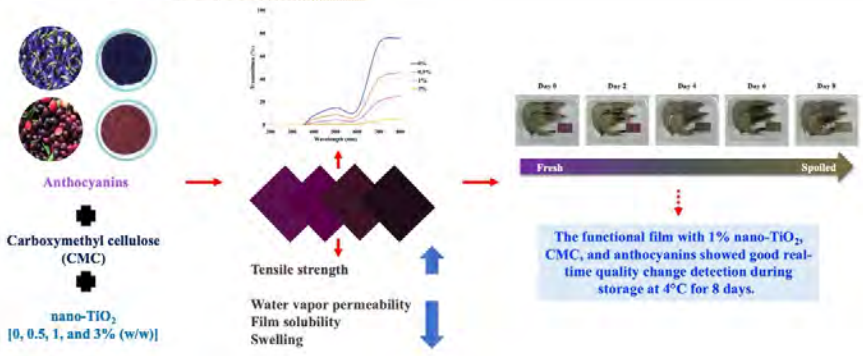
In this study, anthocyanin-based indicator films consisting of Karanda fruit and butterfly pea flower anthocyanins (CCA) and titanium dioxide nanoparticles (nano-TiO_2) in a carboxymethyl cellulose (CMC) are prepared using a solvent casting method. Nano-TiO_2 addition affected the films' color by increasing b^* and decreasing L^* and a^* values as well as lowering light transmittance and transparency. Increasing the nano-TiO_2 content improved the tensile strength (17.70–31.33 MPa) but decreased the elongation at break (50.23–40.03%) and degree of swelling (149.55–92.02%) of the CMC/CCA film ($p < 0.05$). Nano-TiO_2 addition also significantly improved the water vapor barrier properties of films ($3.88–3.42 \times 10^{-10}$ g m m^{-2} s^{-1} Pa^{-1}). After exposure to volatile ammonia, the nano-TiO_2-added films showed poor color changes, particularly at high nano-TiO_2 levels. The 1% nano-TiO_2-loaded indicator film exhibited optimal performance between enhanced properties and color indication capability, making it efficient for real-time shrimp quality change detection. Therefore, the developed nano-TiO_2-loaded CMC/CCA indicator film shows promise as an intelligent food packaging.

Keywords: anthocyanins, food waste reduction, intelligent packaging, shrimp, titanium dioxide nanoparticles

References:

Carbohydrate Polymer Technologies and Applications 11 (2025) 100877.

Funding Source(s): This work was supported by the CMU Junior Research Fellowship Program, Chiang Mai University (Grant No. JRCMU2566R_077).



Potential of Mealworm Frass for Bio-organic Fertilizer Production

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Mealworm frass, a by-product of insect farming, has garnered interest as a potential organic fertilizer for sustainable agriculture and environmental recovery. This enthusiasm is due to its ability to provide valuable nutrients for plants when utilized as an organic fertilizer.

Objective: This study evaluated the potential of mealworm frass, a waste product from mealworm farming, as a bio-organic fertilizer to help sustainable agriculture needs and waste utilization challenges.

Methods: Three experiments were conducted at Chiang Mai University (May 2023-February 2024): (1) frass characterization and microbial isolation with molecular identification, (2) soil nitrogen mineralization assessment using completely randomized design, and (3) Chinese kale growth evaluation under greenhouse conditions using randomized complete block design.

Results: Mealworm frass had nitrogen (5.09%), phosphorus (6.88%), and potassium (2.29%), and researchers found fourteen types of helpful microbes for plant growth, such as *Rothia koreensis*, *Streptomyces sampsonii*, and *Staphylococcus lloydii*. Nitrogen mineralization occurred rapidly at 93.75 mg/kg/day. Combining mealworm frass (30 g/plant) with chemical fertilizer yielded the highest biomass (141.73 g/plant) and vitamin C content (227.97 mg/plant). Mealworm frass outperformed both chemical fertilizer and chicken manure.

Conclusion: Mealworm frass shows enormous promise as a bio-organic fertilizer for organic and combined farming methods, helping to promote recycling and waste-free farming practices.

Keywords: insect frass, nitrogen mineralization, biofertilizer, zero waste, Chinese kale

References:

Journal of Economic Entomology 117(4) (2024) 1261-1268
Biomass Conversion and Biorefinery 14 (2022) 1-10.

Funding Source(s): CMU Junior Research Fellowship Program, Chiang Mai University.

Unveiling Anti-Inflammatory Peptides from Lion's Mane Mushroom (*Hericium erinaceus*): Preparation, Bioactivity Assessment, and Peptides Identification

Buddhika Silva [1], Korawan Sringarm [2], Saranyapin Potikanond [3], Pipat Tangjaidee [1], Pensiri Buacheen [3], Pornchai Rachtanapun [1], Suphat Phongthai [1,*]

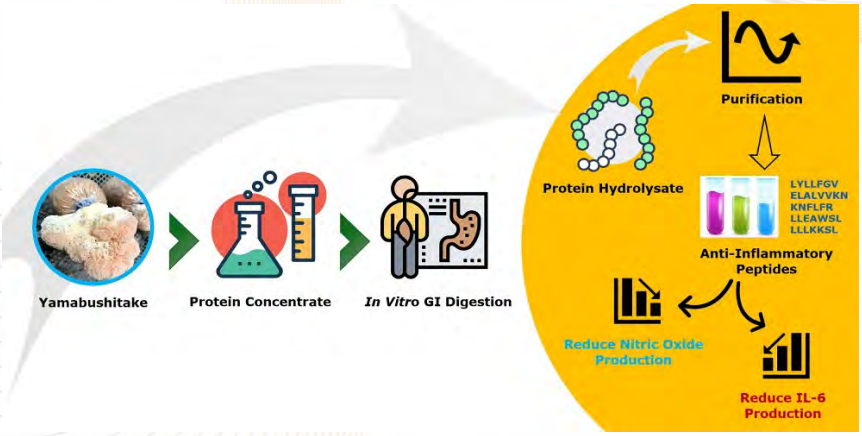
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[2] *Faculty of Agriculture, Chiang Mai 50250, Thailand*
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Lion's Mane mushroom (*Hericium erinaceus*) is acknowledged worldwide for its substantial contribution of medicinal compounds and nutrients, including protein. The efficient extraction and hydrolysis of proteins are essential for revealing their bioactive properties. This study demonstrates that the optimal pulsed electric field (PEF)-assisted extraction achieved a 42.44% increase in protein extraction efficiency relative to traditional alkaline extraction ($p < 0.05$). *H. erinaceus* protein contained 44.59% essential amino acids and exhibited 71.33% in vitro digestibility. Pepsin-trypsin hydrolysis produced the most significant anti-inflammatory activity, resulting in a 36.2% reduction in nitric oxide and a 31.8% decrease in interleukin-6 levels ($p < 0.05$). Subsequent fractionations employing membrane ultrafiltration and size exclusion chromatography effectively purified the peptides, resulting in enhanced anti-inflammatory activity ($p < 0.05$). This research discovered nine important peptide sequences containing 50-100% hydrophobic amino acids in Lion's Mane mushroom proteins, which could aid in the synthesis of natural anti-inflammatory peptides.

Keywords: Anti-Inflammatory Peptide, Alternative Proteins, Lion's Mane Mushroom, Protein Hydrolysates, *In Vitro* Digestion

References:
Applied Food Research 5 (2025) 101167

Funding Source(s): Fundamental Fund 2024, Chiang Mai University



Potential enhancement of high-quality livestock sexed semen production using electrospun nanopolymer combined with recombinant antibody innovation

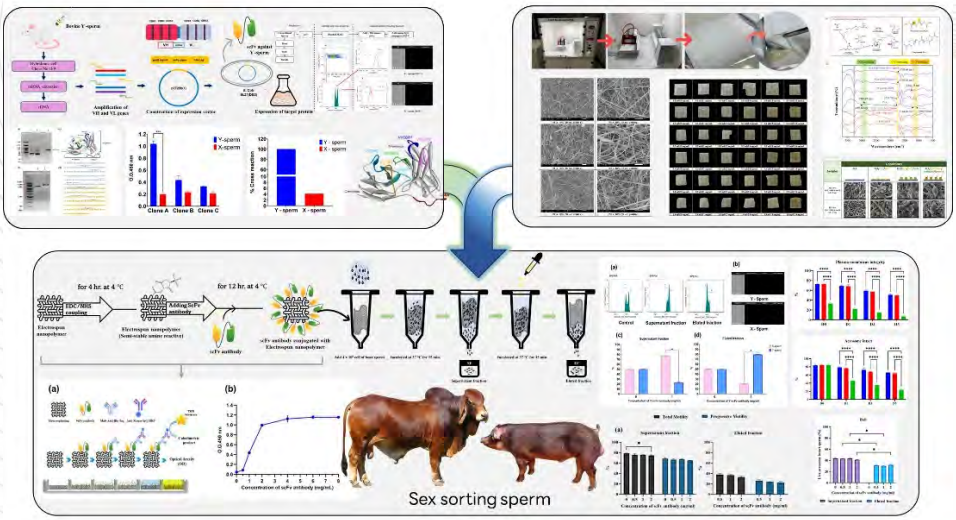
Korawan Sringarm[1*], Surat Hongsibsong[2], Pornchai Rachtanapun[3], Kittisak Jantanasakulwong[3], Anucha Sathanawongs[4], Supamit Mekchay[1], and Maninphan Thongkam[1]

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In modern livestock systems, controlling offspring sex is crucial for efficiency and profitability, as dairy operations need female calves, while meat production prefers faster-growing males. This research developed an efficient, cost-effective sperm sex-sorting technology for pigs and cattle using advances in molecular biology and materials science. Scientists produced scFv antibodies targeting the plasma membrane of Y-chromosome-bearing pig sperm, with *E. coli* (clone A) generating highly specific antibodies that bound 100% to Y-sperm and minimally to X-sperm. Electrospun polymer fiber sheets made with 8% PLA and coated with these antibodies were optimized for sperm separation. ELISA and flow cytometry testing showed that 1 mg/ml scFv antibody concentration significantly enriched X-sperm (up to 78%) in the supernatant and Y-sperm (up to 79%) in the eluted fraction, confirming effective sex sorting. In cattle, PLA fibers containing 8% PLA blended with 4 mg/mL of scFv antibody achieved up to 77% separation efficiency for Y-sperm and a recovery rate of 78–80% for X-sperm. The sorted semen maintained good motility post-freezing. The upcoming project phase will test fertilization efficiency and field application, aiming to establish this innovative PLA electrospun combined with scFv antibody method as an effective, scalable, and economical solution for the livestock industry's breeding needs.

Keywords: Recombinant antibody, sexed sorting kit, Biopolymer

Funding Source(s): Fundamental Fund 2025, Chiang Mai University.



Tracing Man, Tracing Rice: Correlation between the Genetic History of the Mon-Khmer Ethnic Groups and Rice Landraces Distribution in Northern Thailand

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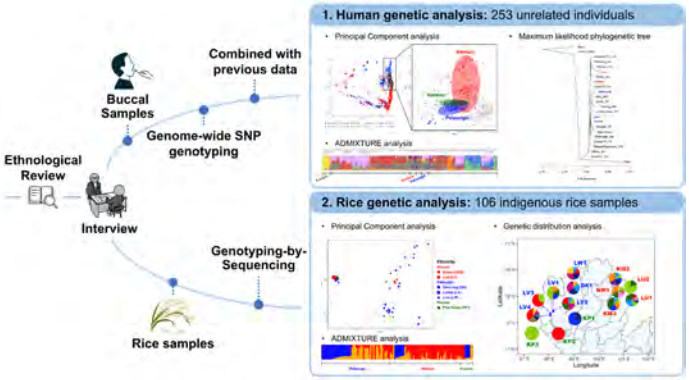
Mon-Khmer-speaking populations are considered among the earliest settlers in northern Thailand and are thought to have introduced rice cultivation from southern China during the Neolithic period. However, the relationship between the distribution of local rice varieties and ethnolinguistic migrations remains insufficiently explored. To address this gap, we integrated human and rice genetic data collected between 2022 and 2024. Genome-wide SNP data were generated for 81 individuals from the Khmuic and 89 from the Palaungic branches of the Mon-Khmer group, along with 83 Pwo Karen individuals from the Tibeto-Burman language family. These data were analyzed alongside previously published genomic datasets from other Asian populations. In parallel, we genotyped 106 indigenous rice samples collected from the same communities. Human genetic analyses revealed a distinct structure in the Khmuic group, while the Palaungic and Karenic groups were more closely related. Similarly, rice genetic data showed greater diversity and shared genetic origins between Palaungic and Pwo Karen groups, while Khmuic-associated rice varieties were more isolated. These patterns suggest cultural and genetic exchange between Karenic and Palaungic groups, whereas the Khmuic group maintained historical isolation and localized seed selection. Our findings reveal a link between human genetic variation and rice diversity in northern Thailand.

Keywords: Mon-Khmer ethnic group, Pwo Karen, Indigenous rice, Genome-wide SNP analysis, Northern Thailand

References:

BMC Genomics 25 (2024) 956–956
Rice 18 (2025) 60–60.

Funding Source(s): Fundamental Fund (R66EX01174), Chiang Mai University, Thailand.



Cells Recycling Application in Single-Stage and Sequential-Stage Co-production of Xylitol and Ethanol Using Corn Cob Hydrolysates

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This study investigated the application of recycled cells from the wild type of *Candida magnoliae* TISTR 5664 in the single-stage and sequential-stage co-production of xylitol and ethanol. Corn cob xylose-rich and glucose-rich hydrolysates were used as carbon sources without detoxification process. The novelty of the sequential-stage co-production employing cells recycling strategy was adapted from sequential aerobic and anaerobic cultivations with cells recycling to substantially enhance the production of xylitol and ethanol. The statistically significant maximum ($p \leq 0.05$) ethanol concentration was improved by 9.9% (50.9 – 54.1 g/L or 77.3 – 83.9% of the theoretical) from the second step of sequential-stage co-production using recycled cells without xylitol accumulation. The statistically significant maximum ($p \leq 0.05$) xylitol was achieved at 25.9 g/L (58.6% of the theoretical) when sequential-stage co-production was initiated in the first step with fresh inoculum only and not recycled cells. The sequential-stage co-production of xylitol and ethanol presented the potential for improvement of both xylitol and ethanol production processes. This process could maximize productivity by eliminating the time required for seed propagation and cultivation preparation. The benefits of applying a cells-recycling strategy to both single-stage and sequential-stage production of ethanol were also strongly pronounced with equivalent optimal concentrations and yields.

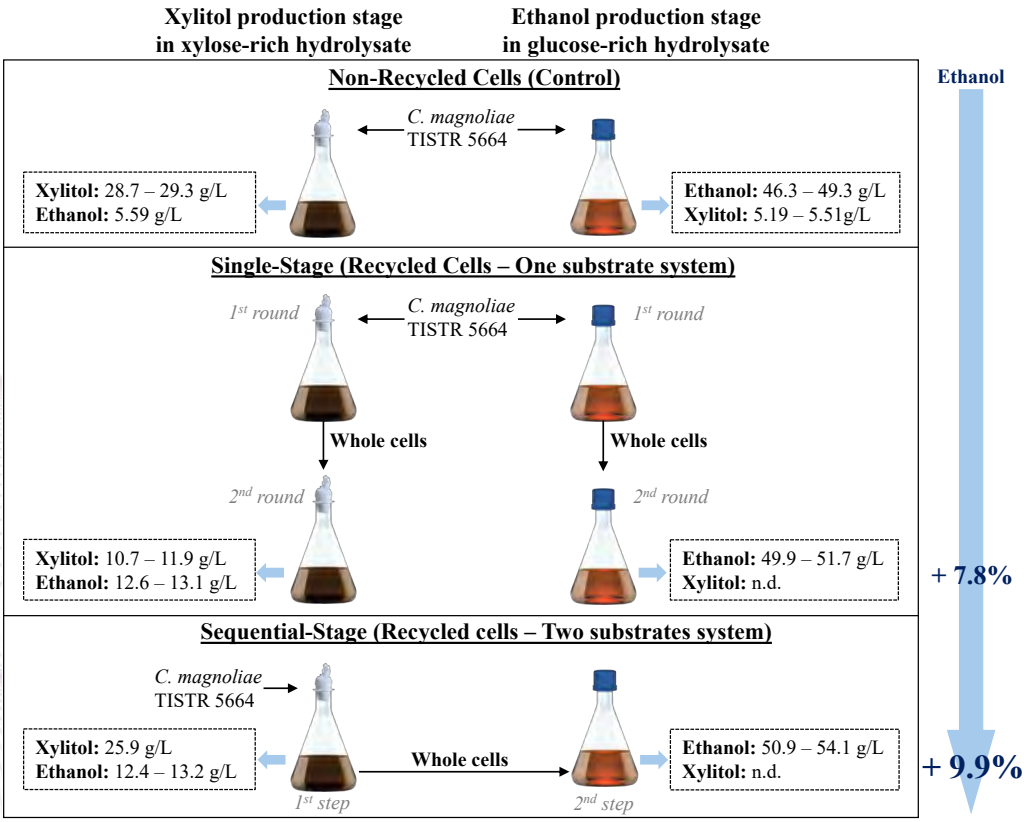
Keywords: sustainable development, solid waste, recycling process, high value-added chemical, co-production

References:

Frontiers in Bioengineering and Biotechnology 11 (2023) 1332185.
Scientific Reports 13 (2023) 727.

Funding Sources: Golden Jubilee (RGJ) Ph.D. Programme /Grant Number: PHD/0111/2560); Fundamental Fund 2024/Grant Number: FF037/2567; Chiang Mai University (CMU) Proactive Postmaster Researcher/Grant Number: 881/2566; Center of Excellence-Agro Bio-Circular-Green Industry (Agro-BCG)/Grant Number: CoE66-P001.

Graphical Abstract


Xylitol production stage
in xylose-rich hydrolysate
Ethanol production stage
in glucose-rich hydrolysate
Non-Recycled Cells (Control)
C. magnoliae
TISTR 5664
Xylitol: 28.7 – 29.3 g/L
Ethanol: 5.59 g/L
Ethanol: 46.3 – 49.3 g/L
Xylitol: 5.19 – 5.51g/L
Single-Stage (Recycled Cells – One substrate system)
1st round
C. magnoliae
TISTR 5664
1st round
Whole cells
Whole cells
2nd round
2nd round
Xylitol: 10.7 – 11.9 g/L
Ethanol: 12.6 – 13.1 g/L
Ethanol: 49.9 – 51.7 g/L
Xylitol: n.d.
Sequential-Stage (Recycled cells – Two substrates system)
C. magnoliae
TISTR 5664
Xylitol: 25.9 g/L
Ethanol: 12.4 – 13.2 g/L
Whole cells
Ethanol: 50.9 – 54.1 g/L
Xylitol: n.d.
1st step
2nd step
Ethanol
+ 7.8%
+ 9.9%

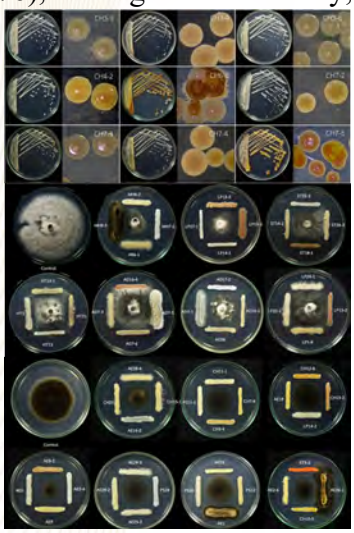
Epiphytic Yeasts from Fabaceae and Poaceae: Biocontrol Potential in Highland Intercropping Systems

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This study is part of the project "Co-benefits of maize-highland legume intercropping as a sustainable farming method for safeguarding both food security and air quality," which explores the agroecological benefits of sustainable intercropping systems in northern Thailand. A total of 104 epiphytic yeast isolates were obtained from asymptomatic leaves of key intercropped crops-legumes in the Fabaceae family (e.g., *Vigna* spp.) and maize in the Poaceae family (e.g., *Zea mays, Oryza zativa*). These two plant families represent the primary components of the highland intercropping system designed to reduce open-field burning and enhance on-farm biodiversity. Representative yeast isolates were evaluated for antagonistic activity against plant pathogenic fungi, including *Stagonosporopsis cucurbitacearum* and *Alternaria brassicicola*. Several isolates demonstrated strong mycelial growth inhibition, likely through competitive exclusion and potential antifungal metabolite production. The results suggest that intercropping legumes and maize not only promotes beneficial microbial communities on plant surfaces but also offers natural disease suppression mechanisms. These findings highlight the role of Fabaceae–Poaceae cropping systems in supporting phyllosphere biodiversity and the development of eco-friendly bioprotectants for sustainable highland agriculture.

Keywords: Agrobiodiversity, Bioprotectants, Plant pathogenic fungi, Phyllosphere microbiome

Funding Source(s): Co-benefits of maize-highland legume intercropping as a sustainable farming method for safeguarding both food security and air quality FF071/2567 and Fundamental Fund (R66EX011676), Chiang Mai University, Thailand.



Integrated agrobiodiversity research in highland ecosystems: From knowledge to sustainable utilization and climate resilience

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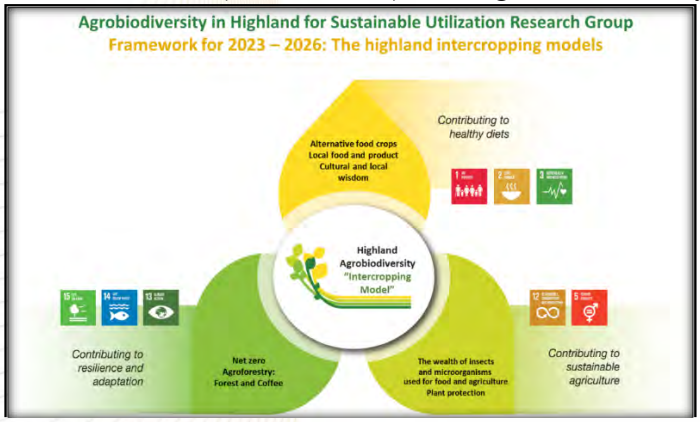
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Integrated agrobiodiversity research provides a pathway to strengthen highland agricultural systems through ecological resilience, sustainable resource use, and scientific innovation. In the first year of operation, the Agrobiodiversity in Highland and Sustainable Utilization Research Group focused on building foundational knowledge and generating practical outcomes that connect biodiversity with climate-smart utilization. Research efforts included the application of SPAD-502 chlorophyll meters for real-time, non-destructive nitrogen assessment in Arabica coffee leaves, enabling precision nutrient management in highland plantations. Beneficial endophytic actinomycetes were identified as plant growth-promoting agents that significantly improved tomato yield and fruit quality under low-input conditions. Insect biodiversity assessments revealed spatiotemporal distribution patterns of Mecoptera, supporting their use as indicators for climate and ecosystem changes. Novel species of freshwater fungi were documented, contributing to global fungal taxonomy and highlighting microbial diversity in upland water systems. Additionally, scientific data supported the successful Geographical Indication (GI) applications of Fang Honey Mandarin and Fang Imperial Lychee, reinforcing the link between biodiversity conservation and value-added local products. These interdisciplinary outcomes demonstrate the group's integrated approach to harnessing agrobiodiversity for sustainable development, community engagement, and adaptation to climate challenges in highland ecosystems.

Keywords: Agrobiodiversity, Intercropping, Microbial ecosystem, Carbon neutrality

Funding Source(s): Agrobiodiversity in Highland and Sustainable Utilization Research Group RG 33/2566 and Fundamental Fund (R68IN00037), Chiang Mai University, Thailand.



A Comparison of the Chemical Compositions and Nutrient Values of the Sanim and Srithong Varieties of the Farmed Golden Apple Snails (Gastropoda; Ampullariidae; *Pomacea canaliculata*)

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The comparison of the Sanim (SN) and Srithong (ST) varieties of the farmed apple snail *Pomacea canaliculata* as an alternative protein source has shown that ST contained more hydroxyproline and possessed a greater firmness than SN. Nevertheless, both varieties yielded similar protein contents of 20.90-23.07% and exhibited similar texture, color, cooking yields and cooking losses after cooking. Good palatability with high liking score was obtained from both snail meat samples, particularly color, texture, and overall attributes. Snail meats possessed good nutritive value with an amount of protein and low-fat content, whereas SN contained higher protein and total energy (P<0.05). Other nutritionally useful chemicals (such as calcium, sodium, iron, vitamins B1 and B2) are present. Sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) results discovered that myosin heavy chain, paramyosin, and actin were the prevalent protein components. Differences in nitrogen content distribution were observed between SN and ST, in which alkaline-soluble protein was the major fraction. Amino acid composition and fatty acid content varied regarding snail varieties with a large amount of essential amino acids and good source of MUFA and PUFA. Therefore, both farmed SN and ST snails could be an effective alternative protein source with a significant amount of nutritive value.

Keywords: Farmed golden apple snail, *Pomacea canaliculata*, varieties, alternative meat, nutritional value.

References:

Future Foods 10 (2024) 100422.

Funding Source(s): Research Group Development (R68IN001117), Chiang Mai University, Thailand.

Graphical Abstract



Biofortified High Selenium Rice: Elevating Nutritional Value for Human Health

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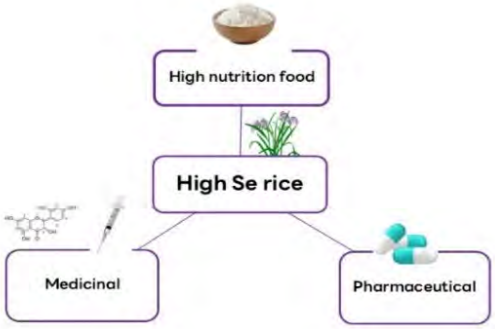
Selenium (Se) is an essential element for metabolic processes in humans, providing protection against several serious diseases e.g., heart disease and cancer. Increasing Se levels in rice grains could be an effective way to enhance Se intake and reduce Se deficiency among the population. This experiment was conducted in three steps: (1) evaluating the effect of foliar Se on grain Se accumulation among 20 rice varieties; (2) testing the effects of polishing degree and extraction solvents on appearance, γ-oryzanol content, and antioxidant activity from Se-enriched KDML105 grains; and (3) assessing the effects of Se in rice grains on the viability and proliferation of peripheral monocytes (RAW 264.7). The results showed that all rice varieties accumulated higher levels of grain Se after foliar application, with increases compared to non-foliar Se treatment ranging from 5.7 to 67.5%. The polishing degree and extraction solvent significantly affected the extract color, γ-oryzanol levels, and antioxidant capacity. Extracts from Se-enriched rice were able to stimulate cell growth at low concentrations (25–200 µg/mL). However, the addition of rice Se alone did not significantly enhance proliferation-stimulating effects, indicating that rice Se by itself did not have a direct effect on cell proliferation and a combination with other factors may be needed.

Keywords: Selenium rice, Nutrition rice, Antioxidant, Anticancer, Cell growth, Medicinal rice

References:

Journal of Soil Science and Plant Nutrition 25 (2025) 2503 – 2517
Frontier in Plant Science 11 (2020) 589835

Funding Source(s): Thailand Science Research and Innovation (FF67) and Fundamental Fund (R67EX00038), Chiang Mai University, Thailand.



Ectoparasites Infestation in Companian Dogs and Associated Pathogens in Chiang Rai province

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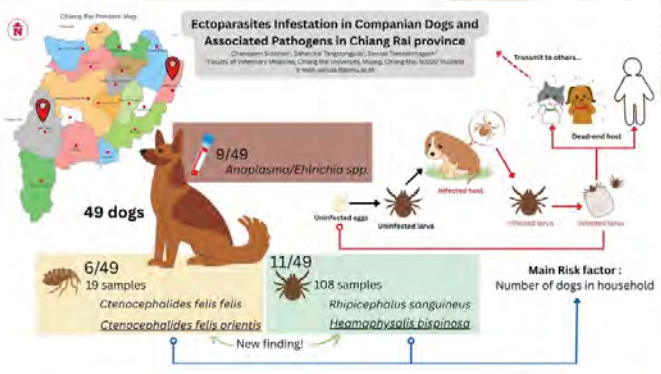
Ectoparasite infestations are frequently reported in dogs from northern Thailand, particularly ticks of the genus *Rhipicephalus* and fleas of the genus *Ctenocephalides*, both of which are potential vectors of pathogens such as *Babesia gibsoni, Anaplasma platys*, and *Bartonella* spp. However, data on their distribution and associated pathogens remain limited. This study examined 49 dogs from Wiang Kaen and Mae Suai districts, Chiang Rai Province. Ticks were found on 11 dogs (22.45%) and fleas on 6 dogs (12.24%). Morphological identification revealed *Rhipicephalus sanguineus* as the predominant tick, with one dog (2.04%) infested by *Haemaphysalis bispinosa*. *Ctenocephalides felis orientis* and *C. felis felis* were identified in 10.20% and 6.12% of dogs, respectively. PCR screening of 49 blood samples, 108 ticks, and 19 fleas detected *Anaplasma/Ehrlichia* in 9 dogs (18.37%). Univariable logistic regression showed that dogs living with 2–5 others were significantly more likely to be infested with ticks ($P < 0.05$). This study confirms the presence of *H. bispinosa* and *C. felis orientis* in dogs from Chiang Rai and highlights the need for further research on their epidemiological and medical significance.

Keywords: Tick, Flea, *Haemaphysalis*, *Ctenocephalides*, *Anaplasma*, *Ehrlichia*

References:

Vectors 13 (2020) 420.
Journal of Medical Entomology 26(6) (1989) 573–600.

Funding Source(s): โครงการทุนพัฒนานักวิจัยรุ่นใหม่ มหาวิทยาลัยเชียงใหม่, โครงการทุนพัฒนานักวิจัยรุ่นกลาง สำนักงานการวิจัยแห่งชาติและมหาวิทยาลัยเชียงใหม่



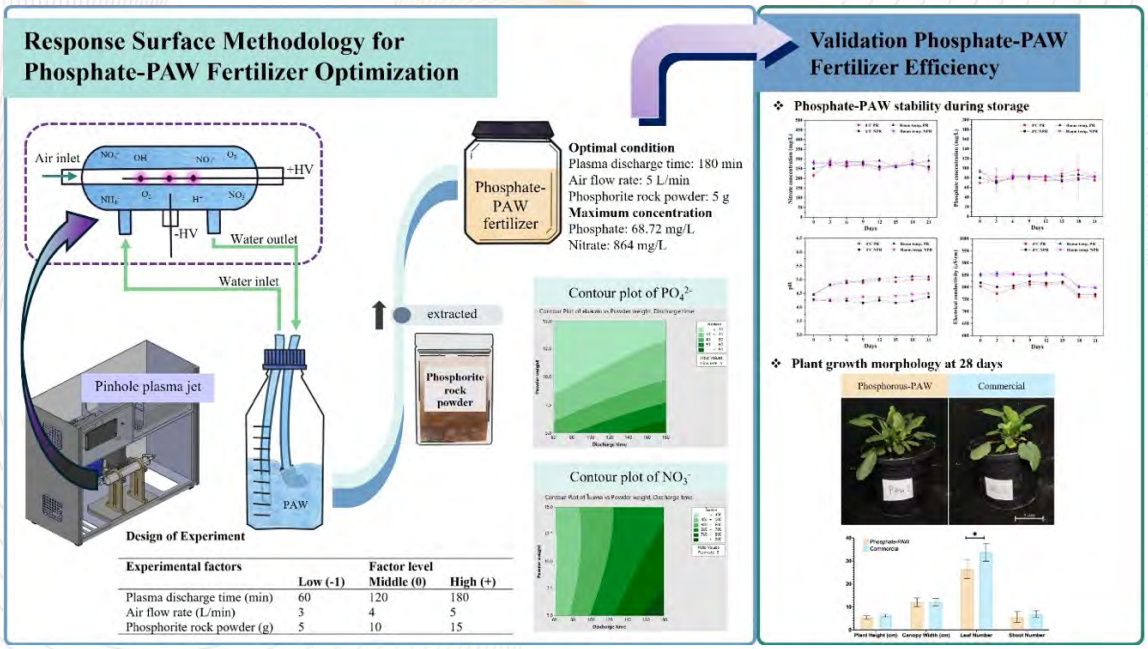
Enhancing Phosphorus Fertilizer Production from Phosphorite Using Low-Temperature Plasma Technology

Takron Opassuwan[1], Nattida Tachaboon[1], Choncharoen Sawangrat[1] and Komgrit Leksakul[1,*]
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This study optimizes phosphorite-based fertilizer production using response surface methodology. The optimal PAW concentration for nitrate and phosphate was determined by activating PAW with air flow rates of 3, 4, and 5 L/min for 60, 120, and 180 minutes. Phosphorite rock powder (5, 10, and 15 g) was then extracted with the optimal PAW. The R^2 values for nitrate and phosphate production were 0.9755 and 0.9731, respectively. Discharging time and phosphorite weight significantly increased nitrate and phosphate in the fertilizer. The optimal production is 180 minutes discharging time with a 5 L/min air flow rate and 5 g of phosphorite rock, with a composite desirability of 96.86%. After 24 days of storage at 4 and 25°C, with the phosphorite residue compared to without the residue, nitrate, nitrite, and phosphate concentrations decreased by less than 10.84%, 29.88%, and 12.32%, respectively. Phosphate-PAW fertilizer growth in pansy (*Viola* × *wittrociana*) was similar to commercial fertilizer, with no significant differences in plant height, canopy width, or shoot number. However, inflorescence growth is under investigation. This study suggests cold plasma technology can produce phosphate and nitrate fertilizers similarly to commercial ones.

Keywords: plasma technology, plasma activated water, phosphorus, fertilizer

Funding Source(s): This research is supported by Chiang Mai University.



Diversity and Characteristics of Endophytic Bacteria from the Yang Na Tree (*Dipterocarpus alatus*) in Front of the Inthakhin Shrine: A Cultural Symbol of Lanna

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[*] *E-mail: nuttapol.n@cmu.ac.th*

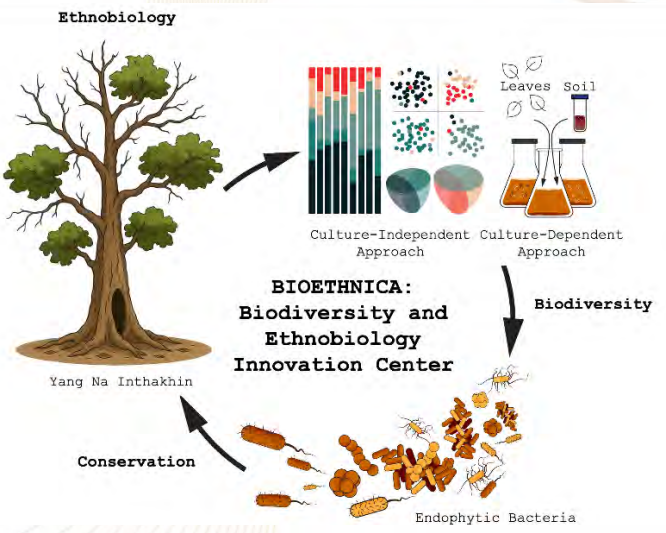
The Yang Na Inthakhin tree (*Dipterocarpus alatus*) located in front of the Inthakhin Shrine at Wat Chedi Luang is over 200 years old. It represents a cultural and spiritual symbol of Chiang Mai. It was planted during the city's restoration and is part of the proposal to recognize Chiang Mai as a UNESCO World Heritage Site. However, the tree is currently deteriorating, showing symptoms such as leaf loss, dry branches, and crown hollowing. To conserve this iconic tree, the "Save Yang Na Hak Sa Inthakhin" campaign was initiated. This study explored the diversity and potential functions of endophytic bacteria isolated from the tree's leaves using conventional and molecular methods. Of the 25 bacterial isolates obtained, all except PRL-W5 were able to grow in a nitrogen-free medium, suggesting a potential for nitrogen fixation. None could solubilize inorganic phosphate, but around 25% produced siderophores and plant hormones. Illumina-based culture-independent analysis revealed *Bryobacter* and *Mycobacterium* as dominant genera. Functional predictions indicated a prevalence of branched-chain amino acid biosynthesis pathways. Network analysis showed both promotive and inhibitory interactions among the bacteria. These findings may support future strategies for biological restoration and conservation of the Yang Na Inthakhin.

Keywords: Ethnobiology, Biodiversity, Conservation, Endophytic bacteria, *Dipterocarpus alatus*

References:

Applied Sciences 11(2) (2021) 688.

Funding Source(s): CMU Junior Research Fellowship Program



Screening for Zoonotic Host of Severe Fever Thrombocytopenia Syndrome Virus in Chiang Mai, Thailand

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Severe Fever Thrombocytopenia Syndrome Virus (SFTSV) is predominantly spread by tick vectors and can infect humans and animals in multiple locations, especially in Asia. The initial human case in Thailand was identified in 2019 in the central region, followed by reports of animal infections in both the central and northeastern regions. This study sought to examine animals in Chiang Mai, situated in northern Thailand, for SFTSV infection. Serum samples were collected from 422 animals, including elephants, cats, dogs, and others, and analysed using RT-PCR. All samples yielded negative results for SFTSV. These findings reveal critical data for future surveillance and highlight the imperative of continuous monitoring for potential zoonotic transmission.

Keywords: SFTSV, screening, animals**,** RT-PCR

References:

Medical Journal 16(2) (2020) 204-204
Journal of clinical microbiology 52(9) (2014) 3325-3333

Funding Source(s): CMU junior Research Fellowship program (R66IN00206), Chiang Mai University, Thailand

Effects of *Wolffia globosa* Supplementation in Diet on Growth Performance, Carcass Characteristics, Fatty Acid Profile, and Lipid Synthesis-Related Gene Expression in Nile Tilapia (*Oreochromis niloticus*)

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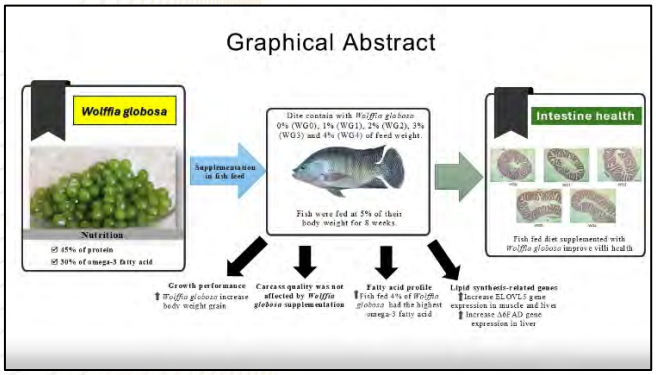
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Wolffia globosa, a small aquatic plant, is notable for its high protein content (approximately 45% dry matter) and rich omega-3 fatty acid profile. This study aimed to investigate the effects of dietary supplementation of *Wolffia globosa* at different levels on growth performance, carcass quality, fatty acid composition, and the expression of lipid synthesis-related genes in Nile tilapia. A total of 300 fish were randomly assigned to five treatment groups (0%, 1%, 2%, 3%, and 4% *Wolffia* inclusion) with three replicates and fed for 8 weeks. The results showed that fish in *Wolffia globosa* supplemented group showed significantly higher weight gain compared to the control group (p = 0.0024). Carcass quality did not differ significantly among treatments. Regarding fatty acid composition, fish fed the 4% *Wolffia* diet had the highest omega-3 fatty acid levels in the muscle tissue. *ELOVL5* gene revealed that was significantly upregulated in both the muscle and liver tissues of fish fed *Wolffia* 3% and 4% (p = 0.0015 and p = 0.003, respectively). For *Δ6FAD* gene showed no significant difference in muscle tissue among groups, but its expression was significantly higher in the liver of fish fed 3% and 4% *Wolffia globosa* (P < 0.0001).

Keywords: Wolffia globosa, omega-3 fatty acid, growth performance, carcass quality

Funding Source(s): Junior research grant 2023



Evaluation of passive immunity in calves receiving colostrum from cows immunized with a live attenuated lumpy skin disease vaccine

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The aim of this study was to determine the duration of maternally derived immunity against lumpy skin disease virus (LSDV) in dairy calves born to cows vaccinated with a live attenuated homologous Neethling strain vaccine, using the virus neutralization test (VNT) and an in-house enzyme-linked immunosorbent assay (ELISA). A total of 37 pregnant cows from 12 LSD-free dairy farms in Lamphun province, Thailand, were immunized and subsequently calved between December 2021 and April 2022. Blood samples were collected from dam-calf pairs within one week of calving, followed by monthly blood collection from the calves for four months to assess humoral immune responses. The results showed that antibodies against LSDV persisted in cows for 4 –9 months following vaccination. LSDV-specific antibodies were detected in 75.68% of calves during the first week after colostrum intake. However, the proportion of seropositive calves declined steadily, falling below 50% by day 60 and reaching 13.51% by day 90. No seropositive calves were detected by day 120. These findings indicate that passive immunity in calves lasts up to three months, suggesting a potential window of susceptibility to LSDV infection after maternal antibodies wane. This information is crucial for optimizing vaccination strategies in young calves under field conditions.

Keywords: Lumpy skin disease; Newborn calves; Passive immunity; Virus neutralization test; Enzyme-linked immunosorbent assay

Funding Source(s): CMU Junior Research Fellowship Program (JRCMU2565_035) and Fundamental Fund 2024, Chiang Mai University (FF086/2567)

Effect of dietary *Hydrilla verticillata* supplementation on growth performance, fillet fatty acid profiles, muscle quality, intestinal histology and gene expression of Nile tilapia (*Oreochromis niloticus*)

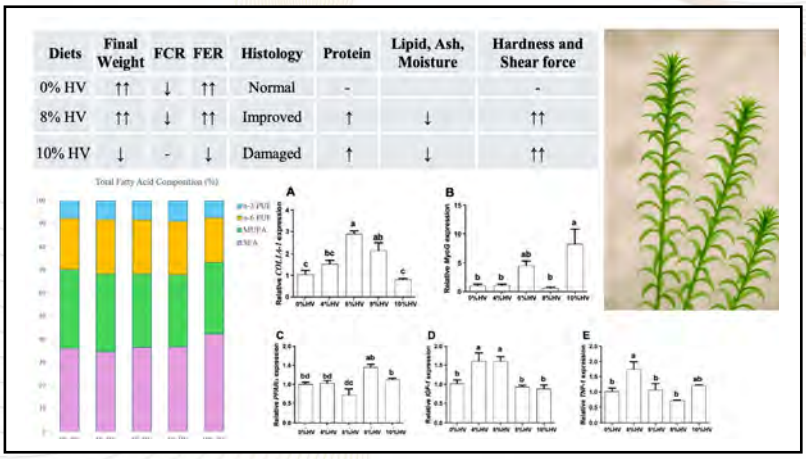
Panita Prathomya[1], Zhengyong Wen[2], Napatsorn Montha[1], Thi Diem Quynh Tran[1], Patipan Hnokaew[1], Chaiwat arjin[1], Angkhana Inta[3], Hien Van Doan[1]*

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This study evaluated the effects of dietary inclusion of *Hydrilla verticillata* (HV) at 0%, 4%, 6%, 8%, and 10% on Nile tilapia (*Oreochromis niloticus*) over 8 weeks, focusing on growth, fillet fatty acid composition, fillet quality, intestinal histology, and gene expression. Final weight and feed conversion ration (FCR) were significantly improved in fish fed 0% and 8% HV diets. Lysozyme activity increased in the HV-fed groups. HV-fed fish showed significantly increased fillet protein and reduced lipid, ash, and moisture contents, with improved texture (hardness and shear force). Fatty acid analysis revealed the highest saturated fatty acids (SFAs) and lowest monounsaturated fatty acids (MUFAs) levels in the 10% HV group. The 8% HV group had the highest n-3 polyunsaturated fatty acids (PUFAs), particularly docosahexaenoic acid (DHA), while the 4% group had the highest n-6 PUFA. Histological analysis showed increased villi height and absorptive surface area in 10% HV group. Gene expression analysis showed upregulation of *COL1A1* (6%), *MyoG* (10%), *TNF*-α (4%), *IGF1* (4% and 6%), and *PPARα* (8%). Overall, moderate HV inclusion (6-8% HV) enhanced immune response, muscle quality and gene expression without compromising growth, supporting its use as a sustainable aquafeed ingredient.

Keywords: *Hydrilla*, PUFA, fillet, Nile tilapia, gene expression

Funding Source(s): Junior Researcher Funding: The utilization of *Hydrilla verticillata* in feed on growth performance, health and immune response of Nile Tilapia (*Oreochromis niloticus*)



Application of Application of Purple Eggplant Flour as a Natural Fat Replacer in Beef Patties

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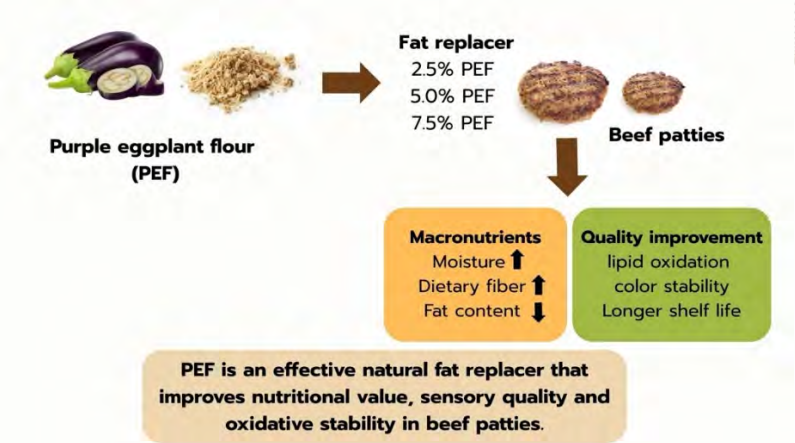
This study investigated the application of purple eggplant flour (PEF) as a natural fat replacer in beef patties and its effects on nutritional composition, technological properties, oxidative stability, and sensory quality. Beef patties were formulated with 0%, 2.5%, 5.0%, and 7.5% PEF. The incorporation of PEF significantly increased moisture, ash, and dietary fiber contents, while reducing protein and fat levels ($p < 0.05$). PEF-treated patties showed improved cooking yield, moisture retention, and fat retention compared to the control. Sensory evaluation revealed significantly enhanced tenderness and juiciness. Colorimetric analysis indicated higher lightness (L*) and redness (a*) values during refrigerated display. Moreover, thiobarbituric acid-reactive substances (TBARS) were significantly lower in PEF-formulated patties throughout 7 days of storage at 4°C, indicating reduced lipid oxidation. These findings demonstrate that PEF can function as a clean-label fat replacer, enhancing dietary fiber content and oxidative stability while maintaining desirable sensory and visual attributes in beef patties.

Keywords: Purple eggplant flour, Fat replacer, Functional ingredient, Beef patties, Oxidative stability

References:

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Funding Source(s): CMU Junior Research Fellowship Program (R000031941), Chiang Mai University, Thailand.



Selenopeptide with Antioxidant and Anticancer Activities from Se-Enriched *Wolffia globosa*: Fractionation, Isolation and Identification

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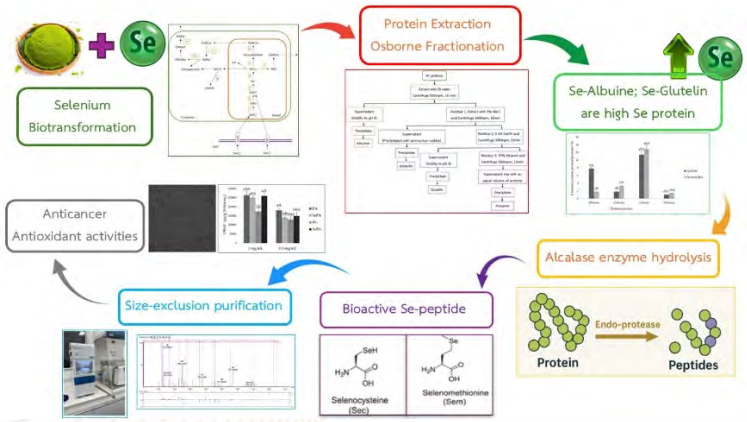
Regionally derived food materials hold significant potential for development into high-value products with advanced bioactivities. Our research group focuses on the production and promotion of these materials as sources of bioactive compounds or functional food products with proven bioactivity. In this study, we present an example of our work on the production of bioactive selenopeptides derived from plant-based materials, which represent promising candidates for development as plant-based bioactive agents for applications in health and agriculture. *Wolffia globosa*, a protein-rich, rootless aquatic plant, has the ability to absorb selenium (Se) from water and synthesize selenopeptide. The study aimed to extract selenoprotein using Osborne fractionation and enzymatic hydrolyzed to produce seleopeptide from Se-enriched *W. globosa*. Anticancer and antioxidant activity of the bioactive selenopeptides were detected. The results indicated seleno-albumin (SePA) and seleno-glutelin (SePG) were the major fractions derived from selenoproteins in Se-enriched *W. globosa*, with Se contents of 181.40 and 112.64 µg Se/g protein, respectively. The selenopeptides demonstrated significant antioxidant properties. They also provide anticancer effects against cervical cancer cells (C33A, SiHa) and lung cancer cells (A549). Importantly, the Se-enriched peptides exhibited superior biological activities compared to non-Se peptides, suggesting potential applications as functional ingredients in the food and pharmaceutical industries.

Keywords: *Wolffia globose*, Se-biotransformation, Antioxidant peptide, Anticancer peptide, Selenopeptide

References:

Foods 12(20) (2023) 3815

Funding Source(s): CMU Junior Research Fellowship Program (R000031998), Chiang Mai University, Thailand.



Biogenic Selenium Nanoparticles from Deep Sea *Dermacoccus abyssi* MT1.1^{T} Improve Physiological and Antioxidant Responses in Tomato Seedlings under Salt Stress

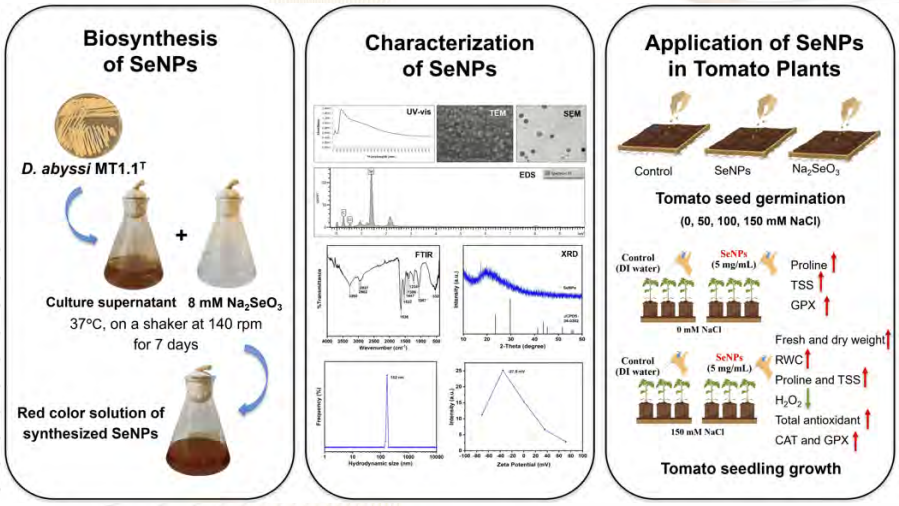
Pharada Rangseekaew[1], Supawitch Hoijang[2], Sirasit Srinuanpan[1], Mathurin Meethangdee[3], Sitthisak Intharasit[1] and Wasu Pathom-aree[1*]

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Selenium nanoparticles (SeNPs) have attracted attention as promising agents in agriculture for mitigating salt stress in plants, due to their bioactivity, stability, and bioavailability. This study aimed to synthesize selenium nanoparticles (SeNPs) using the culture supernatant of deep-sea *Dermacoccus abyssi* MT1.1^{T}, and to evaluate their effects on seed germination and tomato seedling growth under salt stress condition. The SeNPs were successfully synthesized and characterized as spherical, nanoscale particles with negatively charged surfaces and moderate stability. SeNPs at 5 mg mL^{-1} showed no phytotoxicity to tomato development under 50, 100, and 150 mM NaCl. The application of SeNPs significantly enhanced biomass and relative water content (RWC) under 150 mM NaCl. Additionally, SeNPs mitigated salt-induced osmotic stress by promoting the accumulation of proline and total soluble sugar. SeNPs also mitigated salt-induced oxidative stress by reducing hydrogen peroxide levels through both enzymatic and non-enzymatic antioxidant defenses, as indicated by elevated levels of key antioxidant enzymes, catalase (CAT) and guaiacol peroxidase (GPX) and total antioxidant activity. Our study highlights the potential of biogenic SeNPs from *D. abyssi* MT1.1^{T} as an effective nanobiostimulant for mitigating salt stress in tomato, offering environmentally friendly strategy for sustainable agriculture under saline conditions.

Keywords: Biogenic selenium nanoparticle, Climate resilient agriculture, Plant growth promoting actinobacteria, Salinity stress mitigation, Sustainable agriculture

Funding Source(s): CMU Junior Research Fellowship Program for budget year 2023, Chiang Mai University, Thailand.



Exploring the Industrial Potential of *Williamsia marianensis*: A Deep-Sea Actinomycete from the Mariana Trench with Insights from Genome-Scale Metabolic Modeling

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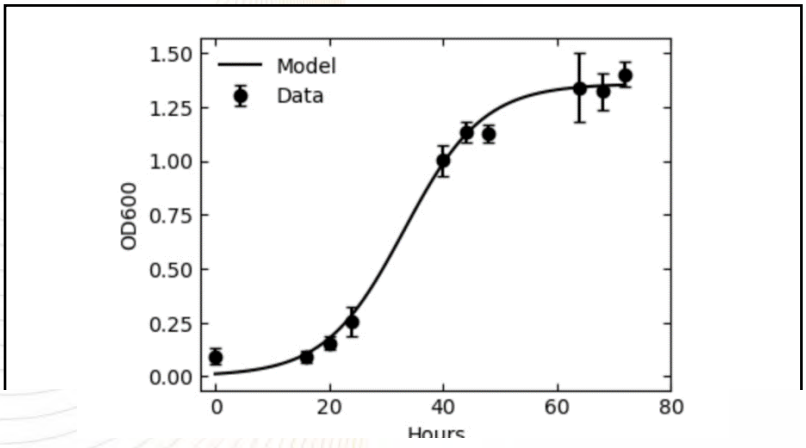
Williamsia marianensis, an actinobacterial isolate from the Mariana Trench, exhibits significant potential for industrial applications due to its ease of cultivation and robust biosynthetic capabilities. This study comprehensively characterizes its potential through experimental validation, genomic analysis and metabolic model reconstruction. Cultivation experiments determined that optimal growth occurs at pH 7 and 0% NaCl, with colonies producing a bright orange pigment and yielding biomass with 56.4-58% protein content and high carotenoid levels. Genomic analysis showed high similarity to strain DSM 44944, indicating its potential as a functional ingredient in food and pharmaceutical industries with minimal toxicity risk. A genome-scale metabolic model (GEM) was successfully constructed, with the ability to perform flux balance analysis (FBA) to accurately predict growth and identify strategies to enhance carotenoid production. This research highlights the biotechnological potential of *W. marianensis*, positioning it as a promising candidate for further industrial development.

Keywords: *Williamsia marianensis*, genome-scale metabolic model (GEM), carotenoid biosynthesis, Bacterial biomass

References:

Microbiology 56(5) (2006) 1123-1126.
Environmental Microbiology Reports 16(1) (2024) e13231.

Funding Source(s): Chiang Mai University



Application of Next-Generation Sequencing in the Diagnosis of Hematological Disorders in Companion Animal

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Blood parasites, particularly those transmitted by ticks, represent a significant cause of anemia and thrombocytopenia in companion animals such as dogs and cats. Conventional diagnostic methods, including microscopy, often exhibit limited sensitivity and scope, especially when detecting multiple or novel pathogens. This study aimed to employ next-generation sequencing (NGS) for broad-spectrum detection of blood-borne pathogens and microbial profiling in anemic dogs and cats. Blood samples were collected from 10 dogs and 10 cats presenting with anemia and thrombocytopenia. DNA was extracted and amplified targeting the 16S and 18S rRNA gene regions, followed by sequencing using the Illumina MiSeq platform. Sequencing data were analyzed using bioinformatics pipelines to determine the taxonomic composition of each sample. In canine samples, microbial profiles revealed a high proportion of unclassified bacterial taxa alongside common genera such as *Streptomyces*, *Burkholderia*, and *Bacteroides*, suggesting possible co-infections or environmental bacterial contamination. In feline samples, *Mycoplasma*—a known causative agent of feline infectious anemia—was detected in only one individual. Other samples were dominated by unclassified bacteria and genera including *Pseudomonas* and *Bradyrhizobium*. The substantial presence of "Unassigned" or "Unclassified" sequences highlights the potential existence of novel or poorly characterized organisms. Overall, NGS demonstrates considerable potential as a comprehensive tool for the detection of blood-borne microbes in veterinary diagnostics. It uncovers a broader spectrum of microbial diversity compared to conventional techniques, providing insights into both known and emerging pathogens that may contribute to hematological disorders. These findings underscore the necessity for advanced molecular methodologies to enhance early detection, disease surveillance, and evidence-based treatment strategies in veterinary medicine.

Keywords: Next-Generation Sequencing (NGS), pathogens, blood, companion animals, microbial profiling

Funding Source(s): Ching Mai University/ RCMU2566R_070 that support the reported work

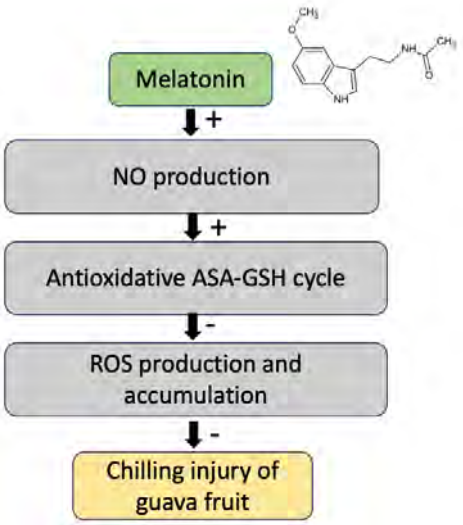
Exogenous Melatonin Mediates Endogenous Nitric Oxide Promoting the Antioxidative Ascorbate-Glutathione Cycle and Alleviates Chilling Injury in Postharvest Guava Fruit

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Chilling injury (CI) is a bottleneck factor constraining the refrigeration and cold chain logistics of guava fruit. Melatonin (MT) is an important phytohormone that can regulate multiple abiotic stresses. This study evaluated the potential effects of MT on CI in 'Kim Ju' guava fruit stored at 8 °C and then store at its underlying mechanisms involved in the regulation of antioxidative ascorbate-glutathione (ASA-GSH) cycle and nitric oxide (NO) production. The application of 100 µM MT mitigated CI symptoms and improved ripening-related quality during refrigeration, as indicated by a lowered CI index, retarded declines in chromaticity L* and advanced color transformation (from green to yellow), softening and accumulation of soluble solids. MT treatment repressed the increases in malondialdehyde content, relative conductivity, and reactive oxygen species including hydrogen peroxide and hydroxyl radical. Reduced ROS generation in MT-treated fruit was a consequence of the enhancement of antioxidative AsA-GSH cycle, including ascorbate peroxidase and glutathione reductase. These findings suggest that MT could reinforce cold tolerance in guava fruit by inhibiting oxidative stress and promoting antioxidative AsA-GSH cycle via NO production.

Keywords: Nitric oxide, ROS, Signaling, Chilling Injury, Postharvest

Funding Source(s): The CMU Junior Research Fellowship Program, grant number JRCMU2566R_045.



Effects of Nitrogen and Sulfur Concentrations on Growth Performance and Quality of Wasabi (*Eutrema japonicum*) in Substrate Culture

Suchanuch Jaipinta[1], Chaiartid Inkham[2,3,4], Kanokwan Panjama[2,3,5], Suriya Tateing[3,5], Soraya Ruamrungsri[2,3,5,*]

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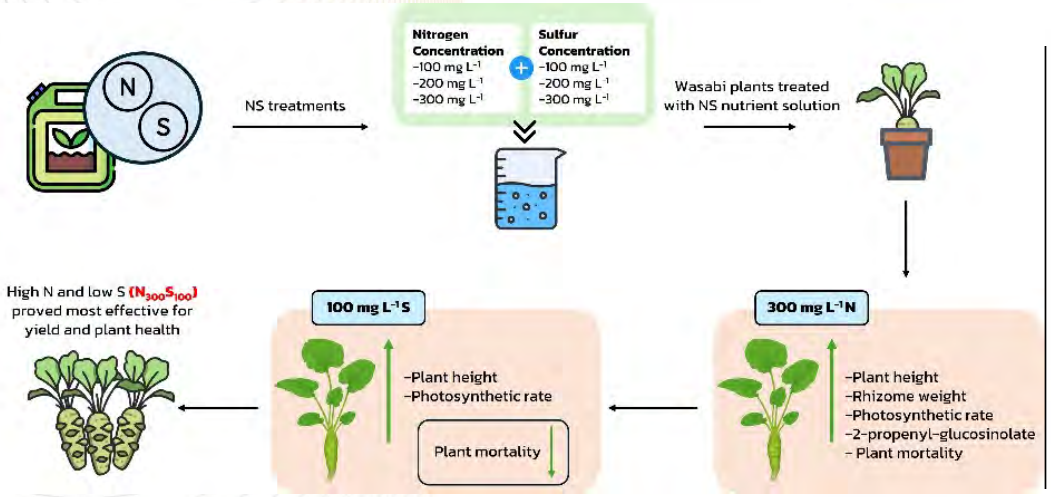
Nitrogen (N) and sulfur (S) are essential macronutrients that play a vital role in the growth, yield, and quality of wasabi (*Eutrema japonicum*). This study investigated the effects of three N (100, 200, and 300 mg L^{-1}) and three S (100, 200, and 300 mg L^{-1}) concentrations on the performance of 'Daruma' wasabi grown in a controlled plant factory environment. The application of 300 mg L^{-1} N significantly improved plant height, rhizome weight, photosynthetic rate, and 2-propenyl-glucosinolate accumulation, although it also led to a rise in plant mortality. Similarly, while 300 mg L^{-1} S enhanced rhizome development, it negatively affected photosynthesis and survival rates. Conversely, a lower S level of 100 mg L^{-1} was associated with better plant height, improved photosynthetic performance, and reduced mortality, indicating its suitability for optimal plant health. Overall, the combination of high N (300 mg L^{-1}) and low S (100 mg L^{-1}) emerged as the most effective treatment, balancing productivity with plant vitality in wasabi cultivation.

Keywords: Wasabi production, Nutrient solution, Glucosinolates, Nitrogen, Sulfur

References:

Plants 10 (2021) 1-16.
Eurasian Journal of Soil Science 14 (2025) 58-66.

Funding Source(s): Fundamental Fund (FY2567), "Wasabi Production in a Plant Factory"



Optimizing Rice Varieties and Management to Advance Medicinal and Pharmaceutical Applications

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Ornanong Kittipongpatana[4], Nisit Kittipongpatana[4], Sonthaya Umsumarng[5], Chanakan Prom-u-thai[1,2*]
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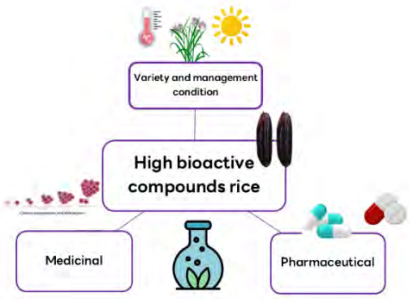
Rice varieties and management methods promote the production of bioactive compounds for use in nutritional, medical, and pharmaceutical applications. This research selected rice variety 'Kum Jao CMU 107' with high bioactive compounds such as anthocyanins, phenolics, and antioxidant capacity and tested its cultivation in different environments across 12 locations in Thailand. The high bioactive compounds rice grains were extracted and examined for their anti-inflammatory properties in lung cells and the wax obtained from rice bran oil extraction was also developed a lubricant for pharmaceutical tablet production. The results showed that cultivation Kum Jao CMU 107 under optimal environmental conditions with suitable light intensity, humidity, and temperature can enhance the production of these bioactive constituents e.g. at Nakhon Sawan province. The rice germ and bran extract exhibited strong antioxidant properties and suppressed nitric oxide production and inflammatory cytokine secretion in LPS-induced macrophage cells. Additionally, rice bran wax, the byproduct from rice bran oil extraction, was developed and tested as a lubricant/anti-adherent a pharmaceutical excipient used in the production of tablets. The results indicate the potential of high bioactive compounds for medicinal and pharmaceutical applications.

Keywords: High quality rice, Functional food, Antioxidant, Anti-inflammation, Medicinal rice

References:

Pharmaceutics 16(3) (2024) 428
European Food Research and Technology 249(2) (2023) 451-464

Funding Source(s): Thailand Science Research and Innovation (FF66) and Fundamental Fund (R65EX00152), Chiang Mai University, Thailand.



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Poster Presentation



Herbs, Cosmetic, Supplements, Drugs, High Valued Food

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Toxicological and Anticarcinogenic Evaluation of Oligofructans in Rats

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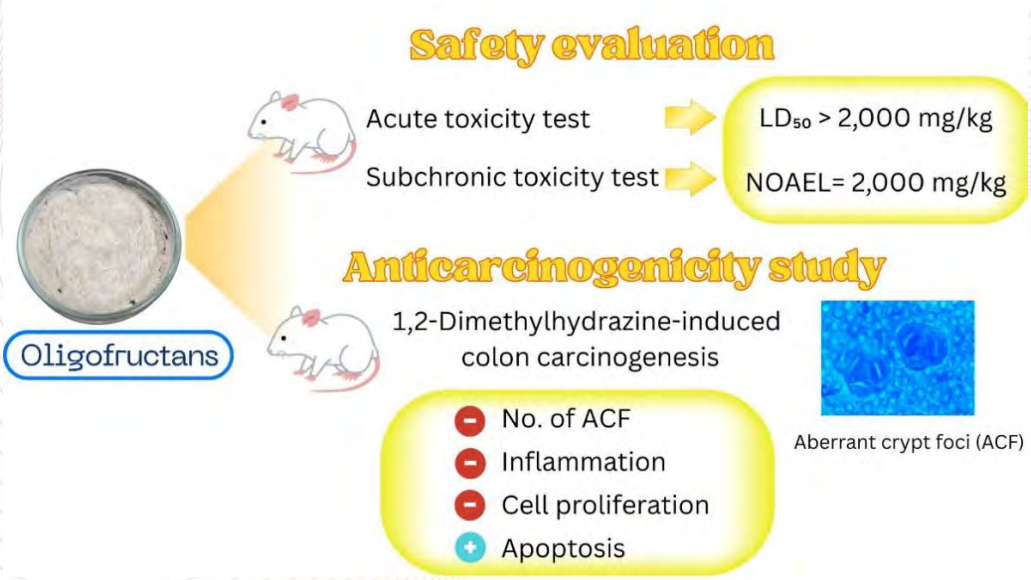
Our previous study produced oligofructans by fermenting sugar with *Bacillus subtilis* TISTR 001. However, safety and efficacy have not been evaluated in *vivo*. This study assessed the toxicity and anticarcinogenic potential of oligofructans in rats. Acute and subchronic toxicity tests showed no adverse effects, with an LD_{50} > 2,000 mg/kg body weight and a no-observed-adverse-effect level (NOAEL) at 2,000 mg/kg body weight. For anticarcinogenicity testing, 1,2-dimethylhydrazine (DMH) was used to induce rat colon carcinogenesis, and aberrant crypt foci (ACF) were used as the end-point marker. Rats were administered oligofructans (100 and 500 mg/kg) for 15 weeks. The results showed that oligofructans significantly reduced the number of ACF in DMH-initiated rats. Inhibitory studies demonstrated that the low dose of oligofructans significantly down-regulated the expression of inflammation- and cell proliferation-related genes. The high dose of oligofructans also down-regulated genes involved in the Wnt signaling pathway and pro-apoptotic markers. These results suggest that oligofructans are non-toxic and inhibit DMH-induced colon carcinogenesis through modulation of inflammatory responses, cell proliferation, and apoptosis.

Keywords: Anticancer, Chemoprevention, Colon cancer, Oligofructans, Toxicity

References:

Biotech 11 (2021) 1-11.
Sugar Tech 25 (2023) 950-958.

Funding Source(s): Fundamental Fund 2024, Chiang Mai University (FF016/2567)



Development of Rice-Waste-Derived Hydrogel Patch Infused with Lanna Herbal Extracts for Anti-Inflammation Activity

Patompong Khaw-on[1,2*]; Suthaphat Kamthai[1,3]; Ratana Banjerdpongchai[4]; Aree Deenu[5]; Kamonwan Tachai[3] ;Sawichaya Orpool[5]

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[2] *Faculty of Nursing, Chiang Mai University, Thailand*
[3] *Division of Packaging Technology, School of Agro-Industry, Faculty of Agro-Industry, Chiang Mai University, Chiang Mai, Thailand*
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**Corresponding author: Patompong.kh@cmu.ac.th*

This study converted cellulose-rich residues from rice milling into a carboxymethyl-cellulose (CMC) hydrogel patch loaded with traditional Lanna herbal extracts for topical anti-inflammatory therapy. Cellulose from rice straw and starch obtained from broken rice were modified to CMC (degree of substitution 0.72) and solution-cast with polyvinyl-pyrrolidone and gellant gum, producing flexible hydrogels that were subsequently infused with water polyherbal extract. The resulting patch exhibited good mechanical strength (firmness 11.49 N, hardness 12.38 N), a 480 % swelling ratio, and released 92 % of total phenolics within two hours under skin-mimetic conditions. Antioxidant assays demonstrated strong radical-scavenging activity (DPPH IC_{50} 11.8 µg mL^{-1}), whereas nitric-oxide production in lipopolysaccharide-stimulated RAW264.7 macrophages decreased by 68 % at 50 µg mL^{-1} ($p < 0.05$). The infused solution was biocompatible with HaCaT keratinocytes, maintaining viability of at least 90% after 24 hours and significantly downregulating pro-inflammatory expression, confirming its epithelial anti-inflammatory efficacy. These findings suggest that rice-processing waste can be transformed into a safe and sustainable hydrogel delivery platform for Lanna herbal bioactives, offering a promising biomaterial for pain-relief applications and supporting traditional medicinal practices.

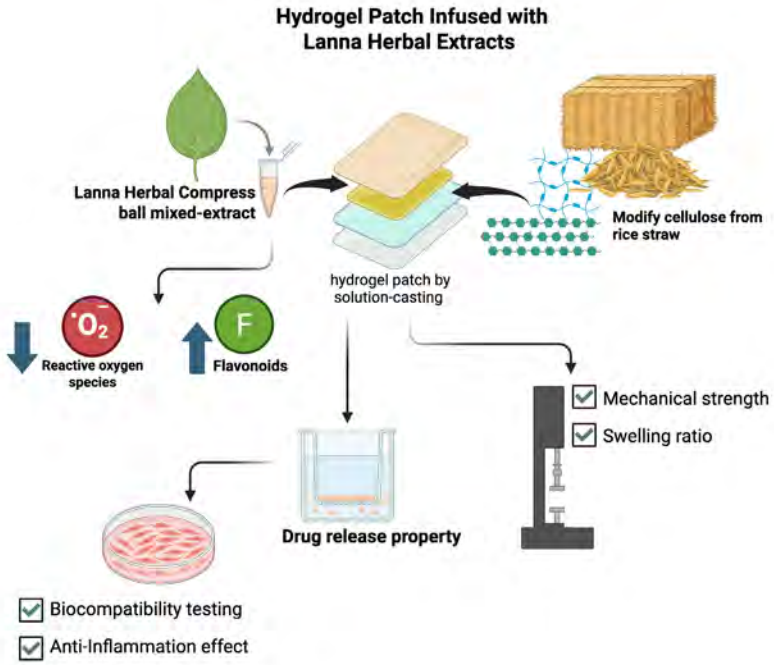
Keywords: Rice-waste cellulose, Carboxymethyl-cellulose, hydrogel, Lanna herbal extracts, Anti-inflammatory patch

References:

International Journal of Biological Macromolecules 2025, 309, 142980

Funding Source(s): Fundamental Fund (FF) 2567 that supports the reported work

Graphical Abstract



Germination Alters the Bioactive Compounds of Pigmented and Non-Pigmented Rice Varieties in Fresh and Year-Old Stored Seeds

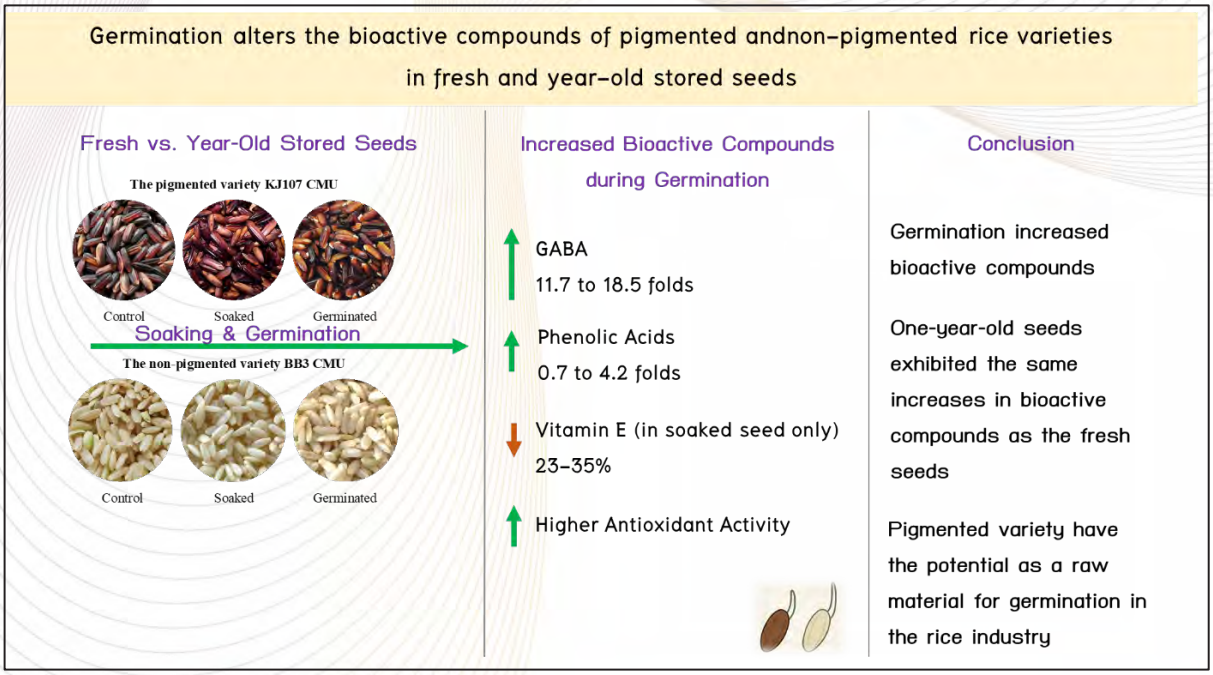
Supapohn Yamuangmorn[1], Chalermpong Saenjum[2], Chanakan Prom-u-thai[1,3]*
[1]*Lanna Rice Research Center, Chiang Mai University, Chiang Mai 50200, Thailand*
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This study assessed the effect of germination on bioactive compounds in fresh and one-year-old seeds of pigmented and non-pigmented rice varieties. Rice varieties had similar changes in bioactive compounds during germination. GABA and several phenolic acids increased 11.7 to 18.5 folds and 0.7 to 4.2 folds, respectively in germinating seeds. The vitamin E compounds, γ-tocotrienol and α-tocopherol increased by 23 to 35 % only in soaked seeds, but declined after seed germination. In the germinating seeds, higher levels of phenolic acids (e.g., protocatechuic acid, 0.5-fold higher) and some compounds of vitamin E (e.g., γ-tocotrienol, 0.4-fold higher) were observed in the pigmented rice compared to the non-pigmented line, in accordance with antioxidant activity. Additionally, one-year-old seeds exhibited the same increases in bioactive compounds as the fresh seeds. We conclude that the seeds of the pigmented variety have the potential as a raw material for germination in the rice industry.

Keywords: Germination, Bioactive compounds, Rice variety, Seed age, Pigmented rice

References:
Food Chemistry 24 (2025) 102005.

Funding Source(s): CMU Junior Research Fellowship Program, Chiang Mai University, Thailand



Effect of Temperature and Time on Physicochemical and Functional Properties of Black Lychee Extract Using Steam Explosion

Supakit Chaipoot[1,2], Pairote Wiriyacharee[2,4], Kuntathee Chaimueng[1], Sirinthip Jaijoi[1], Apinya Khampakool[4], Rewat Phongphisutthinant[1,2], and Kanokwan Kulprachakarn[3,*]

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[4]*Faculty of Agro-Industry, Chiang Mai University, Chiang Mai 50100, Thailand*

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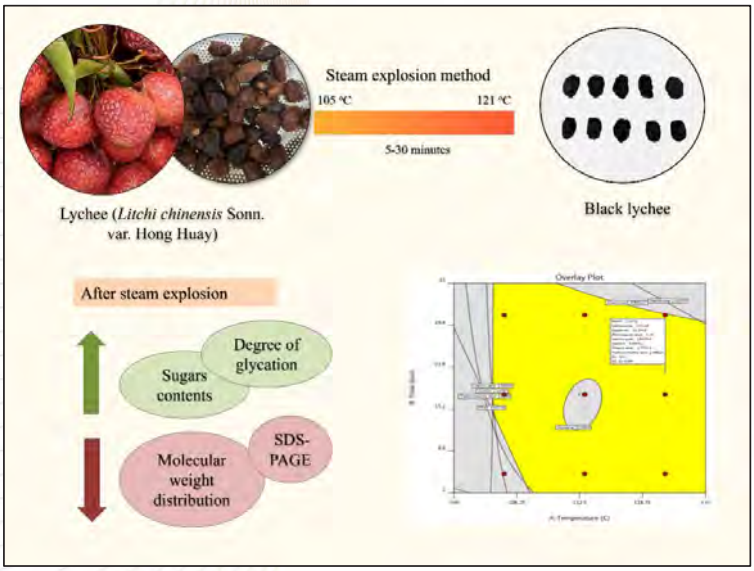
This study investigates the effects of steam explosion on the physicochemical properties and bioactive compounds of black lychee extract. Dried lychee was processed using steam explosion at temperatures ranging from 105–121°C and times between 5–30 minutes. The results revealed that temperature and time significantly influenced color parameters, moisture content, antioxidant activities (DPPH, ABTS, FRAP) and total phenolic and flavonoid contents. Maximum antioxidant activity (FRAP: 20.06 mg $FeSO_4$/g TSS) and phenolic content (10.58 mg GAE/g TSS) were found at 121°C for 30 minutes. Sugar profile showed varying levels of glucose, fructose, allulose and allose with higher temperatures enhancing allulose formation. SDS-PAGE and molecular weight distribution indicated protein degradation into low molecular weight peptides (100–1,000 Da with 71.81–86.68%). The highest of Degree of glycation (DG) was found at 5.25 mg/g TSS. Amino acid contents show leucine being the most abundant (up to 3,131.12 mg/100 g TSS) and Phenolic profile revealed protocatechuic acid (up to 42.82 µg/g TSS), epicatechin, and vanillic acid as dominant compounds. Optimal processing conditions were identified as 121°C for 21 minutes. These results suggest that steam explosion can enhance the functional and nutritional quality of black lychee extracts, providing a promising method for fruit processing.

Keywords: Steam explosion, Black lychee, Antioxidant activity

References:

Foods 12:17 (2023) 3307.
Food Chemistry 406 (2023) 135025.

Funding Source(s): Fundamental Fund 2024, Chiang Mai University (FF020/2567), and by Thailand Science Research and Innovation (TSRI) (FRB670083/0162).



Plant Protein and Fiber Powder from Mustard and Guava Processing By-Products

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[1] *Faculty of Agro-Industry, Chiang Mai University, Chiang Mai, Thailand*
[2] *Research Institute for Health Sciences, Chiang Mai University, Chiang Mai, Thailand*
[3] *Cluster of High Value Products from Thai Rice and Plants for Health, Chiang Mai University, Chiang Mai, Thailand*
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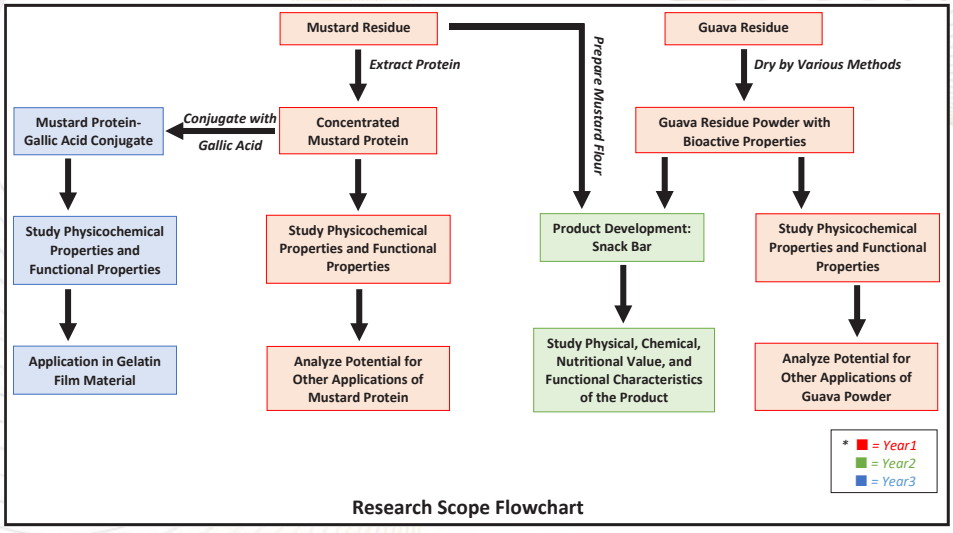
This research aimed to develop value-added products from agro-industrial waste which were 1) protein extract from mustard residue (from essential oil production) and 2) dried fiber powder from white and pink-fleshed guava residue (from juice extraction). Alkaline extraction of mustard protein showed increased yields with higher solvent ratios (1:5 to 1:30). The protein extract contained 61.36 % protein, significant essential amino acids (such as histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, and valine), and demonstrated excellent functional properties, including water-holding, oil absorption, emulsifying, foaming capacities, and strong antioxidant activities (DPPH scavenging, ABTS scavenging, ferric reducing antioxidant power (FRAP), and metal-chelating). For the production of fiber powder, various drying methods were evaluated, including hot-air, vacuum, and freeze-drying. Freeze-drying proved to be the most effective, as it best preserved the powder's color, nutrients, and bioactive compounds (such as dietary fibers, lycopene, and total phenolics). This method also significantly enhanced the powder's water absorption, antioxidant, and anti-diabetic properties. These findings advocate a "zero-waste" strategy, positioning mustard and guava residues as valuable sources of functional ingredients for food and healthcare applications.

Keywords: Solid waste, Guava pomace, Mustard residue, Plant protein, By-product valorization

References:

Applied Food Research 5 (2025) 100696.

Funding Source(s): Cluster of High Value Products from Thai Rice and Plants for Health, Chiang Mai University, Chiang Mai, Thailand, and New Growth Engine Project under the Ministry of Higher Education, Science, Research and Innovation, Thailand.



Research Scope Flowchart

Development of *Euglena* for Functional Food with Immunomodulatory, Antidiabetic and Antihypertensive Activities

Jeeraporn Pekkoh[1,2*], Sahutchai Inwongwan[1,2], Chayakorn Pumas[1,2], Kritsana Duangjan[2,3], Khomsan Ruangrit[4], Phinyarat Sensupa[2], Kittiya Phinyo[2,3], Yingmanee Tragoolpua[1], Thida Kaewkod[1], Pachara Sattayawat[1,2]

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[4] *Multidisciplinary Research Institute, Chiang Mai University, Chiang Mai 50200, Thailand*
[*] *E-mail: jeeraporn.p@cmu.ac.th*

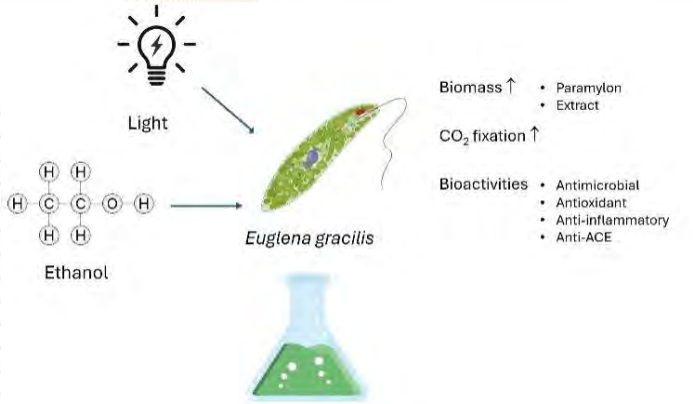
This research aims to develop an integrated, ethanol-based mixotrophic cultivation strategy to enhance biomass and paramylon production in *Euglena gracilis* under non-axenic conditions, while exploring its potential health applications. The research addresses the dual challenge of low biomass yield and microbial contamination. Three cultivation modes—photoautotrophic, heterotrophic, and mixotrophic—were compared, with mixotrophy yielding the highest biomass (1.79–2.48 g/L) and CO_2 capture (0.07 g CO_2 L^{-1} day^{-1}). Ethanol served as both a metabolic substrate and an antimicrobial agent, with optimization by Response Surface Methodology identifying 0.58% (v/v) ethanol and pH 4.46 as optimal. Paramylon content reached 84%, and yields increased up to 33-fold compared to controls. Additionally, bioactive compounds from ethanol extract and paramylon exhibited strong antioxidant, anti-inflammatory, anti-α-glucosidase, and angiotensin-I-converting enzyme inhibitory activities, highlighting their value for functional food and pharmaceutical use. These findings demonstrate a scalable, sustainable approach for producing high-value biomass and bioactive compounds from *E. gracilis*, aligning with circular bioeconomy and health innovation goals.

Keywords: paramylon, euglenoid, supplement food

References:

Algal Research 90 (2025) 1041481.
Future Foods 11 (2025) 100548.

Funding Source(s): Fundamental Fund 2024, Chiang Mai University



Effect of Conventional Humid-Dry Heating Time on Chemical Properties and Antioxidant Activity of Soy Protein Hydrolysate-Mannose Conjugates

Thanyaporn Siriwoharn[1], Pairote Wiriyacharee[1,2], Supakit Chaipoot[2,3], Pattavara Pathomrungsiyounggul[1], Patamaphorn Utarat[1], Rewat Phongphisutthinant[2,3*]

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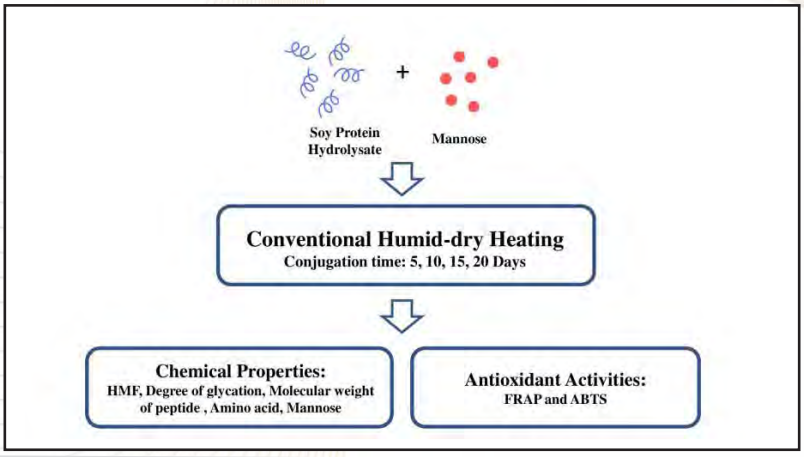
This research aimed to investigate the changes in chemical compounds and bioactivity of Soy Protein Hydrolysate–Mannose (SPH-M) conjugates during the conventional humid-dry heating process. Soy protein hydrolysate (SPH), derived from enzymatic hydrolysis of soy protein isolate using Alcalase, and mannose (M), extracted from yeast cells, were combined to produce SPH-M conjugates via conventional humid-dry heating. The conjugates were incubated at 75% relative humidity and 60 °C for 0, 5, 10, 15, and 20 days. Results showed significant decreases in amino acid content, from 261.84 to 13.20 mg/100 g db by day 20, and a rapid decline in mannose content from 4.46 to 0.06 g/100 g db, with an 88% reduction observed by day 5 ($p < 0.05$). Simultaneously, the proportion of peptides with molecular weights above 10 kDa increased from 2.32% to 10.70%, indicating successful covalent binding between SPH and mannose. In terms of bioactivity, the highest FRAP and ABTS values were observed at 10 days of incubation, reaching 5.27 mg Ferrous/100 g db and 7.74 mg TE/100 g db, respectively. These findings suggest that a 10-day conventional humid-dry heating process is optimal for producing SPH-M conjugates for further research.

Keywords: Humid-dry Heating, Soy, Mannose, Conjugate, Antioxidant

References:

Heliyon 7(5) (2021) e07094.
Foods 12 (2023) 2714.

Funding Source(s): This research project was supported by Fundamental Fund 2022-2024, Chiang Mai University.



Dual Production of High-Value Canthaxanthin and Echinenone by Hot-Spring Bacterium *Paracoccus* sp. PH1

Anuttree Inyoo[1], Jeeraporn Pekkoh[1], Chayakorn Pumas[1], Thidarat Nimchua[2], Pachara Sattayawat[1], Sakunnee bovonsombut[1], Amonrat Kanokrung[3], Rawiwan Watanadilok[3], Rapeepun Mahawan[1], Kreuawan Thonglem[1], Thararat Chitov[1,*], Wasu Pathom-aree[1,*]

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[*]*E-mail: thararat.chitov@cmu.ac.th, wasu.p@cmu.ac.th*

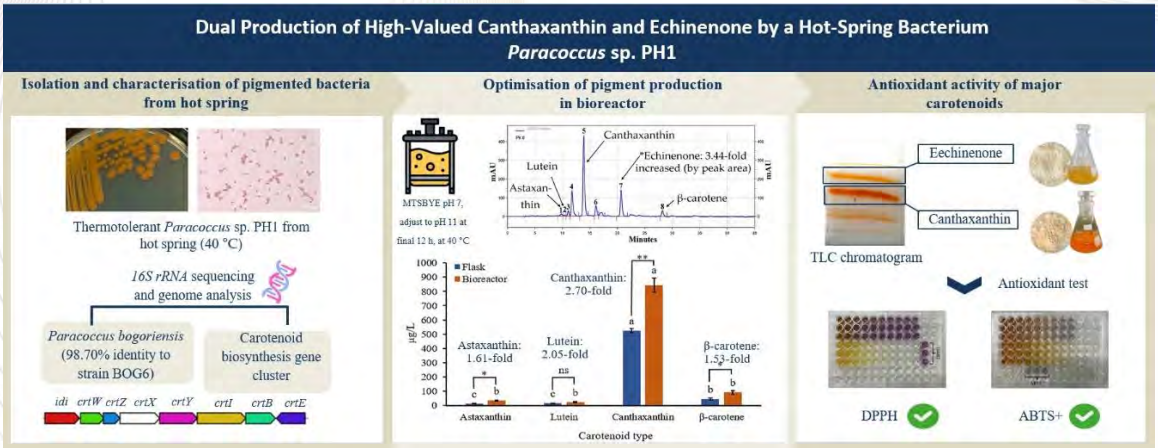
Bacteria from extreme environments are potential sources of carotenoids owing to the improved controllability of culturing conditions and reduced risk of contamination. In this study, we isolated and characterised a carotenoid-producing bacterium from a hot spring, optimised its carotenoid synthesis, and assessed the antioxidant properties of the predominant carotenoids produced. A thermotolerant strain, *Paracoccus* sp. PH1 was isolated and identified as *Paracoccus bogoriensis* using 16S Rrna sequencing. Genome analysis identified a carotenoid biosynthetic gene cluster comprising *idi*, *crtE*, *crtB*, *crtI*, *crtY*, *crtW*, and *crtX* genes. Culturing the isolate in a 2 L bioreactor in a modified trypticase soy broth supplemented with yeast extract at 40°C, with 250 rpm agitation, 2 vvm aeration, and a Ph elevation prior to harvesting, significantly increased carotenoid yield. High-performance liquid chromatography indicated that canthaxanthin was the predominant carotenoid synthesised by *Paracoccus* PH1. The optimised condition resulted in a 2.70-fold increase in canthaxanthin production, yielding 843.80 ± 49.11 µg/L, and a 3.44-fold increase of echinenone. The purified pigments exhibited antioxidant activity, as determined by DPPH and ABTS assays.

Keywords: Pigmented bacteria, Thermotolerant bacterium, Carotenoids, functional substance.

References:

Applied Biochemistry and Biotechnology 194 (2022) 4655–4672.
Heliyon 6 (2020) e04654.

Funding Source(s): The Fundamental Fund for Fiscal Year 2024 (FF67) under the Thailand Science, Research and Innovation (TSRI) (Grant No. 4710183)



Enhancing the Functional Potential of *Wolffia globosa* via Controlled Drying Techniques

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Wolffia spp. has emerged as a nutrient-dense plant and a promising alternative source of plant-based protein, offering significant potential in addressing global nutritional challenges. However, its high postharvest moisture content (approximately 95%) necessitates efficient drying to prevent microbial growth and to improve shelf life, handling, storage, and transportation. This study evaluated the effects of hot-air and vacuum drying at 60°C and 70°C on the physicochemical properties of *Wolffia globosa*. Dried samples were ground into powder and analyzed for moisture content, water activity, color, pH, fat, protein, crude fiber, ash, and carbohydrate levels. Vacuum drying at 70°C yielded the lowest moisture content (5.39% ± 0.176) and water activity (0.408 ± 0.030), along with the highest fat (3.58% ± 0.195), protein (26.44% ± 0.045), and ash (17.87% ± 0.106) contents, and the lowest carbohydrate content (39.11% ± 0.209). The brightest color was observed in hot-air drying at 60°C, while the highest crude fiber content (13.68% ± 0.404) was recorded in vacuum drying at 60°C. Overall, vacuum drying at 70°C appears to be the most effective method for preserving the nutritional and functional properties of *Wolffia globosa*, supporting its application as a high-protein ingredient in plant-based food formulations.

Keywords: Watermeal, Plant-based protein, Good Health and Well-being

References: None

Funding Source(s): None

Enhanced Stability and Anesthetic Performance of Holy Basil Essential Oil via SNEDDS and Microemulsion Systems in *Cyprinus carpio* var. koi

Kantaporn Kheawfu[1], Chuda Chittasupho[1], Taepin Junmahasathien[1], Wasana Chaisri[2], Surachai Pikulkaew[2,*]
[1]*Faculty of Pharmacy, Chiang Mai University, Chiang Mai 50200, Thailand*
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[*]*E-mail: surachai.pikul@cmu.ac.th*

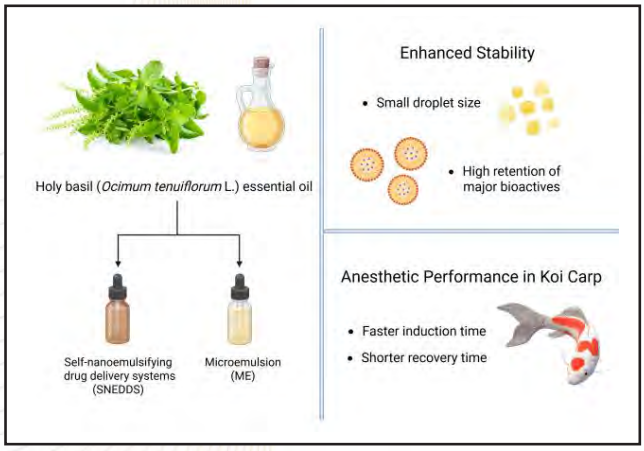
Holy basil (*Ocimum tenuiflorum* L.) essential oil possesses notable antioxidants, antimicrobial, and anesthetic properties, primarily attributed to eugenol, methyl eugenol, and β-caryophyllene. However, its clinical and veterinary use is limited by poor water solubility and chemical instability. This study formulated and compared self-nanoemulsifying drug delivery systems (SNEDDS) and microemulsions (ME) to enhance the stability of holy basil essential oil and anesthetic efficacy in *Cyprinus carpio* var. koi. The optimized SNEDDS (25% basil oil, 8.33% coconut oil, 54.76% Tween 80, 11.91% PEG 400) and ME (12% basil oil, 32% Tween 80, 4% sorbitol, 12% ethanol, 40% water) were evaluated for physicochemical properties and storage stability. SNEDDS maintained a small droplet size (~22.78 nm) and low PDI over 60 days, while ME showed significant droplet growth and instability. After 90 days at 45 °C, both systems retained major bioactive compounds, while SNEDDS showed slightly lower degradation. *In vivo* studies demonstrated that SNEDDS induced anesthesia more rapidly (114.70 ± 24.80 s at 120 ppm) and allowed faster recovery (379.60 ± 15.61 s) in koi carp than ME or ethanol. These findings highlight SNEDDS as a promising platform for delivering holy basil essential oil in aquatic anesthesia and other biomedical applications.

Keywords: holy basil essential oil, self-nanoemulsifying drug delivery system (SNEDDS), microemulsion (ME), anesthetic activity, aquaculture

References:

Aquaculture 233 (2004) 129-147.
Journal of Essential Oil Research 32 (2020) 1-12.

Funding Source(s): Fundamental Fund 2024, Chiang Mai University.



Optimized SNEDDS Formulation for Enhancing the Solubility of Ginger Extract

Kantaporn Kheawfu[1,*], Maung Maung Than[1], Chuda Chittasupho[1], Songwut Yotsawimonwat[1]
[1]*Faculty of Pharmacy, Chiang Mai University, 50200, Chiang Mai, Thailand*
**Email: kantaporn.kheawfu@cmu.ac.th*

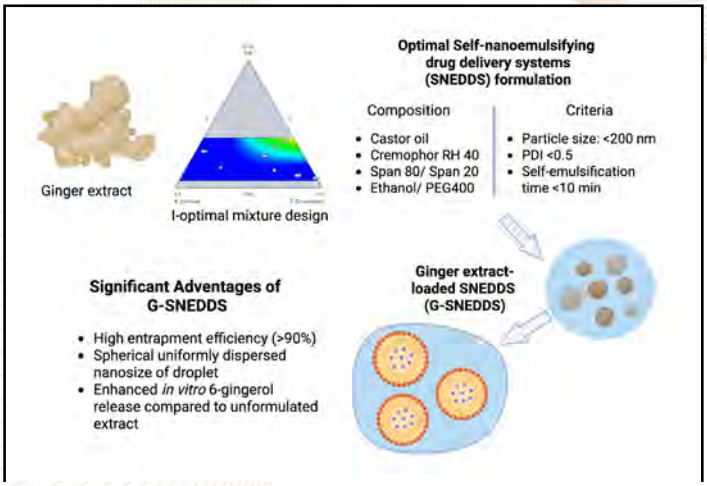
This study focused on the development and optimization of a self-nanoemulsifying drug delivery system (SNEDDS) to enhance the solubility, stability, and oral bioavailability of ginger extract. An I-optimal mixture design was employed to evaluate formulations comprising castor oil, Cremophor RH40, co-surfactants (Span 20 or Span 80), and co-solvents (PEG 400 or ethanol). The optimal formulation containing Span 80 and ethanol produced nanoemulsions with droplet sizes below 200 nm, a polydispersity index (PDI) below 0.5, and self-emulsification times under 10 minutes. Selected SNEDDS formulations were further loaded with ginger extract (G-SNEDDS) and characterized for entrapment efficiency, morphology, and in vitro release. Both 6-gingerol and 6-shogaol exhibited high entrapment efficiencies (>90%). Transmission electron microscopy confirmed the formation of spherical, uniformly dispersed nanodroplets. In vitro studies demonstrated a significant enhancement in 6-gingerol release from G-SNEDDS compared to unformulated extract. Among the tested formulations, G-F1 showed the greatest stability, maintaining consistent particle size and active compound content under thermal and storage conditions. These findings support the potential of SNEDDS as a promising delivery system for improving the oral efficacy of poorly soluble phytoconstituents such as ginger extract.

Keywords: ginger extract, self-nanoemulsifying drug delivery system (SNEDDS), 6-gingerol, nanoemulsion

References:

International Journal of Medical Science and *Innovative Research* 9 (2015) 813-817.
AAPS Pharm Sci Tech 19 (2018) 3661-3669.

Funding Source(s): CMU Junior Research Fellowship program 2023



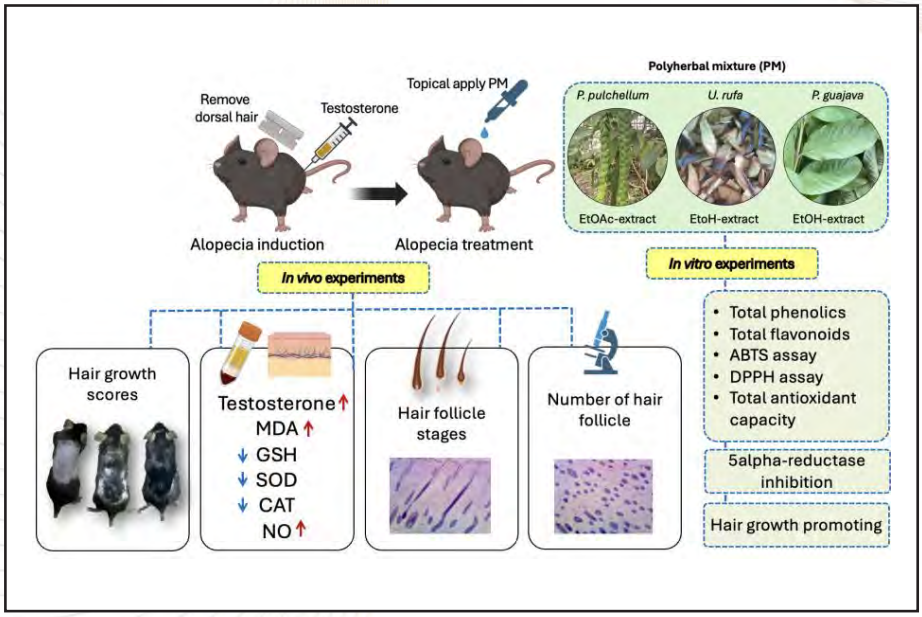
Hair Growth-Promoting Effect of Herbal Formula Containing Extracts of *Phyllodium pulchellum*, *Uvaria rufa* Blume and *Psidium guajava* L.

Kanokporn Saenphet, Krit Chumsak, Phongsadathon Aonmanee, Supap Saenphet, Wararut Buncharoen*
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Phyllodium pulchellum, *Uvaria rufa* Blume and *Psidium guajava* L. are traditional medicinal plants used as components of complex herbal prescriptions for alopecia treatment. However, the efficacy of a herbal formula (HF) developed from these three plants has not been clearly demonstrated. Therefore, this study aimed to evaluate the hair growth-promoting effects of HF prepared from *P. pulchellum* (PP), *U. rufa* (UR) and *P. guajava* (PG) using both *in vitro* and *in vivo* models. Ethanolic extracts from the arial parts of PP and leaves of PG, and ethyl acetate extract from the stems of UR were combined and assessed for their anti-hair loss properties through three *in vitro* assays: antioxidant activity, hair follicle elongation assay, and 5α-reductase inhibitory activity. For the *in vivo* experiment, six-week-old male C57BL/6NJcl mice were randomly assigned to six groups (normal control, alopecia model, HF, finasteride, and minoxidil). The test substances were topically applied to the depilated dorsal skin once daily for 28 consecutive days. Hair growth was evaluated visually, microscopically and biochemically. HF demonstrated anti-hair loss efficacy by exhibiting antioxidant activity, inhibiting α-reductase, and promoting hair follicle elongation *in vitro*. *In vivo*, HF-treated mice showed faster hair regrowth than the alopecia model and had the highest hair density, with all follicles in the anagen phase. Moreover, HF significantly reduced skin testosterone levels, comparable to the finasteride-treated group. Additionally, HF attenuated oxidative stress in the skin, as indicated by increased antioxidant markers and decreased levels of malondialdehyde and nitric oxide.

Keywords: hair growth, hair loss, *Phyllodium pulchellum*, *Psidium guajava* L., *Uvaria rufa* Blume

Funding Source(s): Targeted Research 2023, Chiang Mai University



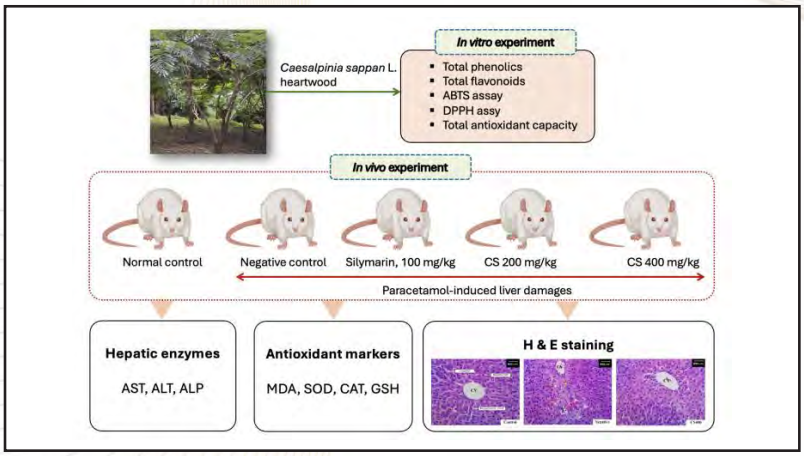
Hepatoprotective Effect of *Caesalpinia sappan* L. Extract in Paracetamol-Induced Hepatotoxicity in Male Rats

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Caesalpinia sappan L. is a traditional medicinal plant widely used to treat various ailments, including wounds, ulcers, skin diseases, diarrhea, diabetes, and liver diseases. However, there is limited scientific evidence supporting its traditional use, particularly as a hepatoprotective agent. Therefore, this study aimed to evaluate the hepatoprotective activity of an ethanolic heartwood extract of *C. sappan* (CS) against paracetamol-induced liver damage in rats. The hepatoprotective activity of the CS extract was assessed through both *in vitro* and *in vivo* experiments. Total phenolic and total flavonoid contents, ABTS and DPPH scavenging activities, and total antioxidant capacity were determined. For the *in vivo* study, male albino rats were divided into five groups (n=6 per group). Group 1 served as the normal control and received distilled water orally. Groups 2 and 3 were the negative and positive control groups, respectively, receiving distilled water and silymarin (100 mg/kg). Groups 4 and 5 received CS extract at doses of 200 and 400 mg/kg, respectively. All treatments were administered orally once daily for seven consecutive days. On day 7, hepatotoxicity was induced in groups 2-5 by oral administration of paracetamol (2 g/kg). Liver function markers-aspartate aminotransferase, alanine aminotransferase, and alkaline phosphatase-as well as hepatic antioxidants (superoxide dismutase, catalase, and reduced glutathione) and malondialdehyde levels were measured. The CS extract significantly restored liver function markers and antioxidant levels toward normal values, compared to the elevated levels observed in the negative control group. Histopathological examination also revealed improvements in liver architectures in CS-treated groups. This study demonstrates that the ethanolic extract from the heartwood of *C. sappan* possesses hepatoprotective activity against paracetamol-induced liver toxicity.

Keywords: *Caesalpinia sappan* L., hepatoprotective, liver, paracetamol, rats

Funding Source(s): Junior Research 2023, Chiang Mai University



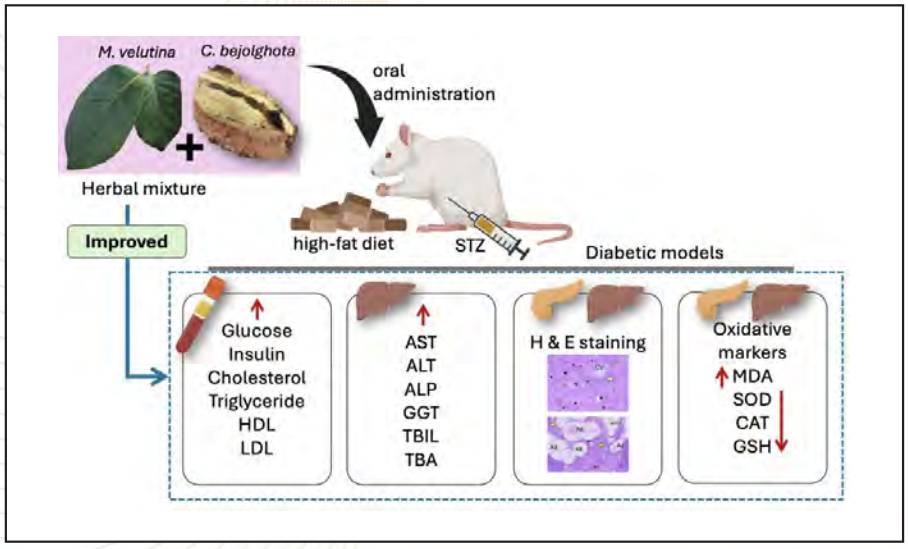
Herbal Mixture of *Miliusa velutina* (A.DC.) Hook.f. & Thomson and *Cinnamomum bejolghota* (Buch.-Ham.) Attenuates Hyperglycemia and Hyperlipidemia in High-Fat Diet/Streptozotocin-Induced Diabetic Rats

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Miliusa velutina (A.DC.) Hook.f. & Thomson (MIV) and *Cinnamomum bejolghota* (Buch.-Ham.) (CIN) have traditionally been used as antidiabetic agents. However, there is a lack of scientific evidence supporting their pharmacological properties, particularly in combination as an herbal mixture (HM). Therefore, this study aimed to investigate the antihyperglycemic and antihyperlipidemic efficacies of an herbal mixture prepared from hydroalcoholic extracts of MIV leaves and CIN bark. The HM was formulated by mixing equal amounts of ethanolic extracts from MIV and CIN, administered orally at a dose of 200 mg/kg to high-fat diet/ streptozotocin-induced diabetes male albino rats. The effect of HM was compared to standard drugs including metformin, orlistat, and atorvastatin. Moreover, the potential adverse effects of HM were evaluated in normal rats. HM demonstrated significant antihyperglycemic and antihyperlipidemic effects by reducing the blood glucose and insulin levels in HM-treated rats compared to diabetic controls. It also significantly (P<0.001) lowered cholesterol, triglyceride, and low-density lipoprotein (LDL) levels, while markedly (P<0.001) increasing high-density lipoprotein (HDL) levels. In addition, HM reduced hepatic enzyme markers such as aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP), gamma glutamyl transferase (GGT), total bilirubin (TBIL), and total bile acid (TBA). Oxidative stress was also alleviated, as evidenced by decreased malondialdehyde levels and increased activities of superoxide dismutase (SOD), catalase (CAT), and glutathione (GSH) in hepatic and pancreatic tissues. Histological observations in liver and pancreatic tissues further supported the biochemical findings. Moreover, HM did not produce any adverse biochemical and histological effects in normal rats. Based on these results, the HM have potential as a herbal remedy for alleviating the severity of diabetes.

Keywords: *Cinnamomum bejolghota* (Buch.-Ham.), diabetes, hypoglycemia, hypolipidemia, *Miliusa velutina* (A.DC.) Hook.f. & Thomson,

Funding Source(s): Targeted Research 2023, Chiang Mai University



Sustainable Utilization of Jasmine Rice Bran through Optimized Enzymatic Hydrolysis with Alcalase and Flavourzyme to Enhance Antioxidant Properties of Protein Hydrolysate

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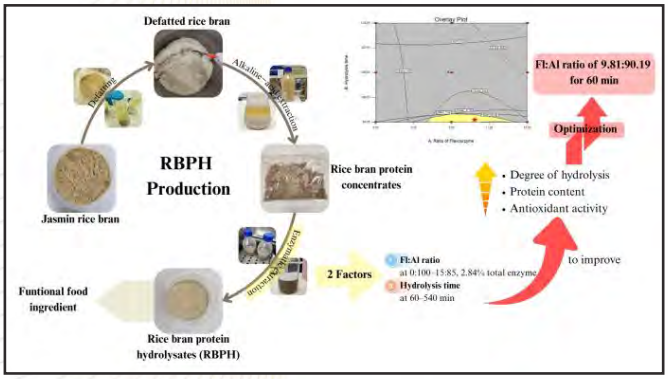
Jasmine rice bran is a by-product of rice milling that is often discarded or underused, despite its potential as a valuable source of protein and bioactive compounds. This study aimed to promote the sustainable utilization of jasmine rice bran by optimizing enzymatic hydrolysis conditions to produce protein hydrolysate with enhanced antioxidant properties. Response surface methodology was employed to investigate the effects of the flavourzyme (Fl) to alcalase (Al) ratio (0:100 to 15:85, at a fixed enzyme concentration of 2.84%) and hydrolysis time (60–540 min). The optimum condition was found at an Fl:Al ratio of 9.81:90.19 for 60 min. This condition produced a protein hydrolysate with a 7.18% degree of hydrolysis, 41.73% protein content, DPPH IC50 of 6.59 mg/mL, ABTS IC50 of 0.99 mg/mL, and FRAP value of 724.81 mmol $FeSO_4$/100 g. Peptides with molecular weights below 3 kDa and between 3–5 kDa were found at 322.35 and 479.05 mAU·s, respectively. The results highlight the potential of a mixed enzyme system to generate antioxidant-rich protein hydrolysate from jasmine rice bran, supporting its value-added application in functional foods and contributing to sustainable resource management and circular bioeconomy development.

Keywords: Jasmine rice bran, Enzymatic hydrolysis, Protein hydrolysate, Antioxidant activity, Sustainable utilization

References:

Scientific Reports 12 (2022) 12582.
International Journal of Food Science 56 (2021) 3289–3298.

Funding Source(s): Fundamental Fund 2024 of Chiang Mai University (FF012/2567)



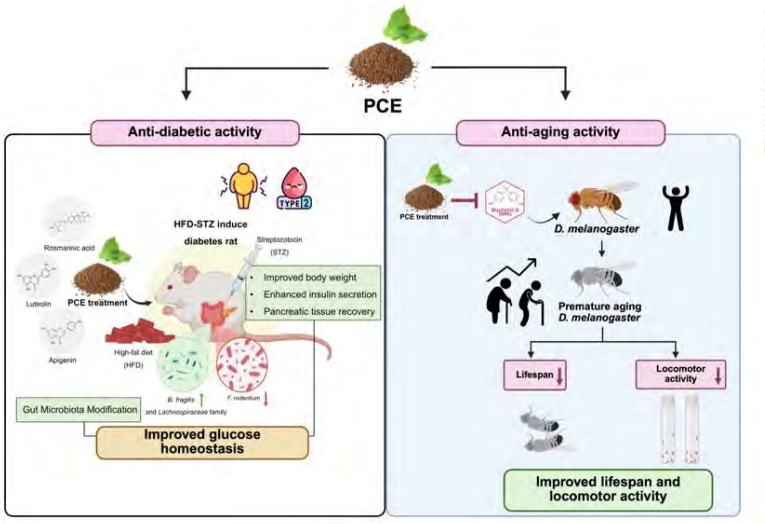
Bioactive Potential of Perilla Seed Cake Extract in Ameliorating Insulin Resistance, Diabetes, and Promoting Longevity in *In Vivo* Models

Pornsiri Pitchakarn[1], Pattharaphong Deethai [1], Pensiri Buacheen[1], Ariyaphong Wongnoppavich[1], Arisa Imsumran, Teera Cheewonarin[1,*]
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Perilla (*Perilla frutescens*) seed cake, a byproduct of oil extraction, is an underutilized source of bioactive phytochemicals. In this study, ethanol (80%) extracts of perilla seed cake (PCE) demonstrated high levels of phenolic acids (78.02 mg GAE/g) and flavonoids (67.63 mg CE/g), alongside potent antioxidant activities. Administration of PCE (100 or 1,000 mg/kg) to high-fat diet-induced insulin-resistant rats significantly attenuated weight gain, reduced adipose fat accumulation, and lowered blood glucose, while restoring insulin homeostasis and reducing HOMA-IR. These benefits were attributed to suppression of adipose inflammation and oxidative stress. In diabetic rats induced by high-fat diet and streptozotocin, PCE treatment mitigated hyperglycemia (up to 43% reduction), enhanced pancreatic β-cell regeneration, and decreased inflammatory mediators. Importantly, PCE also exhibited anti-aging effects in bisphenol A-treated Drosophila (model of accelerated aging), extending lifespan (1 mg/mL PCE) by 1.95-fold and improving locomotor activity (4.0 mg/mL PCE) compared to control. Enhanced mobility, measured by climbing assays, reflected preserved neuromuscular function. Collectively, these findings highlight perilla seed cake extract as a promising functional ingredient for ameliorating metabolic dysfunction and age-related neuromuscular decline *in vivo*, supporting its potential in future health product development.

Keywords: Perilla seed cake extract, Glucose homeostasis, *Drosophila melanogaster*, Anti-diabetes, Anti-aging

Funding Source(s): This work was supported by Fundamental Fund (FF67), 2023, Chiang Mai University.



Development of Targeted Inhibitors and Delivery Systems for Lung Cancer Therapeutics: A Synergistic Approach Combining Medicinal Chemistry, Cellular Nanotechnology, Immunochemotherapy and Molecular Dynamics Simulation

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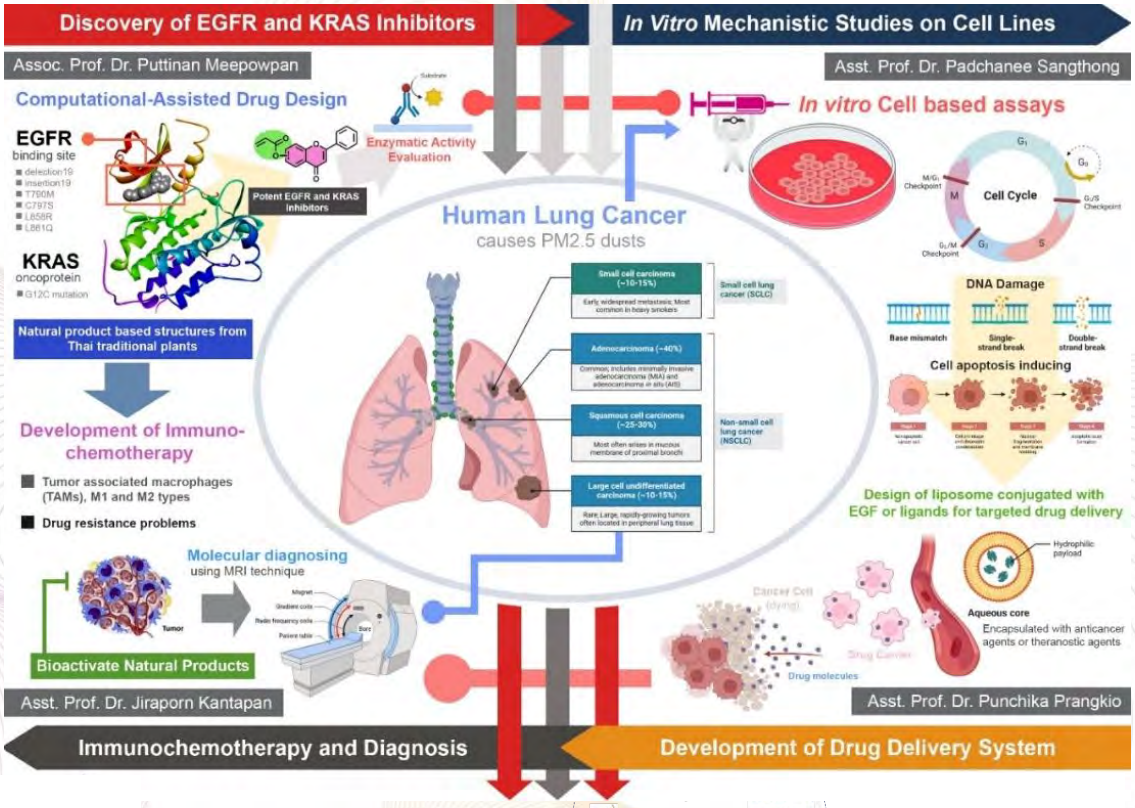
Lung cancer, particularly non-small cell lung cancer (NSCLC), remains a leading cause of cancer-related mortality worldwide. In Northern Thailand, the high incidence of NSCLC is strongly associated with chronic exposure to fine particulate matter (PM2.5). This multidisciplinary research program addresses the prevention, diagnosis, and treatment of NSCLC linked to air pollution through four interrelated sub-projects. Sub-project 1 focuses on the discovery of natural product-based inhibitors targeting common driver mutations, specifically EGFR and KRAS, utilizing synthetic organic chemistry and molecular modeling. Sub-project 2 investigates the molecular mechanisms of selected lead compounds in lung cancer cell lines and 3D cultures, employing assays for apoptosis, DNA damage, and comprehensive omics analyses. Sub-project 3 aims to enhance therapeutic efficacy and reduce systemic toxicity by developing targeted drug delivery systems, including EGFR-specific liposomes and nanoparticles, guided by computational simulations. Sub-project 4 explores PM2.5-induced carcinogenesis, with particular attention to tumor-associated macrophages (TAMs) as both therapeutic targets and diagnostic biomarkers using magnetic resonance imaging (MRI). Collectively, the program integrates expertise in chemistry, cell biology, nanotechnology, and biomedical imaging to develop innovative and accessible therapeutics tailored to the Thai population. It also fosters the sustainable use of indigenous medicinal plants and strengthens national capacity in drug discovery and precision medicine.

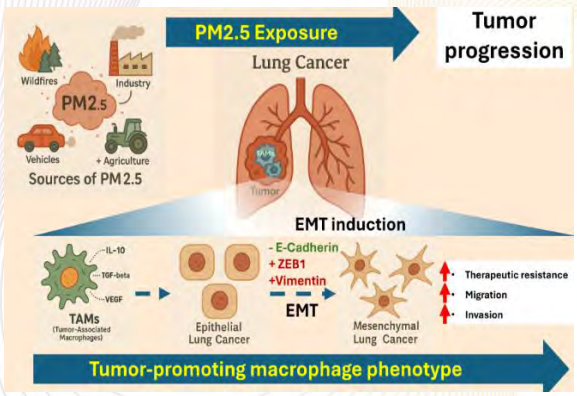
Keywords: anticancer, drug discovery, drug delivery, immunochemotherapy, cellular nanotechnology, molecular dynamics simulation

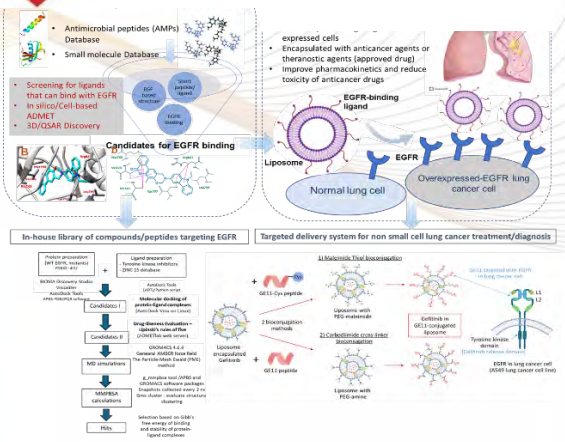
References:

European Journal of Pharmacology 998 (2025) 177636.
Toxicology and Applied Pharmacology 284 (2024) 116955.

Funding Source(s): Targeted Research on PM2.5 and Other Pollutants Associated with Non-Communicable Diseases: From Field to Laboratory to Clinical Applications, Chiang Mai University, 2023







Antibacterial Activities of Phenolic Compounds in *Miang* Extract: Growth Inhibition and Change in Protein Expression of Extensively Drug-Resistant *Klebsiella pneumoniae*

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The antibacterial activity of Miang against XDR bacteria especially colistin-resistant strains had not been investigated. In this study, the compositions of phenolic and flavonoid compounds in fresh, steamed, and fermented Assam tea leaves were examined by HPLC and their antibacterial activities were evaluated by determination of MIC and MBC. Pyrogallol was detected only in the extract from Miang and showed the highest activities with MIC of 0.25 mg/mL and MBC of 0.25 – 0.5 mg/mL against methicillin-susceptible *Staphylococcus aureus*, methicillin-resistant *S. aureus*, *Escherichia coli* ATCC 25922, colistin-resistant *E. coli* and colistin-resistant *K. pneumoniae*. The effect on morphology and proteomic changes of *K. pneumoniae* NH54 treated with Miang extract were characterized by SEM and label-free quantitative shotgun proteomics analysis. The results revealed that Miang extract caused the decrease of bacterial cell wall integrity and cell lysis. The up- and down-regulated expression with approximately 2 to >5-fold change of proteins involved in peptidoglycan synthesis and outer membrane, carbohydrate, and amino acid metabolism were identified. These findings suggested that Miang containing pyrogallol and other secondary metabolites from fermentation has a potential as an alternative candidate with antibacterial agent or natural active pharmaceutical ingredient against XDR bacteria including colistin-resistant bacteria.

Keywords: *Miang* extract, Proteomic analysis, Extensively drug-resistant bacteria, Antibacterial activity, Pyrogallol

References:

Antibiotics 13 (2024) 536.

Funding Source(s): Fundamental Fund (FF082_2567), Chiang Mai University

Antiviral Activity of Sulfated Polysaccharide Extract from *Cladophora* spp. Against Herpes Simplex Virus Types 1 and 2

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Herpes simplex virus (HSV), the causative agent of fever blisters, genital herpes, and neonatal herpes, remains a global health concern due to challenges in long-term therapeutic management. This study aimed to investigate the antiviral activity of sulfated polysaccharide extract from edible algae *Cladophora* spp. against herpes simplex virus type 1 (HSV-1) and type 2 (HSV-2) on Vero cells. The functional groups of extract, including S=O and C–O–S, were identified by Fourier-transform infrared (FT-IR) spectroscopy, confirming the presence of sulfate groups. Cytotoxicity was assessed using the MTT assay, revealing a 50% cytotoxic concentration (CC_{50}) greater than 5000 µg/mL. The 50% effective concentration (EC_{50}) values against HSV-1 when treated by sulfated polysaccharide extract from *Cladophora* spp. before, during, and after viral adsorption without extract removal were 70.31, 15.17, and 9.78 µg/mL, respectively. For HSV-2, the respective EC_{50} values were 5.85, 2.57, and 26.96 µg/mL. The extract also showed direct virucidal effects and inhibition of viral replication. These findings indicate that polysaccharide extract of *Cladophora* spp. exhibits potent anti-HSV activity with low cytotoxicity, suggesting its potential application as a natural antiviral agent against HSV infections.

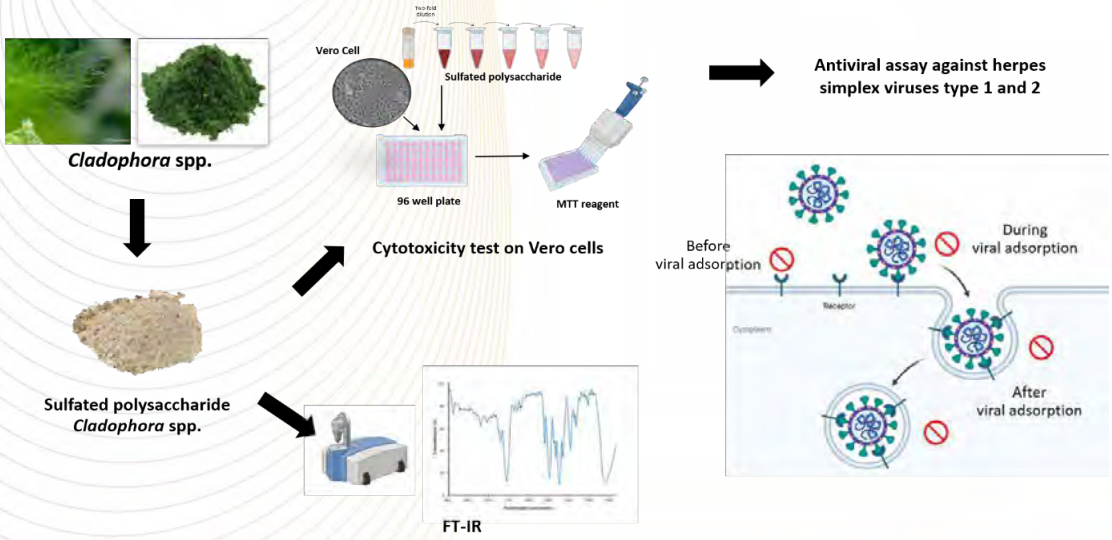
Keywords: algal polysaccharide, *Cladophora* spp., green macroalgae, Herpes simplex virus

References:

Scientific Reports 14:11914 (2024). https://doi: 10.1038/s41598-024-60941-7

Funding Source(s):

Natural Extracts and Innovative Products for Alternative Healthcare Research Group, Chiang Mai University [Grant No. RG 46/2566] and Research and Researcher for Industry from Thailand Science Research and Innovation (MSD61I0107)



Development and Characterization of Bioactive Peptide-Enriched Seasoning Powder from Honeybee Brood

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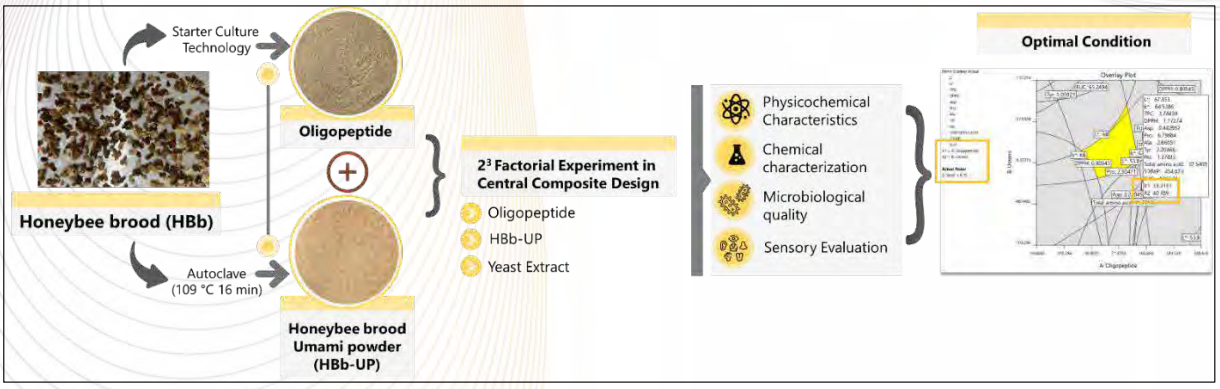
This study explored the formulation of rice seasoning powder derived from honeybee brood, aim to develop a nutrition and natural flavoring agent enriched with bioactive peptides. A factorial experiment using a central composite design was conducted to optimize the formulation of seasoning powder, incorporating varying concentrations of oligopeptide, honeybee brood umami powder (HBb-UP), and yeast extract. Physicochemical properties, chemical characteristics, and microbiological quality were evaluated. Sensory evaluation was also performed to assess overall acceptability. The results revealed that the 3 variables (oligopeptide, HBb-UP, and yeast extract) significantly influenced color parameters, total phenolic content, antioxidant activity measured by the DPPH assay, total amino acid content, including specific amino acids such as aspartic acid, glutamic acid, proline, alanine, tyrosine, and histidine as well as the concentration of 5'-XMP nucleotide and equivalent umami concentration (EUC). The optimal amounts of oligopeptide, HBb-UP, and yeast extract were determined to be 33.32 g, 40.19 g, and 6.72 g, respectively, and the formulation was fully accepted by consumers during sensory evaluation. These findings support the utilization of sustainable insect-based ingredients in the development of functional food products.

Keywords: honeybee brood, oligopeptide, rice seasoning powder, umami powder

References:

Antioxidants 14(3) (2025) 254.

Funding Source(s): Fundamental Fund 2024, Chiang Mai University and also Thailand Science Research and Innovation (TSRI)



Influence of Honey Bee Brood Protein on the Hydrophilic, Mechanical, and Thermal Properties of Polysaccharide Gel Films

Suthaphat Kamthai[1,2 *], Pairote Wiriyacharee[3,4,5], Srisuwan Naruenartwongsakul[6], Patompong Khaw-on[7], Aree Deenu[8], Supakit Chaipoot[4,9], Rewat Phongphisutthinant[4,9], KamonwanTachai[1] and Sawichaya Orpool[8]

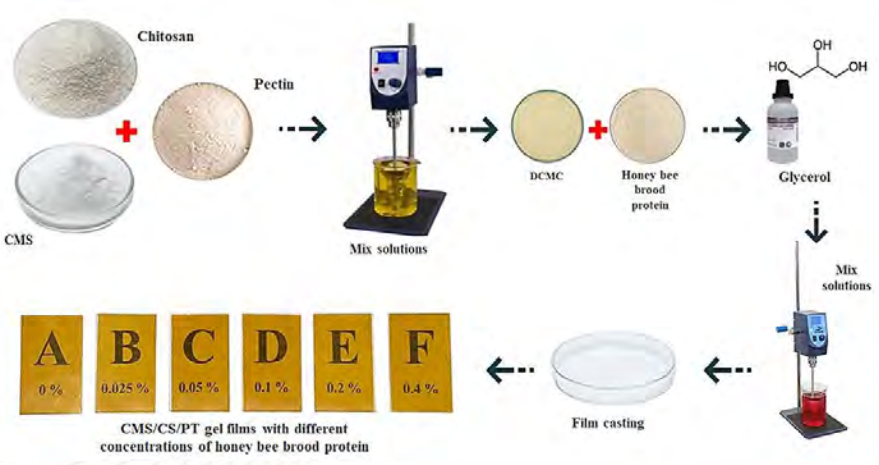
[1]*Division of Packaging Technology, School of Agro-Industry, Faculty of Agro-Industry, Chiang Mai University, Chiang Mai, Thailand*
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Honeybee brood is a source of essential amino acids and non-essential amino acids, which mainly consist of histidine and proline. They were approximately 0.58 and 1.51 mg/g dry basis, respectively. This study focused on how adding protein from honeybee brood affects the properties of gel films made from a mix of carboxymethyl starch (CMS), chitosan, pectin, and honey bee brood protein. The results indicated that the addition of bee larvae protein at 0.1% to 0.2% by weight to the polysaccharide gel film helped improve its thermal and mechanical properties. Additionally, it was also discovered that the gel film had improved swelling and water absorption properties. On the other hand, the protein derived from honeybee brood alters the film's hydrophobic characteristics, which decreases its water solubility. The study's findings suggest that honeybee brood protein can act as a food additive for polysaccharide gel films, making the film suitable for use in food packaging application.

Keywords: honey bee brood, protein, polysaccharide, polysaccharide gel film

References:
Gels 11 (2025) 236.

Funding Source(s): Fundamental Fund 2023, Grant Number FF66/011, Chiang Mai University, Thailand



Interruptins Extracted from *Cyclosorus terminans* Protect Gut Pathologies Induced by High-Fat Diet in Rats

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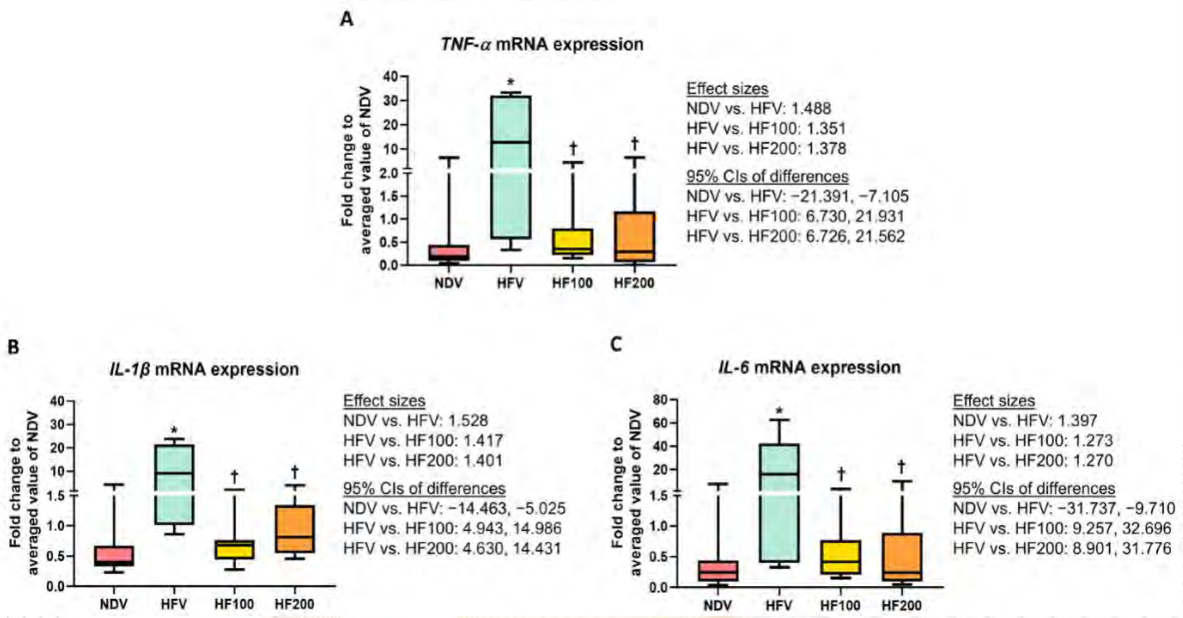
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Background: The fern "*Cyclosorus terminans*" (*C. terminans*) or "*Maiden Fern*" contains interruptin A and interruptin B. This plant could attenuate obesity, insulin resistance, and fatty liver in rats fed a high-fat/calorie diet. However, the benefits of *C. terminans* to the gut remain unknown.
Aim: We investigated the protective effect of *C. terminans* extract against gut dysfunction in rats exposed to a high-fat/calorie diet.
Method: Male Wistar rats were assigned to receive either (1) a normal diet treated with vehicle (NDV), (2) a high-fat/calorie diet treated with vehicle (HFV), (3) a high-fat/calorie diet treated with 100 mg/kg/day (HF100) of *C. terminans* extract, or (4) a high-fat/calorie diet treated with 200 mg/kg/day of *C. terminans* extract (HF200). The rats were euthanized after 12 weeks of treatment to enable feces and colon tissue collection.
Results: Both 100 and 200 mg/kg/day of *C. terminans* extract reduced body weight and ameliorated gut inflammation, gut barrier disruption, changes in short-chain fatty acid levels, and gut dysbiosis caused by high-fat/calorie diet.
Conclusions: *C. terminans* extract attenuated an increase in body weight and exerted prophylactic effects against gut pathologies induced by high-fat/calorie diet.

Keywords: *Cyclosorus terminans*, Gut, Gut microbiota, Interruptin, Obesity

References:
Nutrients 17(8) (2025) 1387.

Funding Source(s): Thailand Science Research and Innovation-Chiang Mai University (Fundamental Fund 2567 to CT, CM and WP), The Mid-Career Research Grant from the National Research Council of Thailand (N42A680478 to CT), the Faculty of Pharmaceutical Sciences, Prince of Songkla University (PSU; PHA6304112S to SK), the Re-search Chair Grant from the National Research Council of Thailand (N42A670594 to NC), a Chiang Mai University Center of Excellence Award (NC), and the Distinguished Research Professor Grant from the National Research Council of Thailand (N42A660301 to SCC).


A
TNF-α mRNA expression
Fold change to averaged value of NDV
NDV
HFV
HF100
HF200
Effect sizes
NDV vs. HFV: 1.488
HFV vs. HF100: 1.351
HFV vs. HF200: 1.378
95% CIs of differences
NDV vs. HFV: −21.391, −7.105
HFV vs. HF100: 6.730, 21.931
HFV vs. HF200: 6.726, 21.562
B
IL-1β mRNA expression
Effect sizes
NDV vs. HFV: 1.528
HFV vs. HF100: 1.417
HFV vs. HF200: 1.401
95% CIs of differences
NDV vs. HFV: −14.463, −5.025
HFV vs. HF100: 4.943, 14.986
HFV vs. HF200: 4.630, 14.431
C
IL-6 mRNA expression
Effect sizes
NDV vs. HFV: 1.397
HFV vs. HF100: 1.273
HFV vs. HF200: 1.270
95% CIs of differences
NDV vs. HFV: −31.737, −9.710
HFV vs. HF100: 9.257, 32.696
HFV vs. HF200: 8.901, 31.776

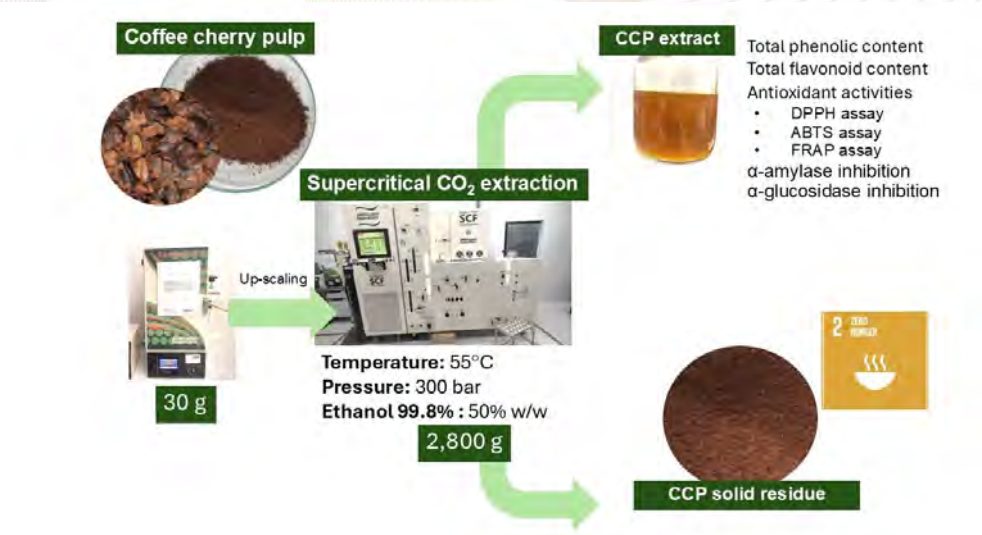
Up-Scale Extraction of Bioactive Compounds from Coffee Cherry Pulp Using SFE-CO_2 and Evaluation of Their Antidiabetic Potential

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Coffee cherry pulp (CCP) is a by-product derived from coffee processing. CCP is rich in bioactive compounds, presenting a promising opportunity for value-added applications. This study evaluated the feasibility of scaling up the extraction of bioactive compounds from CCP using supercritical fluid extraction with carbon dioxide (SFE-CO_2), employing ethanol as a co-solvent. The extraction was conducted at 55°C and 300 bar, yielding an extract with total phenolic content (TPC) of 3.33±0.19 mg GAE/g extract and total flavonoid content (TFC) of 76.45±22.95 µg QE/g extract. The extract displayed remarkable antioxidant activities, including DPPH radical scavenging (7.78±0.12 mmol TE/g extract), ABTS radical scavenging (20.25±1.80 mmol TE/g extract), and ferric reducing antioxidant power (FRAP; 33.83±1.76 mmol TE/g extract). Moreover, the SFE-CO_2-derived CCP extract exhibited stronger inhibitory effects on type 2 diabetes-related enzymes, namely α-amylase and α-glucosidase, compared to hot water and ethanol extractions. The IC_{50} values were 28.88±3.84 mg/mL for α-amylase and 3.07±0.05 µg/mL for α-glucosidase. These findings suggest that SFE-CO_2 is an efficient, green extraction method based on zero waste management strategy. The bioactive-rich CCP extract holds potential for applications in functional foods, nutraceuticals for type 2 diabetes prevention and management, and cosmetics, contributing to the sustainable valorization of coffee industry by-products.

Keywords: α-glucosidase, α-amylase, coffee by-products

Funding Source(s): CMU Junior Research Fellowship Program (JRCMU2567_038)



Protective Effects of Tea Extracts Against *Escherichia coli* Producing Colibactin Toxin: Antimicrobial, Cytoprotective, and Cell Cycle Modulation Properties

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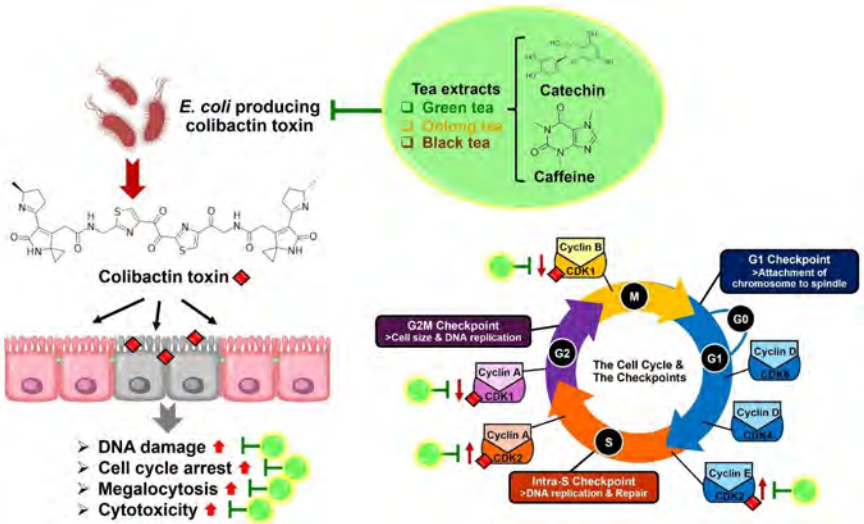
Green tea, oolong tea, and black tea contain bioactive compounds, such as catechin and caffeine, known for their health benefits. This study evaluated the antimicrobial and cytoprotective properties of these tea extracts and compounds against colibactin-producing *Escherichia coli*, focusing on their ability to inhibit transient infections, protect against DNA damage, and influence the cell cycle in Caco-2 colon cell cultures. Antimicrobial activity of the tea extracts and compounds was tested against *E. coli* ATCC 25922. Infected Caco-2 colon cells were treated with varying concentrations of tea extracts and compounds. Cell viability was assessed using MTT assays, DNA damage via alkaline comet assay, and cell cycle regulation through qRT-PCR analysis. Tea extracts and catechin inhibited colibactin-producing *E. coli* and significantly protected Caco-2 cells. Oolong tea, black tea, green tea, and catechin increased cell viability to over 80%, with oolong tea achieving 90.78 ± 2.76%. Moreover, tea extracts and compounds markedly reduced the DNA damage caused by *E. coli* ATCC 25922 infection. Tea extracts and compounds influenced cell cycle regulation, with all extracts upregulating *CDK-1* expression and downregulating *CDK-2* expression in infected cells, thereby restoring normal cell cycle progression. Consequently, treatment with tea extracts and catechin also promoted cell proliferation through *Ki-67* expression, which supported the survival of colon cells during infection. Green, oolong, and black tea extracts, alongside catechin and caffeine, demonstrated strong antimicrobial, DNA-protective, and cytoprotective effects. These findings emphasize their potential in preventing and mitigating colibactin-producing *E. coli* infections and promoting colon cell health.

Keywords: Antibacterial, Colibactin toxin, Cytoprotective effects, *Escherichia coli*, Tea

References:

Science 313 (2006) 848–851.
Journal of Applied Microbiology 130 (2021) 769-785.

Funding Source(s): This research was supported by CMU Junior Research Fellowship Program.



Development of Extraction Methods and Antioxidant Evaluation of Northern Thai *Apis mellifera* Propolis for Cosmeceuticals and Topical Applications

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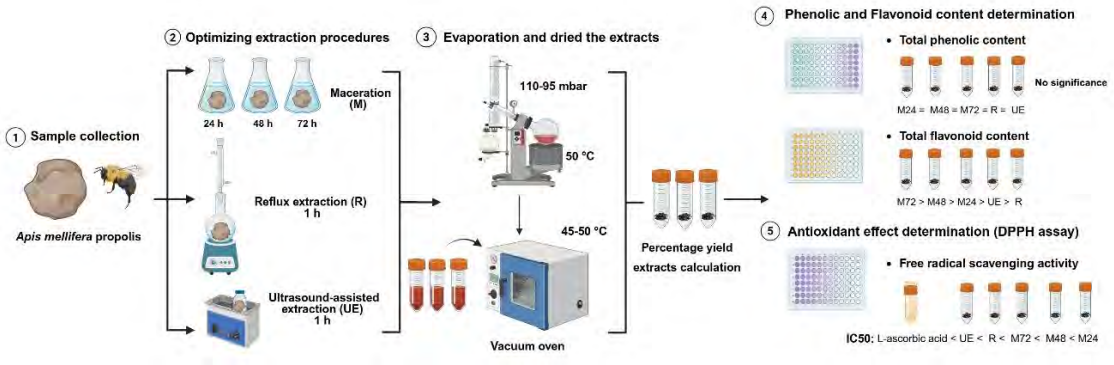
Propolis has been widely used in both traditional and modern medicine due to its numerous biological effects, promising for cosmeceuticals and topical applications. Currently, optimizing extraction methods to maximize the yield of bioactive compounds plays a critical role in enhancing the therapeutic potential of propolis extract. This study aimed to develop extraction techniques to maximize the phenolic and flavonoid content and determine antioxidant activity of propolis from northern Thailand. *Apis mellifera* propolis was collected from Chiang Rai and Payao and extracted using maceration (M) (24, 48, 72 hours), reflux (R) (1 hour), and ultrasonic extraction (UE) (20 minutes, 3 times) with 70% ethanol. Extract yield, total phenolic content (TPC), total flavonoid content (TFC), and antioxidant activity using DPPH assay were investigated. The results revealed that different extraction procedures did not significantly affect the yield and TPC. However, TFC among different extraction methods demonstrated that 72-h macerated extract (M72) yielded the highest levels of flavonoid compounds. All propolis extracts demonstrated dose-dependent free radical scavenging activity. The IC50 values were ranked (lowest to highest) as follows: L-ascorbic, UE, R, M72, M48, M24, respectively. Our findings emphasize the importance of optimized extraction methods in maximizing the therapeutic potential of northern Thai propolis for cosmeceuticals and topical applications.

Keywords: Propolis, Optimizing extraction, Total phenolic content, Total flavonoid content, Antioxidant activity

References:

Journal of Apicultural Research 60(5) (2021) 734-743.
Journal of the Brazilian Chemical Society 26 (2015) 2054-2062.

Funding Source: CMU Junior Research Fellowship Program (Grant No. JRCMU2566 R100, Chiang Mai University, Thailand) that supports the reported work



Low-Cost Fabrication of Porous Floating Tablets Using Hydrophobic/Hydrophilic Polymer Composites Via Sugar Templating

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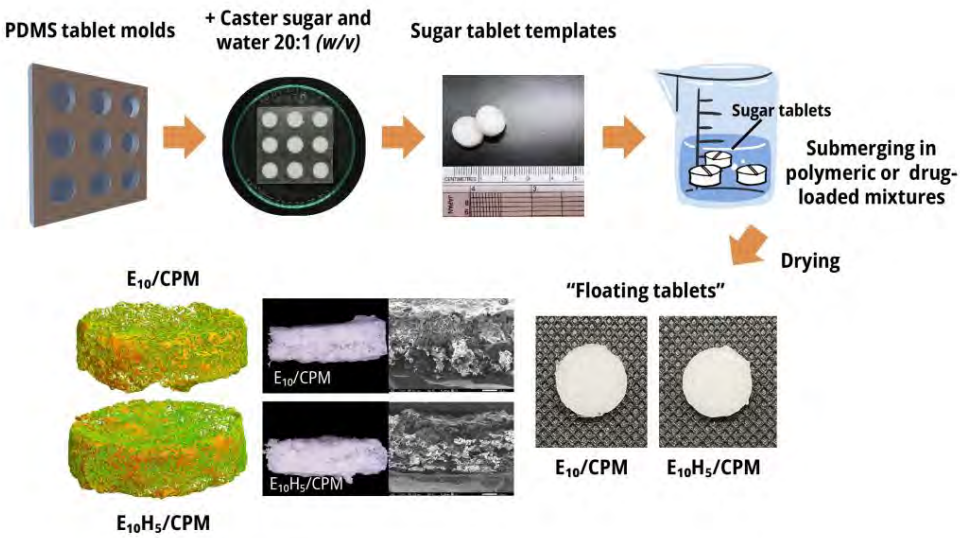
This study presents a low-cost method for fabricating porous floating tablets using cellulose derivatives-based hydrophobic/hydrophilic polymer composites via sugar templating. Various formulations were developed by blending ethyl cellulose (EC) and hydroxypropyl methylcellulose (HPMC) at different ratios to form hydrophobic/hydrophilic polymer composites, aiming to tailor porosity and drug release behavior. Tablets were produced by infiltrating a sugar template with polymer solutions, followed by solvent evaporation and sugar leaching. Among various formulations, the composite containing 10% w/w EC, 5% w/w HPMC, and 4% w/w chlorpheniramine maleate ($E_{10}H_5$/CPM) exhibited optimal properties, including high open porosity (94.4%), immediate buoyancy, and floating duration exceeding 24 h. Structural analysis via micro-CT confirmed uniform pore networks and enhanced matrix density. The addition of HPMC improved mechanical strength and significantly accelerated drug release, achieving 79.01% release over 72 h through a Fickian diffusion mechanism. Although this formulation showed slightly reduced drug loading compared to the EC-only matrix (E_{10}/CPM), the improved release kinetics and tablet integrity demonstrate the effectiveness of polymer blending. These findings support sugar templating as a scalable and cost-effective approach to design gastroretentive porous dosage forms using cellulose derivatives-based polymer composites.

Keywords: floating tablet, sugar templating, porous matrix, cellulose derivative, controlled drug release

References:

Asian Journal of Pharmaceutical Sciences 11 (2016) 575-584.
Pharmaceutics 11 (2019) 171-190.

Funding Source(s): CMU Junior Research Fellowship Program (JRCMU2567_011)



Development and Characterization of Liposomes Loaded Gallic Acid and Curcumin using Self -Emulsification Technique as A Topical Antioxidant

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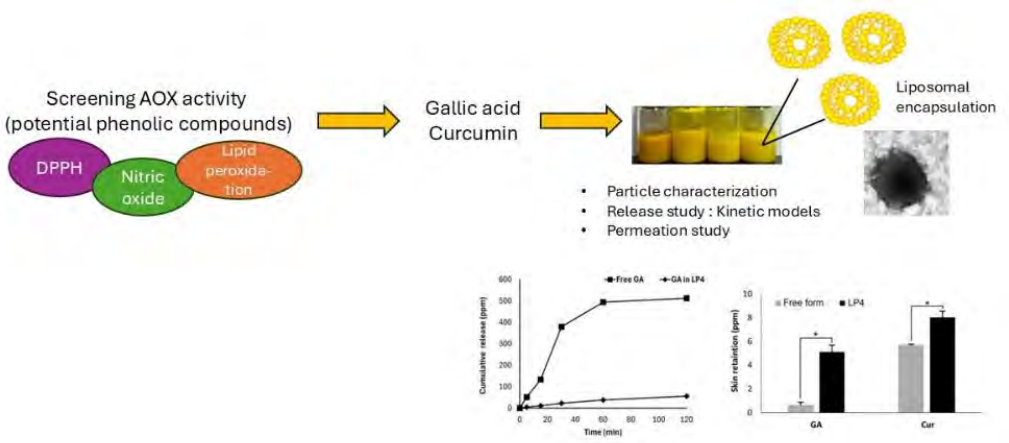
Excessive free radicals in the skin cause oxidative stress, damaging cells and leading to aging, melasma, and inflammation. This study developed a liposome system for co-delivering antioxidants to enhance their efficacy in deeper skin layers. Four phenolic compounds were screened for antioxidant activity using DPPH, nitric oxide scavenging, and lipid peroxidation assays. Gallic acid (GA) and curcumin (Cur), showing the strongest activity, were selected for liposome encapsulation via an emulsification method, with particle size reduction by probe sonication. High-performance liquid chromatography (HPLC) was used for chemical analysis, and particle morphology was examined with transmission electron microscopy. Studies on skin penetration, retention, and release were conducted. The optimized liposome (LP4) had a small particle size (< 150 nm), an unilamellar structure, and high entrapment efficiency (99% GA and 92% Cur). LP4 promoted effective skin retention of Cur with slow penetration, while the release of GA and Cur from LP4 followed a Higuchi kinetic model and Zero-order kinetic model, respectively. This delivery system demonstrates potential for targeted antioxidant delivery, offering enhanced protection against oxidative damage in the skin.

Keywords: gallic acid, curcumin, liposome, skin penetration, kinetic releasing

References:

Drug Discov Ther. 19(1) (2025) 38-48.

Funding Source(s): This work was supported by a grant from CMU Junior Research Fellowship program (Grant number: JRCMU2566R_098).



Elucidating the Bioactivities of Passion Fruit By-Processing for Health Applications

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Passiflora edulis (passion fruit) seeds are a rich source of bioactive compounds with promising applications in skin health and cosmeceutical formulations. This study examined the phytochemical composition and biological activities of *P. edulis* seed extract and seed-with-pulp extract. LC-MS/QTOF analysis identified a diverse range of phenolic and flavonoid compounds. *In vitro* assays demonstrated moderate antioxidant activity (DPPH and FRAP), significant anti-aging effects through hyaluronidase and collagenase inhibition, and no cytotoxicity toward human fibroblasts. Both extracts markedly enhanced collagen type I production, suggesting a role in promoting skin regeneration. Molecular docking analysis revealed strong binding affinities between key phytochemicals and skin-aging enzymes, providing mechanistic insight into their observed bioactivities. Among the tested samples, the seed extract showed the highest efficacy in terms of antioxidant potential, enzyme inhibition, and collagen stimulation. These results highlight the multifunctional properties of *P. edulis* extracts and support their use as effective active ingredients in anti-aging and anti-inflammatory skincare products. The combination of seed and pulp components appears to enhance overall biological performance, making the seed-with-pulp extract a particularly beneficial option for skin health applications.

Keywords: *Passiflora edulis* extract, LC-MS/QTOF, antiaging activity, molecular docking, collagen stimulant

References:

Frontiers in Pharmacology 11 (2020) 530734.
Journal of Agricultural and Food Chemistry 58 (2010) 11112-11118.

Funding Source(s): Junior Researchers Grant, Chiang Mai University



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Poster Presentation



Health and Well-being, Aging Society, Pandemics

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Thai Hereditary Cancer Project: Genotyping Assay Development and Medical Genetics Clinic Implementation

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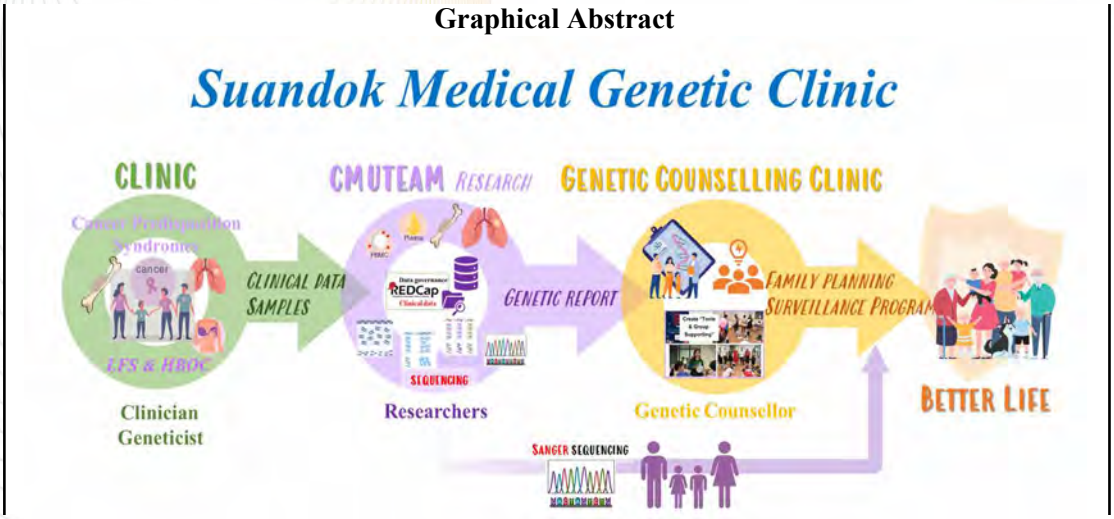
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Genomic research in the Thai population is expanding through national initiatives in precision medicine and pharmacogenomics. However, a Thai-specific genome reference is lacking, and studies on cancer predisposition syndromes (CPSs), such as Li-Fraumeni syndrome (LFS) and hereditary breast and ovarian cancer (HBOC), remain limited in Southeast Asia. This study aimed to identify relevant SNPs and develop a rapid, cost-effective genetic test to support clinical diagnosis. We designed exonic primers for *TP53*, *BRCA1*, and *BRCA2*, and performed Sanger sequencing at hotspot regions in patients meeting Chompret (LFS) and SEOM (HBOC) criteria. Among 93 LFS-spectrum and 84 HBOC-spectrum patients screened in 2024, Sanger sequencing detected no *TP53* variants in 15 LFS cases, while WGS identified pathogenic *TP53* and *RB1* mutations. In HBOC cases, 2 of 20 showed *BRCA1/BRCA2* variants via Sanger, with 3 additional carriers identified by WGS. These findings highlight the need for next-generation sequencing in CPS diagnosis due to high genetic heterogeneity. In parallel, we established a medical genetics clinic to offer targeted testing and counseling services. Our rapid genotyping assay supports family screening and enables integration of genetic services into routine cancer care in resource-limited settings.

Keywords: Li-Fraumeni syndrome, hereditary breast and ovarian cancer, Sanger sequencing, Medical genetics clinic, Mutation

Funding Source(s): Fundamental Fund 2024, Chiang Mai University and also Thailand Science Research and Innovation (TSRI).

Graphical Abstract



Genetic Heterogeneity in Osteosarcoma and CFS: Insights from Sequencing Technologies

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Cancer predisposition syndromes (CPSs) are cancers caused by inherited genetic mutations. Identifying germline variants as biomarkers enables targeted prevention and long-term risk counselling. With support from the Genomic Thailand Project, whole genome sequencing (WGS) was used to detect germline mutations in osteosarcoma patients. For those with pathogenic variants, whole exome sequencing (WES) of tumor tissue was performed to identify somatic mutations for deeper pathophysiological insights. Variants were validated by Sanger sequencing. RNA analysis of patient-derived osteosarcoma cells (PDCs) was conducted to assess transcriptional profiles.

From January 2012 to September 2023, 185 **Osteosarcoma** patients were enrolled in the Sarcoma cohort at Chiang Mai University Hospital. WGS was performed on 72 patients; four had pathogenic variants:

- **Patient 1**: *TP53:c.841G>A*, no somatic mutation
- **Patient 2**: *TP53:c.1010G>T*, with somatic loss of heterozygosity
- **Patient 3**: *RB1:c.869dupA*; somatic *TP53:c.375+5G>C*
- **Patient 4**: *TP53:c.375G>C*; somatic *TP53:c.830G>T*

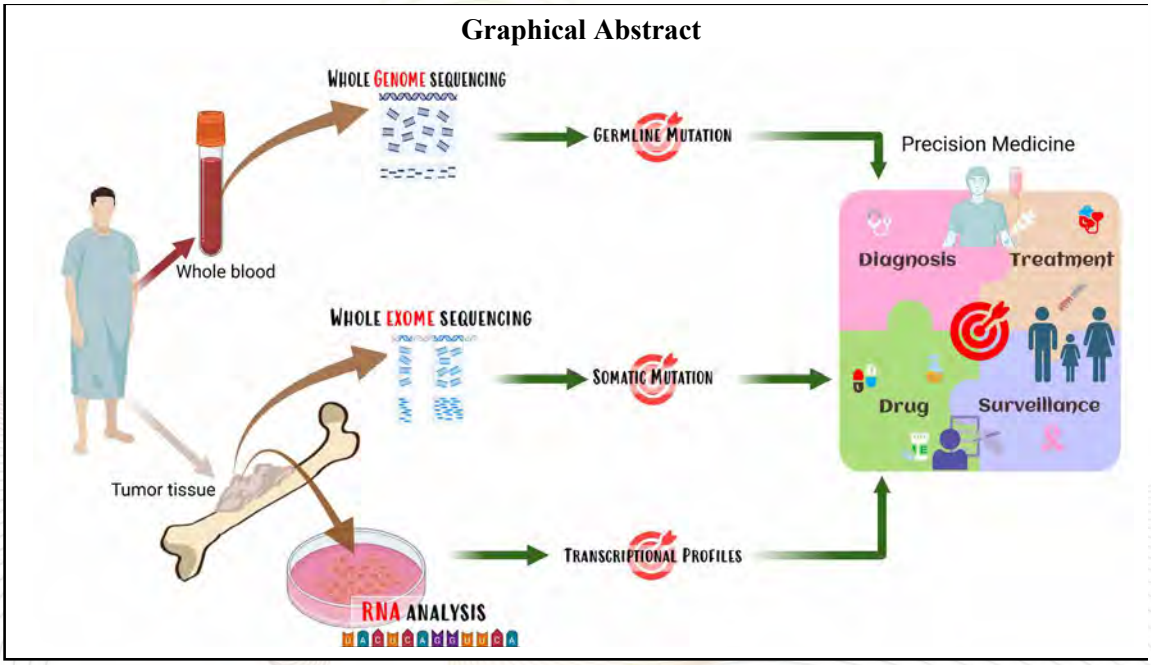
PDCs carried only germline mutations, confirming mutant transcripts in Patients 1–3 and aberrant splicing in Patient 4.

This study highlights the heterogeneity of germline and somatic mutations in osteosarcoma patients with CPS. Next-generation sequencing is essential for accurate diagnosis, genetic counselling, treatment, and surveillance in these individuals.

Keywords: Cancer predisposition syndrome, Osteosarcoma, Sequencing, Mutation, Genetic Heterogeneity

Funding Source(s): CMU Junior Research Fellowship Program 2023

Graphical Abstract



Health Risk Assessment of Potentially Toxic Elements in Upper Southeast Asia During the Dry Season: Daytime and Nighttime Exposure

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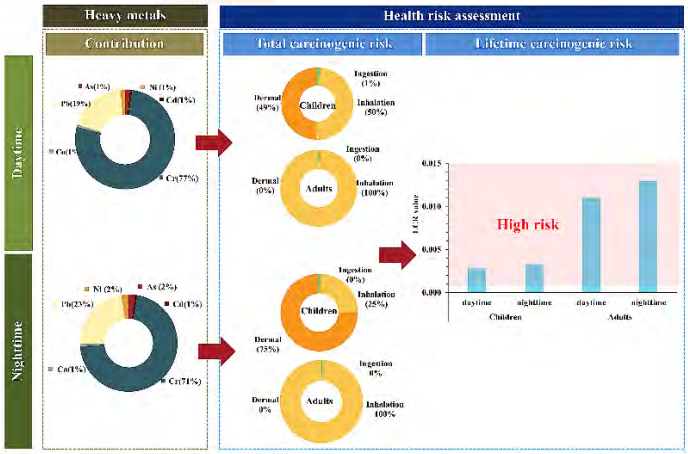
This study assesses health risks from potentially toxic elements (PTEs) in $PM_{2.5}$ in upper Southeast Asia during the dry season, which includes smoke haze periods. It compares daytime and nighttime exposures, focusing on non-carcinogenic and carcinogenic effects. Average $PM_{2.5}$ concentrations were 55.15 ± 14.97 µg/m³ during the daytime and 47.27 ± 12.58 µg/m³ at nighttime. Six PTEs (As, Cd, Cr, Co, Ni, Pb) were analyzed, with concentrations ranked Cr > Pb > Ni > As > Cd > Co during daytime and Cr > Pb > As > Cd > Co > Ni at nighttime. Cd, Pb, As, and Ni were lower at nighttime, while Co and Cr were higher. Health risk assessment showed minimal non-carcinogenic risks for children (Hazard Index: 0.1–1) and negligible risks for adults (HI < 0.1). Ingestion was the primary exposure route. However, inhalation posed significant carcinogenic risks (LCR > 10^{-3}) for both groups. Nighttime exposure presented higher risks for both non-carcinogenic and carcinogenic effects. The main sources were in southwest Chiang Mai province. These findings emphasize the need for protective measures, especially for residents in open-air environments or active at nighttime and highlight the importance of controlling air pollution to reduce health risks.

Keywords: Atmospheric Pollution, Chiang Mai, Health Risk Assessment, Potentially Toxic Elements, $PM_{2.5}$

References:

Air Quality Atmosphere and Health 15(2022)1963–1979.
Atmospheric Environment 327(2024)120517.

Funding Source(s): This work was supported by the CMU Junior Research Fellowship Program (JRCMU2566R_092), Chiang Mai University, Thailand.



Exploring the Impact of Artificial Intelligence on Forensic Osteology Research in Thailand

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The identification of human remains is crucial for preserving humanitarian, legal, and natural rights. Methods of identification can be divided into non-scientific and scientific approaches. While DNA analysis is considered the most accurate technique, it is often unavailable in many cases. In response, we developed a method for extracting human genomic material from metacarpal bones using gelatin-coated magnetic particles in Thailand. We applied the four core principles of biological identification—sex, age, stature, and ancestry—in identifying each set of remains. Sex is a particularly important factor, as it can facilitate the application of the other principles. Our research on sexual dimorphism in Thai bones has been extensive. However, age estimation remains one of the most challenging principles, with limited studies conducted in Thailand. Additionally, we conducted in-depth studies on stature identification in both complete and incomplete long bones, a critical step in the identification process. We have also published a study on ancestry identification between Thai and Japanese populations and have conducted promising research on ancestry identification between Thai and Indonesian populations. To improve the accuracy and precision of these determinations, we are incorporating artificial intelligence, which is expected to play a key role in advancing forensic osteology research.

Keywords: Artificial Intelligence, Forensic Osteology, Biological Identification, Bone, Thailand

References:

Forensic Science, *Medicine and Pathology* 20 (2024) 920-932.
Forensic Science, *Medicine and Pathology* (2025).

Funding Source(s): Excellence Center in Osteology Research and Training Center (ORTC) and Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand

Predicted $PM_{2.5}$ for Evaluating Impact of Smoke-Haze Pollution on COVID-19 Severity in Cancer Patients in Upper Northern Thailand

Patumrat Sripan[1], Sawaeng Kawichai[1], Worawut Srisukkham[2], Kriengkrai Srithanaviboonchai[1,3], Imjai Chitapanarux[4,5], Donsuk Pongnikorn[6], Karnchana Daoprasert[7], Narate Waisri[4], Chirapong Hanpragopsuk[4], Kritchavat Ploddi[8], Surachet Arunothong[9], Tippawan Prapamontol[1*]

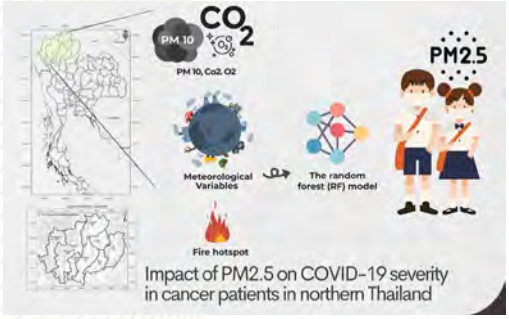
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This study presents the first machine learning (ML) model developed to predict long-term retrospective $PM_{2.5}$ concentrations in upper northern Thailand, a region affected by biomass burning and transboundary air pollution. Various ML techniques were utilized to construct prediction models. Among the proposed approaches, the random forest (RF) model, incorporating PM_{10}, CO_2, O_3, fire hotspots, air pressure, rainfall, relative humidity, temperature, wind direction, and wind speed, yielded the highest predictive accuracy. This robust RF-based prediction model of $PM_{2.5}$ provides a valuable tool to support research on the acute health impact of COVID-19 severity in cancer patients in the region. Among 1,126 cancer patients diagnosed with COVID-19, 7% lived in areas where the average daily $PM_{2.5}$ concentration was >37.5µg/m³ on the date of diagnosis, while 93% lived in areas with daily average $PM_{2.5}$ concentrations ≤37.5 µg/m³. The proportion of severe COVID-19 cases was significantly higher in areas with elevated $PM_{2.5}$ concentrations (15% vs. 7%, $p = 0.025$). In conclusion, $PM_{2.5}$ exposure is associated with increased severity of COVID-19 in cancer patients. This vulnerable patient group requires intensive care during periods of high $PM_{2.5}$ concentrations.

Keywords: Machine learning, $PM_{2.5}$, cancer patient, COVID-19 severity

References: Kawichai S, Sripan P, Rerkasem A, Rerkasem K, Srisukkham W. Long-Term Retrospective Predicted Concentration of PM2.5 in Upper Northern Thailand Using Machine Learning Models. Toxics. 2025 Feb 27;13(3):170.

Funding Source(s): Fundamental Fund 2567



Determinants of Suboptimal Cervical Cancer Screening Among Ethnic Women in the Thailand-Myanmar Border Area

Patumrat Sripan[1], Linda Aurpibul[1], Kriengkrai Srithanaviboonchai[1,2*] Arunrat Tangmunkongvorakul[1], Phuttipol Chaiprom[3], Prin Pongruethat[4*]

[1]Research Institute for Health Sciences, Chiang Mai University, Chiang Mai, Thailand, [2]Department of Community Medicine, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand, [3]Pai Hospital, Ministry of Public Health, Mae Hong Son, Thailand, [4]Faculty of Public Health, Thammasat University, Bangkok, Thailand

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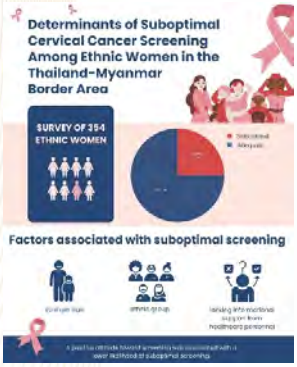
This study aimed to assess the prevalence of suboptimal screening and identify factors associated with inadequate cervical cancer screening among ethnic women in the Thailand-Myanmar border region. A cross-sectional study was conducted from July to December 2023 among ethnic women aged 30–60 years in Pai District, Mae Hong Son Province, northern Thailand. Descriptive statistics characterized the sample, while binary logistic regression was used to identify factors associated with suboptimal screening. Of the 354 ethnic women included, one-quarter had not received optimal cervical cancer screening. Factors significantly associated with suboptimal screening included younger age (adjusted odds ratio [aOR]=1.48, 95% confidence interval [CI]: 1.06–2.07), being of Hmong ethnicity as compared to Karen (aOR=2.63, 95% CI: 1.30–5.34), and lacking informational support from healthcare personnel (aOR=1.88, 95% CI: 1.08–3.29). Conversely, a positive attitude toward screening was associated with a lower likelihood of suboptimal screening (aOR=0.56, 95% CI: 0.32–0.96). In conclusion, support and information provided by local healthcare personnel are crucial for promoting cervical cancer screening and health literacy among ethnic women. Tailoring communication and support to accommodate different languages and cultural contexts can enhance engagement, trust, and screening uptake in these communities.

Keywords: Thailand-Myanmar border, associated factors, ethnic women, cervical cancer, suboptimal screening

References:

Asian Pac J Cancer Prev 26 (2025) In press.

Funding Source(s): Research Group Development (Research Group for AIDS and Sexually Transmitted Diseases, Research Institute for Health Sciences)



Cytotoxic and Genomic Differentiation of Cereulide-Producing and Non-Cereulide-Producing *Bacillus cereus* Group Strains Involved in Emetic Illnesses

Jintana Pheepakpraw [1], Chanita Sinchao [1], Sawannee Sutheeworapong [2], Pachara Sattayawat [1], Aussara Panya [1], Yingmanee Tragoolpua [1], Thida Kaewkod [1], Sakunnee Bovonsombut [1], Thararat Chitov [1,3*]

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[2] *Systems Biology and Bioinformatics Laboratory, Pilot Plant Development and Training Institute, King Mongkut's University of Technology Thonburi, Bangkok 10150, Thailand* [3] *Environmental Science Research Center (ESRC), Faculty of Science, Chiang Mai University, Chiang Mai 50200, Thailand*
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The *Bacillus cereus* group includes closely related species, notably *B. cereus*, *B. thuringiensis*, and *B. paranthracis*, which are associated with diarrhoeal and emetic foodborne illnesses. The major cause of emetic illness is cereulide, a heat-stable peptide synthesised non-ribosomally by cereulide synthetase, encoded by *ces* genes. This study examined the cytotoxic and genome characteristics of *B. cereus* group strains associated with emetic illness, specifically *B. cereus* (F4810/72 (B358)) and *B. thuringiensis* (FC strains). The heat-treated culture supernatants from *B. cereus* F4810/72 decreased HepG2 and Caco-2 cell viability to 29.10±1.12% and 43.07±1.31%, respectively. *B. thuringiensis* strains exhibited lower levels of cytotoxicity, with the survival of HepG2 and Caco-2 cells of 67.41–71.64% and 51.25–56.60%, respectively. Genome sequencing verified the existence of the *ces* gene cluster in F4810/72, whereas the FC strains lacked *ces* but harboured other virulence genes, some of which might be involved in emetic symptoms. The average nucleotide identity analysis indicated that F4810/72 (B358) clustered with cereulide-producing strains, whereas the FC strains were grouped with strains of diarrhoeal ornon-emetic type. The results demonstrated distinct cytotoxic and genomic profiles that differentiate cereulide-producing from non-cereulide-producing strains, which is useful for determining the virulence factors of the toxigenic *B. cereus* group.

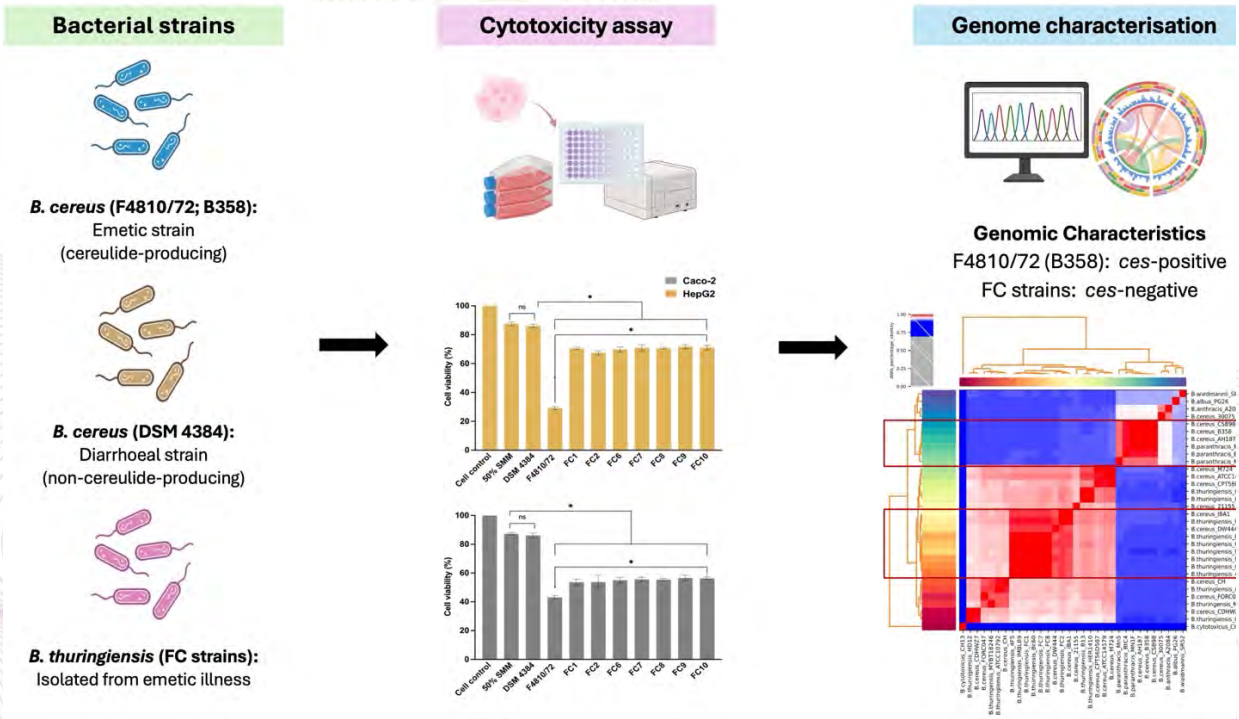
Keywords: *Bacillus cereus* group, emetic toxin, virulence factor, foodborne intoxication, food safety

References:

Foods 14 (2025) 485.
Toxins 15 (2023) 89.

Funding Source(s): This research project was supported by the Fundamental Fund 2024 (FF67) from Chiang Mai University, granted to Thararat Chitov (Grant No. 4710174).

Graphical abstract



Serological Evidence of *Mycobacterium tuberculosis* of Captive Elephants (*Elephas maximus*) in Northern Thailand: Results from a 2024 ELISA-Based Screening

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In 2024, serum samples from 525 captive elephants in northern Thailand were analyzed for antibodies against *Mycobacterium tuberculosis* using an ELISA assay targeting ESAT-6 and CFP-10 antigens. Nine elephants tested seropositive, resulting in a low seroprevalence of 1.71%, markedly lower than previously reported rates in Thailand. However, this figure represents only the sample subset. Of the 881 elephants present in the region during the study, 356 (40.41%) were not sampled due to constraints such as aggression, musth, illness, lack of training, young age or not consented. Furthermore, 139 elephants (26.47% of those tested) produced inconclusive results, raising concerns about possible misclassification, particularly among individuals with known contact with seropositive cases. Confirmatory testing reaffirmed the initial ELISA outcomes, with the same nine elephants remaining positive. These confirmed seropositive cases are now undergoing further molecular diagnostics via PCR to detect *Mycobacterium* DNA using appropriate sampling methods such as bronchoalveolar lavage (BAL) and/or trunk or buccal swabs, in alignment with the guidelines of the Elephant TB Working Group Thailand. Continued investigation and targeted surveillance are essential to ensure early detection, improve diagnostic accuracy, and mitigate potential transmission within captive elephant populations.

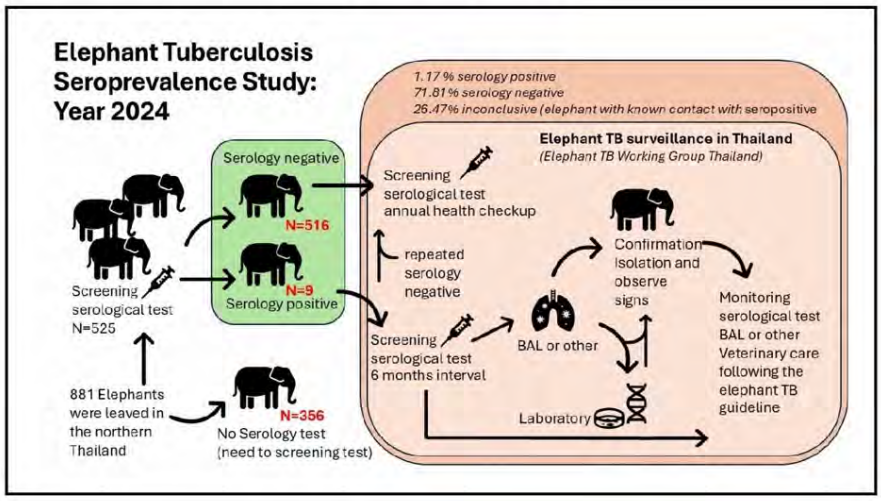
Keywords: Captive Elephant, *Mycobacterium tuberculosis*, Serological test, Screening

References:

European Journal of Wildlife Research Volume 64 (2018) 70.
Frontier in Veterinary Science Volume 8 (2021) 713663.

Funding Source(s): Targeted Research grant, Chiang Mai University that support the reported work

Graphical Abstract



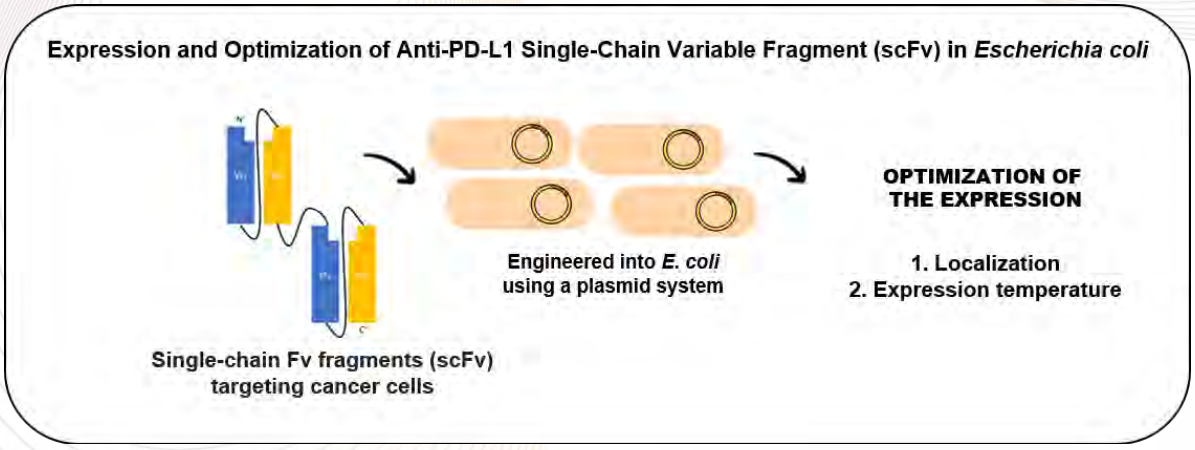
Expression and Optimization of Anti-PD-L1 Single-Chain Variable Fragment (scFv) in *Escherichia coli*

Chonlaphon Chantama[1], Aussara Panya[1,2], Pachara Sattayawat[1,2,*]
[1]*Department of Biology, Faculty of Science, Chiang Mai University, Chiang Mai, 50200, Thailand*
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Immunotherapy has emerged as a highly effective treatment for cancer, particularly through the use of immune checkpoint inhibitors. These inhibitors function by blocking the interaction between inhibitory ligands on cancer cells and receptors on T-cells, thereby restoring T-cell activity. Several commercial monoclonal antibodies target Programmed Death Ligand 1 (PD-L1) to inhibit immune evasion by tumor cells. However, the high production costs associated with eukaryotic cell culture systems make these therapies expensive. This study aimed to develop an alternative antibody production platform by cloning the anti-PD-L1 single-chain variable fragment (scFv) gene into the pET-22b(+) plasmid and expressing it in *Escherichia coli*. *E. coli* was chosen for its rapid growth in cost-effective media, ease of genetic manipulation, and suitability for large-scale protein production. Following successful cloning and transformation into *E. coli* BL21(DE3), expression of the anti-PD-L1 scFv was confirmed by Coomassie Brilliant Blue staining and Western blotting using an anti-His tag antibody. Further analysis of protein localization and expression conditions revealed that the scFv was predominantly intracellular and optimally expressed at lower temperatures (16°C and 30°C). These results demonstrate that the engineered plasmid enables effective bacterial expression of anti-PD-L1 scFv, highlighting its potential as a cost-efficient platform for future cancer immunotherapy development.

Keywords: antibody, cancer immunotherapy, *E. coli*, anti-PDL1 scFv

Funding Source(s): CMU Junior Research Fellowship Program (grant no. JRCMU2567R_020)



Development of Co-processed Rice Starch for Direct Compression Using the Sediment Delivery Model-Orodispersible Tablets (SeDeM-ODT) Expert System

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This study aimed to determine the appropriate proportion of co-processed spray-dried pregelatinized rice starch (Pre-RS) and mannitol using the SeDeM-ODT expert system, and to formulate a directly compressible hydroxyzine orodispersible tablet (ODT). Pre-RS showed good flowability, which decreased after spray drying, though its compressibility improved significantly. Mannitol exhibited good flowability and disintegrability, and spray drying further enhanced its compressibility without affecting flowability. The spray-dried Pre-RS and mannitol had similar disintegrability. The co-processed excipient demonstrated good flowability and disintegration within three minutes. However, hydroxyzine ODTs made using this excipient had poor hardness due to insufficient compressibility. To address this, silicified microcrystalline cellulose was added, which improved tablet uniformity in terms of weight, thickness, and hardness. Despite these improvements, the tablets still failed friability (>1%) and disintegration (5.64 ± 1.47 minutes) criteria. In conclusion, while the optimal ratio of spray-dried Pre-RS and mannitol was effectively determined using SeDeM-ODT parameters, the resulting co-processed excipient was not entirely suitable for ODT production. Nonetheless, the findings suggest potential for future development of spray-dried Pre-RS-based co-processed excipients.

Keywords: Co-processed excipient, Spray drying, Direct compression, Hydroxyzine

Funding Source(s): CMU Junior Research Fellowship Program 2566

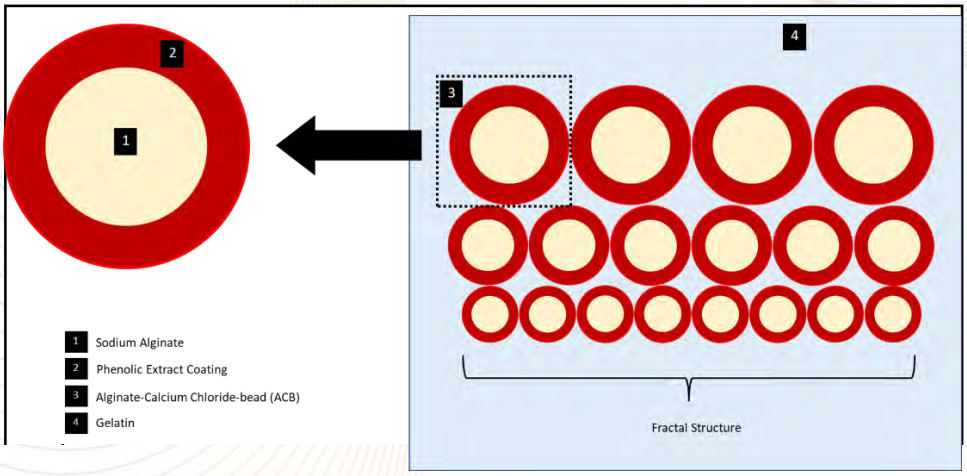
Design and Synthesis of Composite Fractal Hydrogel Wound Dressing for Skin Wounds Dressing from Natural Materials and Phenolic Extracts

Raimee Soh[1*], Rattapol Pinnaratip[2**]
** Biomedical Engineering Institute, Chaing Mai University, Chiang Mai 50200, Thailand*
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This study aims to synthesize a natural composite fractal hydrogel designed to be biocompatible and structurally enhanced, utilizing alginate, calcium chloride, and gelatin to improve exudate absorption and facilitate the healing of small open skin wounds. The research process includes the design and synthesis of the hydrogel, with attention to factors influencing bead size, structural characteristics, and the conditions required for stable fractal formation. The materials are combined under controlled parameters, including temperature, concentration, and other relevant factors, to promote the formation of the desired structure. The hydrogel will be characterized using various analytical techniques: scanning electron microscopy (SEM) to investigate the physical structure, water absorption capacity and contact angle measurements to evaluate hydrophilicity, a universal testing machine (UTM) to assess elasticity, and Fourier-transform infrared spectroscopy (FTIR) to analyze the chemical composition. The results are expected to demonstrate high water absorption capacity, favorable elasticity, a chemical composition conducive to wound healing, and structural integrity suitable for application as a wound dressing. In conclusion, the developed hydrogel exhibits strong potential as a safe, effective, and biocompatible wound dressing, offering improved wound healing through enhanced moisture retention and structural support, making it suitable for the treatment of small open skin wounds.

Keywords: fractal, hydrogel, wound dressing, biocompatible, moisture retention

Funding Source(s): Junior Researcher 2024



Prevalence and Etiological Spectrum of Severe Acute Respiratory Infections Among Adults in Northern Thailand: a Post-COVID-19 Surveillance Study (2023–2024)

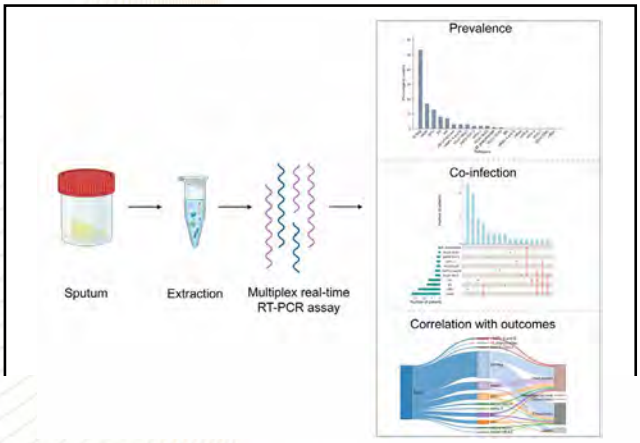
Nang Kham-Kjing[1,2], Rathakarn Kawila[3], Patcharaporn Tariyo[3], Kittiyaporn Puapun[3], Sirinat Wongchotbrorirak[1], Nicole Ngo-Giang-Huong[2,4,5,6], Sayamon Hongjaisee[2,7], Woottichai Khamduang[1,2,6]*

[1]Department of Medical Technology, Faculty of Associated Medical Sciences, Chiang Mai University, Chiang Mai, Thailand; [2]LUCENT International Collaboration, Faculty of Associated Medical Sciences, Chiang Mai University, Chiang Mai, Thailand; [3]Nakornping Hospital, Chiang Mai, Thailand; [4]Maladies Infectieuses et Vecteurs: Écologie, Génétique, Évolution et Contrôle (MIVEGEC), Agropolis University Montpellier, Centre National de la Recherche Scientifique (CNRS), Institut de Recherche Pour le Développement (IRD),Montpellier, France; [5]AMS-PHPT Research Collaboration, Faculty of Associated Medical Sciences, Chiang Mai University, Chiang Mai, Thailand; [6]LMI PRESTO, Faculty of Associated Medical Sciences, Chiang Mai University, Chiang Mai, Thailand; [7]Research Institute for Health Sciences, Chiang Mai University, Chiang Mai, Thailand
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Severe acute respiratory infections (SARI) remain a significant cause of morbidity and mortality worldwide, particularly in low-resource settings. While pediatric SARI surveillance is well established in Thailand, data on adult SARI, especially following the COVID-19 pandemic, are limited. We conducted a prospective observational study from November 2023 to April 2024 at a regional hospital in Chiang Mai, Thailand. Adults (≥18 years) hospitalized with SARI were enrolled. Respiratory samples were analyzed using a multiplex real-time RT-PCR assay targeting 21 respiratory pathogens (Fast Track Diagnostics, Siemens Healthineers, Esch-sur-Alzette, Luxembourg). Among 101 patients (median age 62 years), 47% tested positive for at least one respiratory pathogen, predominantly viruses such as adenovirus (17%) and rhinovirus (13%). Co-infections were identified in 9 cases (9%). Most patients presented with fever and cough; 94% received antibiotics, and 8% died during hospitalization. This study demonstrates a substantial burden of viral pathogens in adult SARI cases in northern Thailand post-COVID-19 and highlights the need for enhanced diagnostic strategies and pathogen-specific surveillance to inform clinical and public health responses.

Keywords: Severe acute respiratory infection, multiplex RT-PCR, respiratory viruses, adult patients, Thailand, epidemiology.

Funding Source(s): Fundamental Fund 2567



TB-GoldDx: A Visual, Equipment-Free Gold Nanoparticle Assay for Tuberculosis Diagnosis

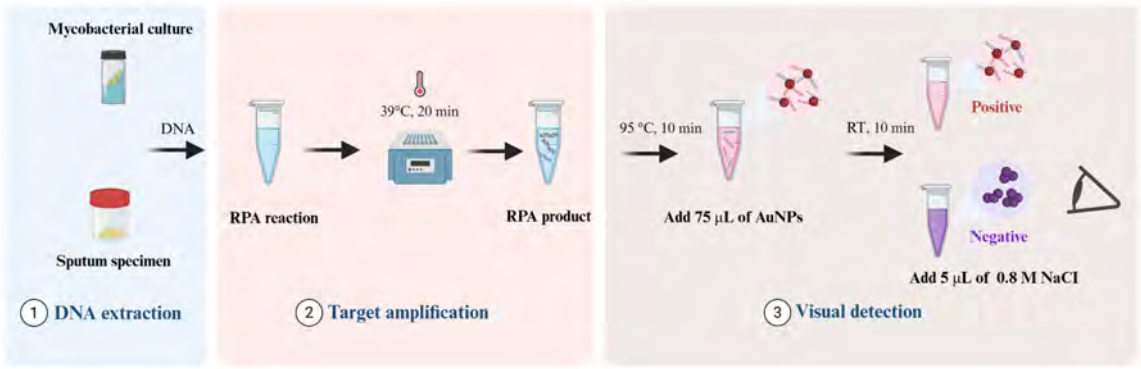
Sukanya Saikaew[1, 2, 3], Sirikwan Sangboonruang[1, 2, 3], Rodjana Pongsararuk4, Prapaporn Srilohasin[5], Bordin Butr-Indr[1, 2], Sorrasak Intorasoot[1, 2], Chayada Sitthidet Tharinjaroen[1, 2], Ponrut Phunpae[1, 2], Surachet Arunothong[4], Wutthichai Panyasit[4], Angkana Chaiprasert[6,7], Khajornsak Tragoolpua[1, 2], and Usanee Wattananandkul[1, 2*]

[1] Division of Clinical Microbiology, Department of Medical Technology, Faculty of Associated Medical Sciences, Chiang Mai University, Chiang Mai, Thailand, [2] Office of Research Administration, Chiang Mai University, Chiang Mai, Thailand, [3] Infectious Diseases Research Unit (IDRU), Faculty of Associated Medical Sciences, Chiang Mai University, Chiang Mai, Thailand, [4] Office of Disease Prevention and Control Region 1 (ODPC 1) Chiang Mai, Department of Disease Control, the Ministry of Public Health, Muang District, Chiang Mai, Thailand, [5] Department of Microbiology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand, [6] Office for Research and Development, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand, [7] Drug Resistant Tuberculosis Research Fund, Siriraj Foundation, Bangkok, Thailand
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Rapid and reliable diagnostics for tuberculosis (TB) at POC are crucial for narrowing the gap of TB diagnosis, especially in resource-limited settings. We established an assay by integrating gold nanoparticle (AuNP)-based visual detection to recombinase polymerase amplification (RPA), termed TB-GoldDx, enabling equipment-free diagnosis of *Mycobacterium tuberculosis* (MTB). By targeting multiple copies insertion sequence, IS*6110*, TB-GoldDx demonstrated a detection limit of 0.001 ng of MTB H37Rv DNA (~210 bacilli) and achieved 95.83% sensitivity and 100% specificity among 100 bacterial species. The evaluation of 140 clinical sputum samples, it exhibited 81.43% sensitivity and 58.57% specificity versus smear microscopy. In Acid-fast bacilli (AFB) 3+ specimens, TB-GoldDx achieved 95.45 to 100% sensitivity. Compared with commercial line probe assays (LPAs), this assay demonstrated comparable sensitivity (84.78% vs. 82.61%) but lower specificity (54.05% vs. 78.38%) in clinical specimens. TB-GoldDx offers a simple, rapid (< 1 hour), and thermocycler-free method for diagnostic suitable for point-of-care TB detection. Its affordability and minimal equipment requirements support its potential for expanding diagnostic access in underserved areas and contributing to End TB strategies.

Keywords: Tuberculosis; Recombinase polymerase amplification (RPA); Gold nanoparticle (AuNP); Point-of-care diagnosis; Resource-limited settings; Global health challenge

Funding Source(s): the Fundamental Fund 2024, the Ministry of Higher Education, Science, Research and Innovation, Thailand, through Chiang Mai University (Project No. 195910).



Tear Biomarkers and Ocular Surface Response to Adjunct Topical Pirenoxine After LASIK and PRK: A Phase II Randomized Controlled Trial

Phit Upaphong[1,2], Chanisa Thonusin[3], Nattayaporn Apaijai[3], Napaporn Tananuvat[1,2], Winai Chaidaroon[1,2], Nipon Chattipakorn[3,4], Siriporn Chattipakorn[3,5,6,*]

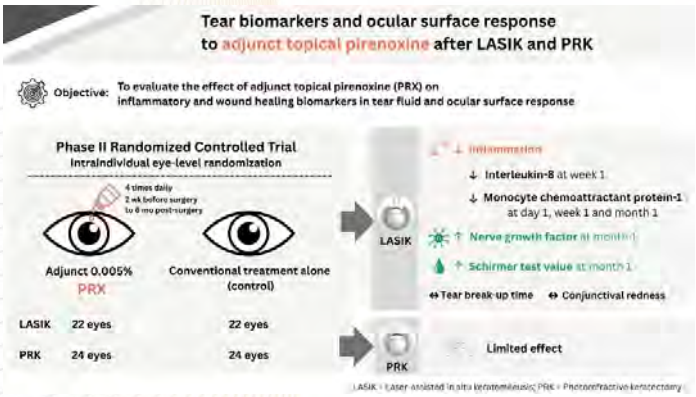
[1] Department of Ophthalmology, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand
[2] Chiang Mai University LASIK Center, Center of Medical Excellence, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand 3 Cardiac Electrophysiology Research and Training Center, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand 4 Cardiac Electrophysiology Unit, Department of Physiology, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand 5 Neurophysiology Unit, Chiang Mai University, Chiang Mai, 50200, Thailand 6 Department of Oral Biology and Diagnostic Sciences, Faculty of Dentistry, Chiang Mai University, Chiang Mai, Thailand
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This phase II randomized controlled trial evaluated the effect of adjunct topical pirenoxine (PRX) on tear biomarkers and ocular surface response following laser in-situ keratomileusis (LASIK) and photorefractive keratectomy (PRK), using intraindividual eye-level randomization. One eye received 0.005% PRX drops four times daily starting 14 days preoperatively through six months postoperatively, alongside standard care. The control eye received standard care alone. The cohort comprised 24 PRK subjects (48 eyes; mean age 30.8 ± 6.0 years) and 22 LASIK subjects (44 eyes; mean age 32.3 ± 6.7 years), with comparable baseline ocular parameters. In the LASIK group, PRX was associated with modest but statistically significant reductions in interleukin-8 at week 1 (effect ratio 0.41; 95% confidence interval [CI] 0.18–0.92), monocyte chemoattractant protein-1 (MCP-1) at day 1 (0.56; 95%CI 0.36–0.87), week 1 (0.62; 95%CI 0.40–0.97), and month 1 (0.56; 95%CI 0.37–0.82). Nerve growth factor (NGF) increased at month 1 (2.12; 95%CI, 1.19–3.78), with improved Schirmer test value (1.38; 95% CI, 1.12–1.60). No significant improvements were observed in tear breakup time, conjunctival hyperemia, corneal staining, or corneal opacity. In conclusion, adjunctive PRX may offer mild anti-inflammatory benefits after LASIK, but demonstrates limited impact on observable clinical parameters.

Keywords: Cornea, Dry eye, Inflammation, Kary Uni, Refractive surgery

Funding Source(s): Fundamental fund 2024, Chiang Mai University and Thailand Science Research and Innovation (TSRI)

Graphical Abstract



Development of Functionalized-Nanomaterials Properties for Preliminary Assessment in Health Promotion and Non-Communicable Disease: *Inhibition of Cholesterol Absorption by Zinc oxide nanoparticles from Flame spray pyrolysis (FZnO-NPs) Indicates a Promising Anti-Hyperlipidemic Candidate*

Thanthakan Saithong[1], Kornwalai Tunkaew[1], Mameaseng Siriwalai[2,3], Chaikarn Liewhiran[4], and Chutima S. Vaddhanaphuti[1,*]

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ZnO-NPs derived from flame spray pyrolysis (FZnO-NPs) firstly exhibits the advantage over other commercial ZnO-NPs (CZnO-NPs) due to it is a one-step synthesis process with high purity. However, the potential benefit in biomedical field is limited. To pursue the potential implication of using FZnO-NPs in lowering lipid levels, therefore, this study aimed to investigate the potential lipid-lowering effect in the transluminal gastrointestinal environment compared with CZnO-NPs. Comparable studies in purity, pore sizes, surface area, and morphology were also determined. The transport rate of fluorescent-cholesterol absorption in human colorectal adenocarcinoma (Caco-2) cells were determined. Results demonstrated that FZnO-NPs have a smaller size and larger surface area compared to that of CZnO-NPs. The FZnO-NPs significantly inhibited cholesterol absorption in Caco-2 cells similarly to the prescribed drug; ezetimibe, while CZnO-NPs did not show any effects. Thus, this study suggests that FZnO-NPs has promising therapeutic potential for inhibition of cholesterol absorption which could further be an option for preventing hyperlipidemia.

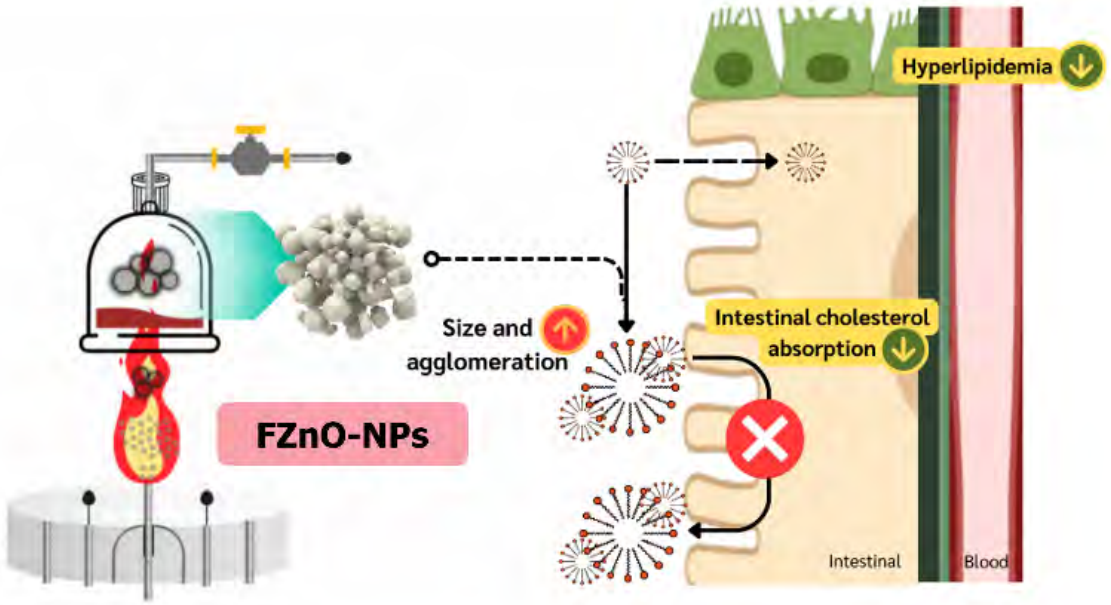
Keywords: Zinc oxide nanoparticle, Flame spray pyrolysis, cholesterol absorption, cholesterol micelles, lipid-lowering effects

References:

1. *Journal of Aerosol Science,* 27 (1996) S153-S154.
2. *Chemical Engineering & Technology* 24 (2001) 583-596.

Funding Source(s): This research was funded by the Fundamental Fund, Chiang Mai University (2024 to CL and CSV).

Graphical Abstract



Melatonin Prevents Kidney Dysfunction, Oxidative Stress, Mitochondrial Impairment, and Cell Death in CKD Patients Undergoing Contrast Exposure: A Prospective, Randomized, Double-Blind, Placebo-Controlled Study

Prit Kusirisin[1,2,3], Nattayaporn Apaijai[2,3,4], Kajohnsak Noppakun[1], Srun Kuanprasert[5], Siriporn C. Chattipakorn[2,3,6], Nipon Chattipakorn[2,3,4*]

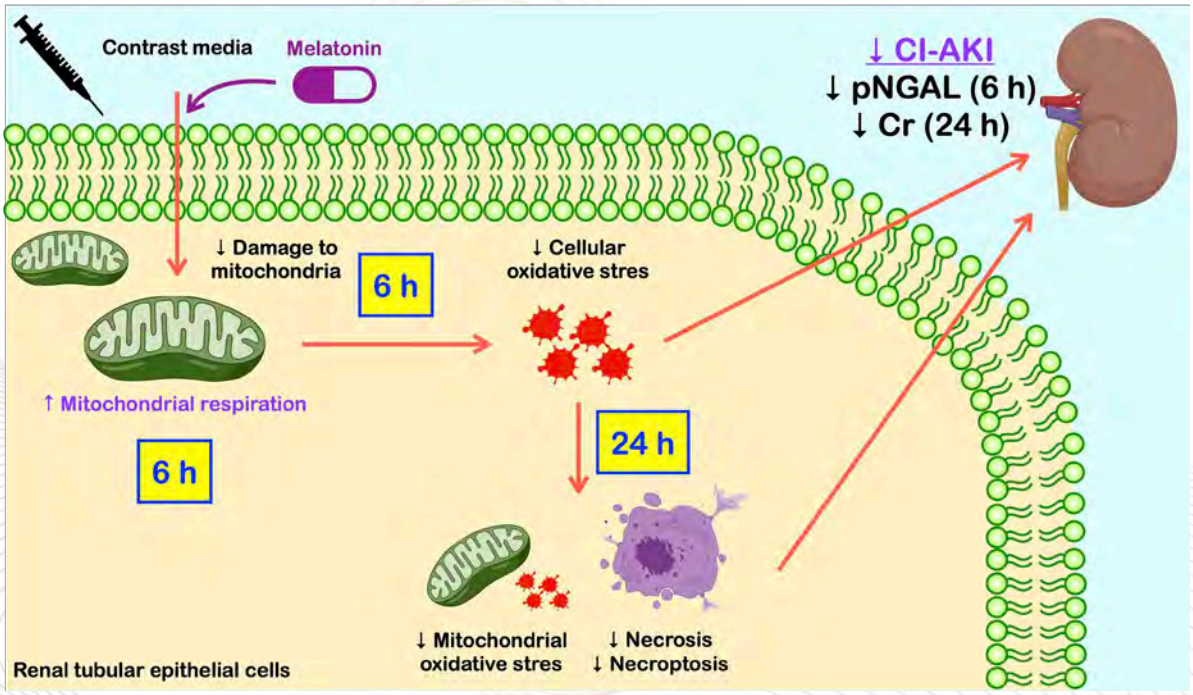
[1]Division of Nephrology, Department of Internal Medicine; [2]Cardiac Electrophysiology Research and Training Center, Faculty of Medicine;[3]Center of Excellence in Cardiac Electrophysiology Research;[4]Cardiac Electrophysiology Unit, Department of Physiology, Faculty of Medicine; [5]Division of Cardiology, Department of Internal Medicine, Faculty of Medicine; [6]Department of Oral Biology and Diagnostic Sciences, Faculty of Dentistry, Chiang Mai University, Chiang Mai, 50200, Thailand.
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Objectives: Patients with chronic kidney disease (CKD) are at increased risk of acute kidney injury following exposure to contrast media. We sought to evaluate the effect of melatonin, a potent antioxidant, as a protective strategy against contrast-induced acute kidney injury (CI-AKI), with a focus on molecular mechanisms.
Methods: We randomized patients with an eGFR <60 mL/min/1.73 m2 undergoing coronary angiography (CAG) into melatonin (10 mg twice daily) and placebo groups. Treatment commenced 48 h before CAG and continued for 6 days. The primary outcome was the incidence of CI-AKI; secondary outcomes included kidney function, oxidative stress, circulating mitochondrial function, and cell death pathways.
Results: CI-AKI occurred in 25% of melatonin-treated patients compared to 60% in the placebo group ($p = 0.025$). Melatonin significantly reduced plasma NGAL levels and cellular oxidative stress at all time points, with lower mitochondrial oxidative stress observed at 48–72 hours. Additionally, mitochondrial respiration improved, and reductions in necrosis and necroptosis were noted at 24 hours post-CAG.
Conclusions: Melatonin administration effectively reduced the incidence of CI-AKI in CKD patients undergoing CAG. This protective effect was associated with decreased oxidative stress, enhanced mitochondrial function, and reduced cell death, suggesting melatonin as a promising preventive strategy for CI-AKI.

Keywords: Cell death; Contrast-induced acute kidney injury; Melatonin; Mitochondria; Oxidative stress

References:
Kusirisin P et al. J Cell Mol Med 27 (2023) 2059-2070
Ehrmann S et al. Intensive Care Med 44 (2018) 104-106

Funding Source(s): This work was supported by the NSTDA Research Chair grant from the National Science and Technology Development Agency Thailand (to NC); the Senior Research Scholar grant from the National Research Council of Thailand (to SCC); the National Research Council of Thailand (N41A640112 to NA, N35A650175 to PK); the Chiang Mai University Center of Excellence Award (to NC); the grant from Faculty of Medicine, Chiang Mai University (117/2564 to PK); and the National Kidney Foundation of Thailand (to PK).



Graphical abstract: Melatonin administration significantly reduced the incidence of contrast media-induced acute kidney injury in chronic kidney disease patients undergoing coronary angiography.

Beta-Glucan Coated PVP/CA Electrospun Nanofiber Mat as a Potential Scaffold for Dental Tissue Regeneration

Thanutham Somboonchokephisal [1,2], Pratchaya Tipduangta [3], Sarawut Kumphune [4,5] and Tanida Srisuwan [6,*]

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Regenerative endodontic procedures (REPs) represent a modern approach in dentistry based on tissue engineering principles, yet further development is required to improve treatment outcomes. Beta-glucan (BG), a natural polysaccharide with bioactive properties, exhibits promising regenerative potential and may serve as a beneficial component in REPs. This study aimed to develop and optimize a BG-incorporated electrospun polyvinylpyrrolidone/cellulose acetate (PVP/CA) blended nanofiber scaffold for potential application in REPs. Electrospun PVP/CA nanofiber mats were fabricated and subsequently coated with BG. The optimal PVP/CA ratio and BG content were determined through biocompatibility assessments using human apical papilla cells (hAPCs). Selected scaffold formulations were then evaluated for morphological characteristics, chemical composition, BG content, water absorption capacity, and degradation behavior. The results demonstrated that optimized scaffolds preserved nanofiber morphology, achieved effective BG deposition, and supported hAPC viability at selected concentrations. Quantitative analysis confirmed BG incorporation, while Fourier-transform infrared (FTIR) spectroscopy revealed potential interactions between BG and the PVP/CA nanofiber matrix. BG incorporation also enhanced water absorption and facilitated progressive increases in porosity during scaffold degradation. These findings support the potential of this scaffold as a bioactive, degradable platform for REPs.

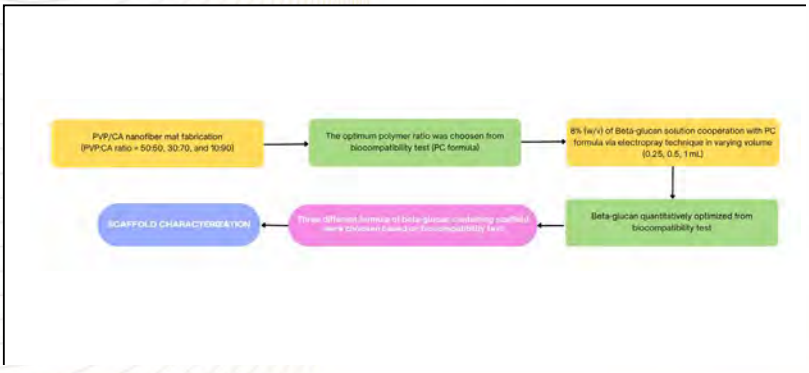
Keywords: polysaccharides; Beta-glucan; dentistry; regenerative endodontic; stem cells.

References:

Journal of Dental Sciences 20 (2025) 1546-1553.
Wound Practice and Research 33 (2025) 79-96.

Funding Source(s): Fundamental Fund of Thailand Science Research and Innovation (TSRI)

Graphical Abstract



Molecular Epidemiology of Human Rotavirus in Post-Vaccination Era in Chiang Mai, Thailand

Pattara Khamrin[1], Kattareeya Kumthip[1], Niwat Maneekarn[1,*]
[1] *Department of Microbiology, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand*
[*] *E-mail: niwat.m@cmu.ac.th*

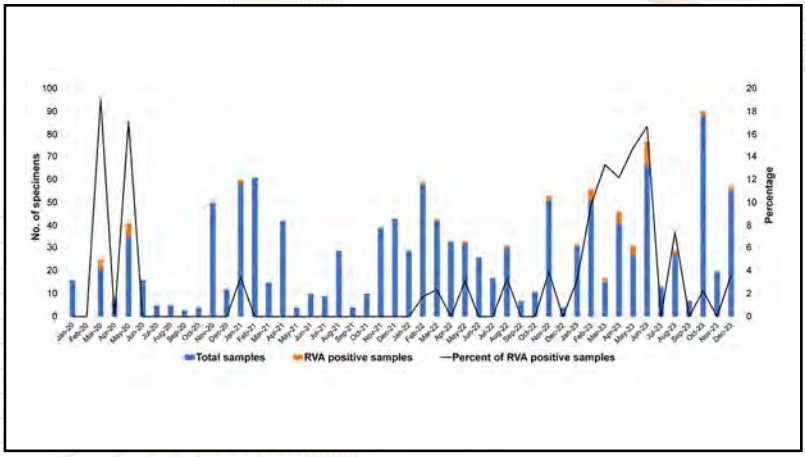
Rotavirus is the most common causative agent that causes acute gastroenteritis in young children. Recently, with the effective implementation of rotavirus vaccines globally, the mortality caused by rotavirus declined significantly. The purposes of this study were to conduct the epidemiological study and to characterize rotavirus strains circulating in pediatric patients in the post-vaccination era in Thailand from 2020 to 2023. A total of 1,192 stool specimens were collected from children admitted to hospitals, from January 2020 to December 2023. Rotavirus was screened by real-time PCR and positive samples were further analyzed for their G and P genotypes by nucleotide sequencing. Of the 1,192 samples, 5.0% (60 samples) were positive for rotavirus. Detection rates were 6.2% in 2020, 3.3% in 2021, 1.9% in 2022, and 8.2% in 2023. Rotavirus genotypes G3P[8] (55.0%), G8P[8] (15.0%), and G1P[8] (13.2%) were the most prevalent. Additionally, several uncommon rotavirus strains, including G1P[6], G3P[9], G5P[8], G9P[4], and G3P[23], were detected at low prevalence rates. When comparing the rotavirus detection prevalence in this study to the studies from the pre-vaccination period (2018–2019) (1), we observed a decrease in prevalence from 17.9% to 5.0%. These imply that the rotavirus vaccine has effectively reduced infections in pediatric population.

Keywords: Rotavirus, Diarrhea, Genotype, Vaccine, Thailand

References:
Infect Genet Evol. 95 (2021) 104898.

Funding Source(s): Research Group Development (RG 37/2566)

Graphical Abstract



Design and Construction of Dust Collector with Evaporative Condensation- Growth Particle Scrubber

Pimphram Setaphram, Pongwarin Charoenkitkaset, Mana Saedan, Apiruk Hokpunna, Watcharapong Tachajapong, Yuttana Mona and Woradej Manosroi*
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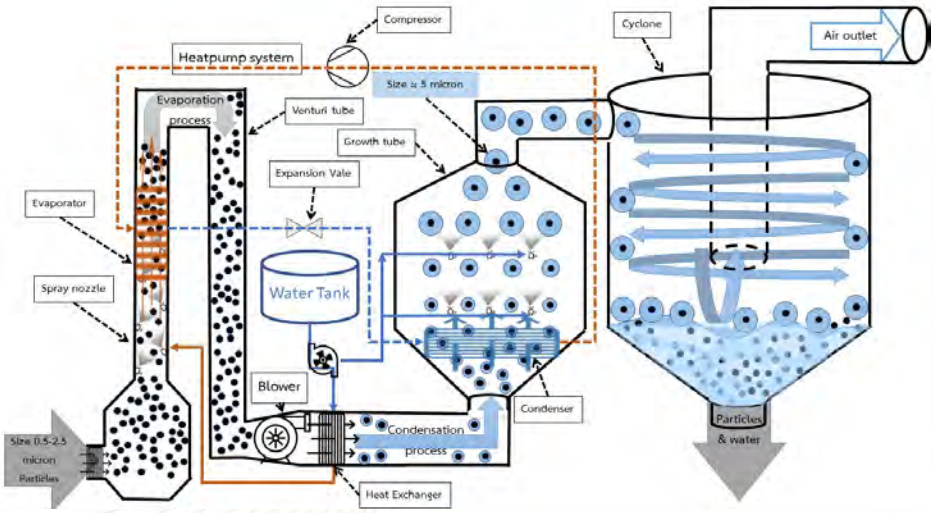
This research project aims to develop a prototype of a real-scale Evaporative Condensation Particle Growth Scrubber (ECPGS) for dust capture. The service area is the Nakhonping Energy Research and Development Institute Building, which has a floor area of 304 square meters and a volume of 2,161 cubic meters (with a high ceiling), operating at an airflow rate of 9,500 cubic meters per hour. The concept behind this research is to enlarge fine particulate matter by means of water vapor condensation. This is a novel approach that differs from conventional CPGS systems, which typically utilize waste steam from steam turbines and Venturi scrubbers. This research leverages the variation in air's moisture-holding capacity as a function of air pressure, based on the following steps:

1. Compressed air is passed through a Venturi tube to create a low-pressure condition, allowing the air to absorb more water vapor.
2. The air is then humidified by spraying fine water droplets to bring it close to saturation.
3. The saturated air is introduced into a Growth Tube, where the pressure is increased and the airspeed is reduced. This results in condensation of water vapor onto dust particles, increasing their diameter to approximately 5 microns.
4. The water droplets containing dust are then passed through a cyclone, where centrifugal force causes the droplets and dust to be separated and collected in a bottom storage tank.

During steps 1 and 2, the evaporation of water draws energy from the air and environment to support the phase change. In step 3, the air temperature increases and heat is released to the surrounding air. Therefore, the ECPGS innovation in this project is capable of simultaneously reducing particulate matter and lowering the temperature of incoming air into the building. Furthermore, it does not require filter replacement throughout its operational life, resulting in lower long-term costs compared to the use of HEPA filters.

Keywords: particles, venturi tube, HEPA filters

Funding Source(s): the Fundamental Fund 2024 by Chiang Mai University



Alterations of Plasma Metabolomes and Their Correlations with Immunogenicity in Maintenance Hemodialysis Patients Receiving Different COVID-19 Vaccine Regimens

Phoom Narongkiatikhun[1], Chanisa Thonusin[2,3,4], Sirawit Sriwichaiin[2,3,4], Wichwara Nawara[3,4], Kanda Fanhchaksai[5], Nuttanun Wongsarikan[6], Sirinart Kumfu[2,3,4], Nipon Chattipakorn[2,3,4], Siriporn C. Chattipakorn[3,4,7*]

[1]Division of Nephrology, Department of Internal Medicine, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand [2]Cardiac Electrophysiology Unit, Department of Physiology, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand [3]Cardiac Electrophysiology Research and Training Center, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand [4]Center of Excellence in Cardiac Electrophysiology Research, Chiang Mai University, Chiang Mai, Thailand [5]Division of Hematology and Oncology, Department of Pediatrics, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand [6]Department of Internal Medicine, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand [7]Department of Oral Biology and Diagnostic Sciences, Faculty of Dentistry, Chiang Mai University, Chiang Mai, Thailand

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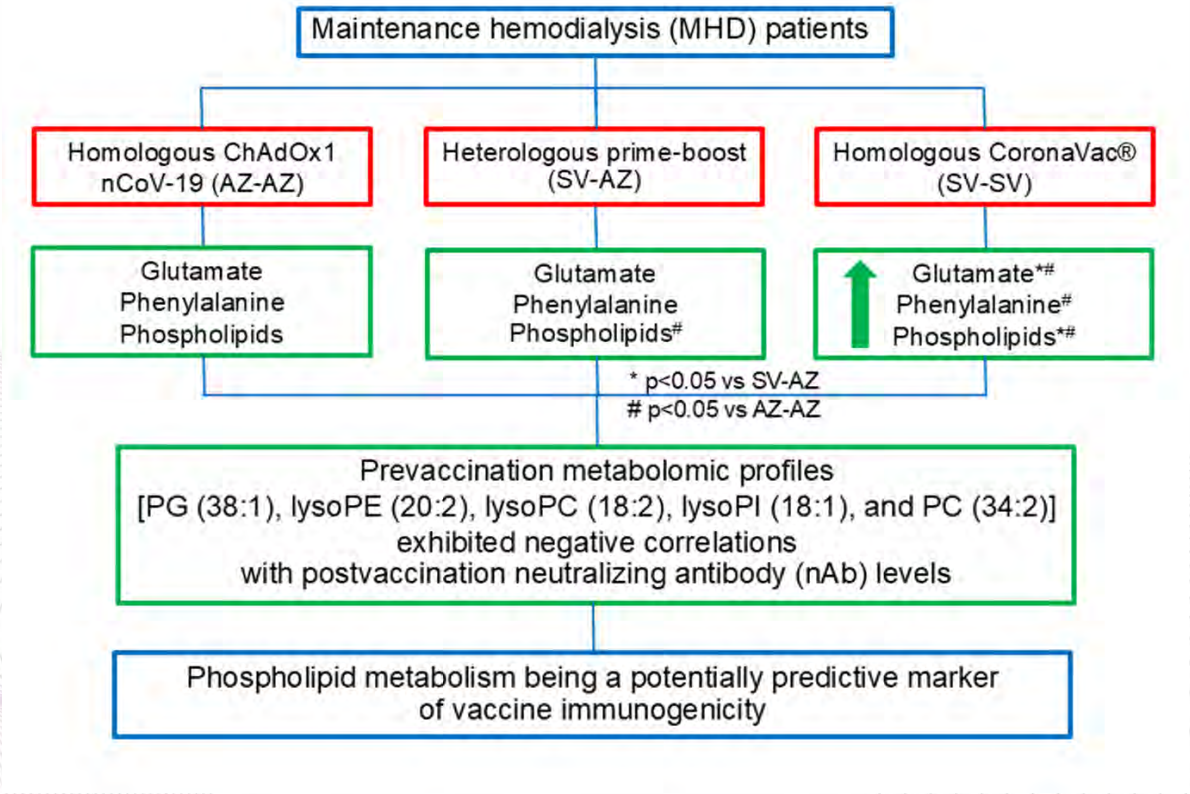
Compared to the general population, patients receiving maintenance hemodialysis (MHD) have weakened immune responses and are therefore less immunogenic to the COVID-19 vaccine (1). It is still unclear which metabolomic factors affect MHD patients' response to the COVID-19 vaccine. Thirty MHD patients participated in a cross-sectional study in which they were split into three vaccine regimen groups (N = 10/group): heterologous prime-boost (SV-AZ), homologous CoronaVac® (SV-SV), and homologous ChAdOx1 nCoV-19 (AZ-AZ). In order to use targeted metabolomics to analyze 92 metabolomic levels, plasma samples were taken both at baseline and 28 days following the last dosage. Thirty MHD patients with comparable neutralizing antibody (nAb) levels across vaccination regimens were included in the study. The most significant differences in metabolomics were found between AZ-AZ and SV-SV, followed by SV-AZ versus SV-SV, and AZ-AZ versus SV-AZ. Overall, phospholipids and amino acids like glutamate and phenylalanine were involved in metabolomic alterations. Postvaccination nAb levels were negatively correlated with prevaccination metabolomic profiles. Different COVID-19 vaccine regimens had unique interactions with the immune response in MHD patients. Both phospholipid and amino acid metabolism are important for the formation of nAb, and phospholipid metabolism may be a predictor of vaccine immunogenicity in patients with MHD (2).

Keywords: COVID-19; hemodialysis; plasma metabolomes; vaccine; vaccine immunogenicity.

References:

Kidney International 101 (2022) 883–894.
Physiol Rep 12 (2024) 1-11.

Funding Source(s): Fundamental Fund 2024, Chiang Mai University and also Thailand Science Research and Innovation (TSRI)


Maintenance hemodialysis (MHD) patients
Homologous ChAdOx1 nCoV-19 (AZ-AZ)
Heterologous prime-boost (SV-AZ)
Homologous CoronaVac® (SV-SV)
Glutamate
Phenylalanine
Phospholipids
Glutamate
Phenylalanine
Phospholipids#
Glutamate*#
Phenylalanine#
Phospholipids*#
* p<0.05 vs SV-AZ
p<0.05 vs AZ-AZ
Prevaccination metabolomic profiles
[PG (38:1), lysoPE (20:2), lysoPC (18:2), lysoPI (18:1), and PC (34:2)]
exhibited negative correlations
with postvaccination neutralizing antibody (nAb) levels
Phospholipid metabolism being a potentially predictive marker
of vaccine immunogenicity

Development and Commercialization of a Rapid Diagnostic Tool for Medical Mycology

Kritsada Pruksaphon [1, 2], Artid Amsri [3, 4], Patcharin Thammasit [4], Joshua D Nosanchuk [5], Sirida Youngchim [4*]

[1]Department of Medical Technology, School of Allied Health Sciences, Walailak University, Nakhon Si Thammarat 80160, Thailand, [2]Center of Excellence Research for Melioidosis and Microorganisms (CERMM),Walailak University, Nakhon Si Thammarat 80160, Thailand, [3]Office of Research Administration, Chiang Mai University, Chiang Mai 50200, Thailand, [4]Department of Microbiology, Faculty of Medicine, Chiang Mai University, Chiang Mai 50200, Thailand, [5]Department of Medicine (Division of Infectious Diseases) Albert Einstein College of Medicine, Bronx, NY 10461, USA

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Cryptococcal meningitis remains a significant cause of mortality among people living with HIV in Thailand. Although effective diagnostic tools such as the CrAg® LFA exist, their high cost limits widespread accessibility in low-resource settings. There is an urgent need for affordable, accurate, and scalable diagnostic alternatives to improve early detection and clinical outcomes. To compare the diagnostic performance of a low-cost, in-house immunochromatographic test (ICT) using monoclonal antibody (MAb) 18B7 with the commercially available CrAg® LFA. A large-scale prototype of the MAb 18B7 ICT was developed for rapid detection of *Cryptococcus neoformans* glucuronoxylomannan (GXM) antigen using a single-antibody sandwich format. The prototype was produced under ISO 13485 standards to ensure quality and consistency. The in-house ICT demonstrated 99.10% sensitivity, 97.61% specificity, and 97.83% overall accuracy in a retrospective analysis of 580 clinical specimens from northern Thailand. The Cohen's kappa coefficient (κ) was 0.968, indicating excellent agreement with the reference test. The MAb 18B7 ICT offers a promising, cost-effective diagnostic alternative for cryptococcal meningitis. Its implementation could significantly support national and global efforts to eliminate cryptococcal-related deaths among HIV-infected individuals by 2030.

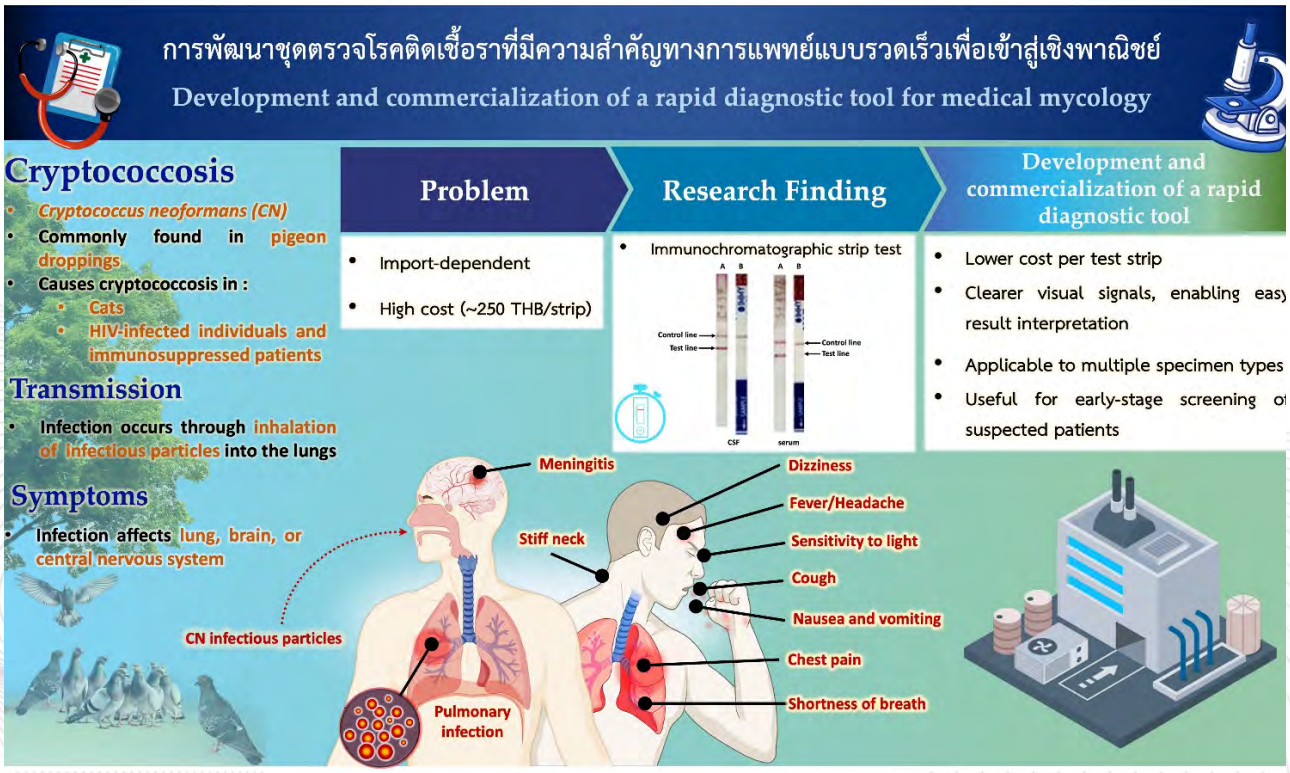
Keywords: *Cryptococcus neoformans*, Capsular polysaccharide antigen, Cryptococcosis, Fungal priority pathogen list, Glucuronoxylomannan (GXM), Immunochromatography, Lateral flow assay, Monoclonal antibody 18B7.

References:

Mycopathologia 189; (2024):75.

Funding Source(s): This research was funded by Chiang Mai University (Grant No. TGCMU 2566P009/2566)

Graphical Abstract



Happy Dentistry: Environmental Design for Mental Restoration in Dental Care Facility

Apichoke Lekagul[1], Chada Romcai[1*], Phattaranant Mahasantipiya[2], Yuthakran Aschaitrakool[2], Arnon Charuakkra[2], Thanapat Sastraruji[2], Punsak Pakdee[3]
[1]*Faculty of Architecture, Chiang Mai University, Thailand*
[2] *Faculty of Dentistry, Chiang Mai University, Thailand*
[3] *Faculty of Architecture and Environmental Design, Maejo University, Thailand*
[*]*E-mail: chada.r@cmu.ac.th*

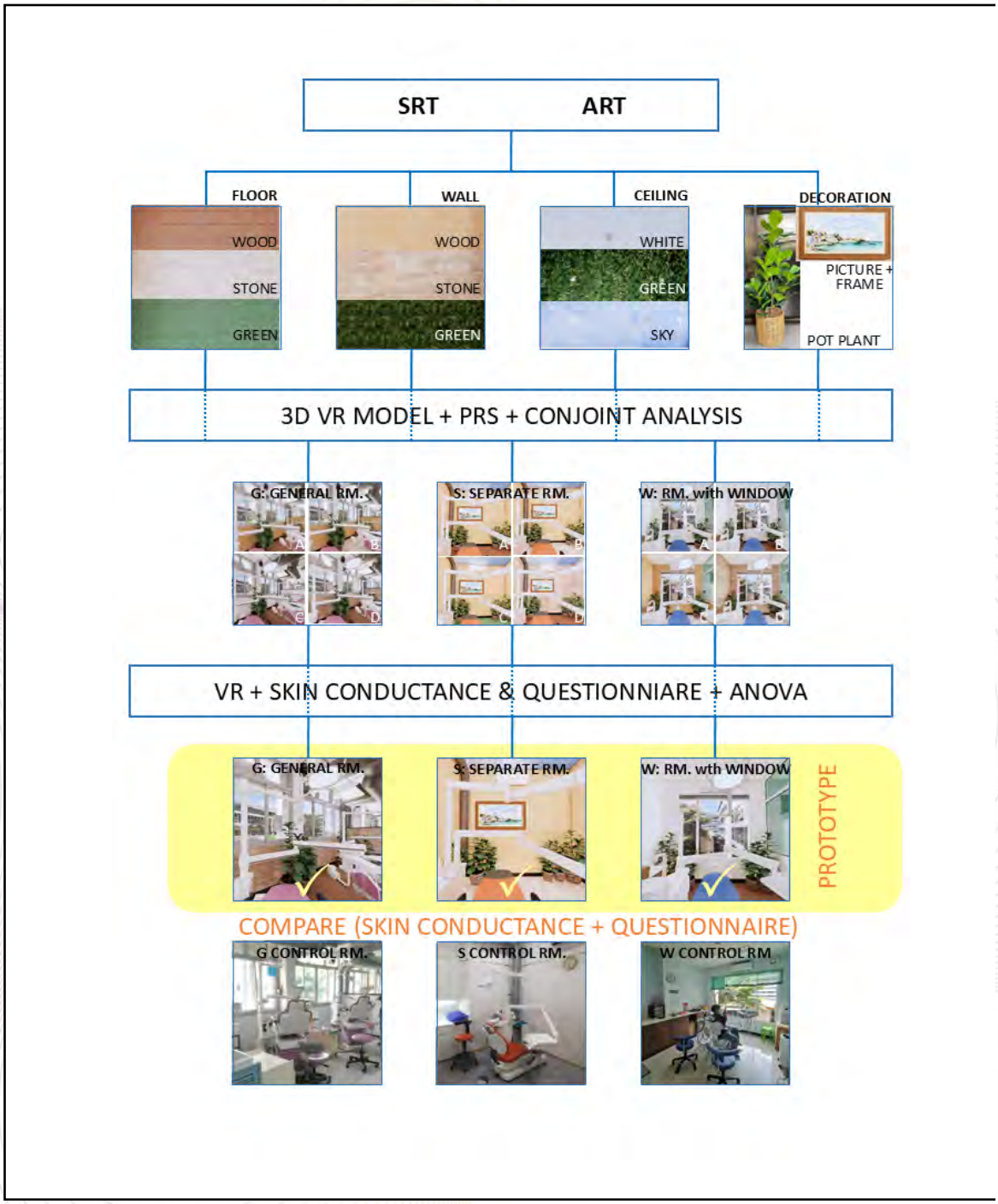
This research explores the design of restorative environments in dental clinics to reduce stress and support psychological recovery during dental procedures. Although routine, dental visits often provoke anxiety and discomfort, negatively impacting mental and physical well-being. Drawing on **Attention Restoration Theory (ART)** and **Stress Reduction Theory (SRT)**, this study investigates how integrating **biophilic design elements**—natural materials, patterns, and imagery—into dental treatment rooms can alleviate stress and improve attentional recovery.

The study is conducted in four phases: (1) identifying effective natural features through literature review; (2) filtering these features using 3D virtual reality simulations evaluated by 50 participants with conjoint analysis; (3) selecting the most effective design elements via psychological questionnaires and physiological skin conductance (SC) data from 400 participants across age groups; and (4) confirming restorative effects by implementing the selected features in three real-world dental room prototypes, comparing results to baseline rooms using t-tests.

Findings show that specific combinations of natural elements vary by room type but consistently reduce stress. Each prototype room significantly outperforms its baseline counterpart. These results confirm the **restorative impact of biophilic design** in dental treatment rooms, offering a scalable solution to enhance patient well-being and reduce dental anxiety through environmental design.

Keywords: restorative environment, stress reduction theory, attention restoration theory, dental examination room, dental fear and anxiety-DFA

Funding Source(s): Targeted Research Grant, Chiang Mai University


SRT
ART
FLOOR
WOOD
STONE
GREEN
WALL
WOOD
STONE
GREEN
CEILING
WHITE
GREEN
SKY
DECORATION
PICTURE + FRAME
POT PLANT
3D VR MODEL + PRS + CONJOINT ANALYSIS
G: GENERAL RM.
S: SEPARATE RM.
W: RM. with WINDOW
VR + SKIN CONDUCTANCE & QUESTIONNIARE + ANOVA
G: GENERAL RM.
S: SEPARATE RM.
W: RM. wth WINDOW
PROTOTYPE
COMPARE (SKIN CONDUCTANCE + QUESTIONNAIRE)
G CONTROL RM.
S CONTROL RM.
W CONTROL RM

Aging with Autonomy: Lifelong Learning and Relational Belonging in Thailand and Japan

Arratee Ayuttacorn[1,*], Soontree Siriinntawong[2], Maliwan Senawong[3], Kanokwan Somsirivarangkool[4]

[1,2,3,4]*Faculty of Social Sciences, Chiang Mai University, Thailand*

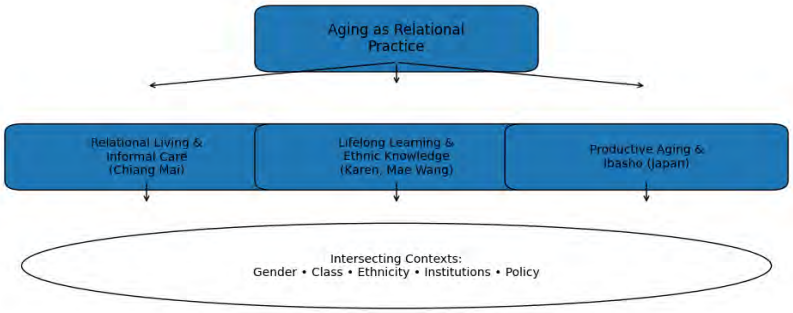
[*]*E-mail: arratee.a@cmu.ac.th*

This research cluster synthesizes three ethnographic studies that examine how older adults in Thailand and Japan experience aging amid diverse cultural and institutional settings. Drawing on sociological and anthropological frameworks, the studies explore how aging is shaped by gender, class, ethnicity, and broader social transformations. The first study investigates older adults living alone in urban and peri-urban Chiang Mai. Through interviews and observation, it finds that solitude can foster self-reliance, spiritual engagement, and autonomy in managing one's final years—challenging assumptions of dependency in old age. The second study focuses on Karen elders in Mae Wang district, whose understanding of lifelong learning emphasizes collective, intergenerational knowledge transmission. Rather than centering individual skill-building, their learning practices promote cultural continuity, gender equity, and ethnic identity. The third study examines Japan's Silver Human Resource Centers and the concept of *Ibasho*, showing how flexible reemployment and community belonging support autonomy and social value in later life under welfare capitalism. Together, these studies reframe aging as an active, relational process. The research calls for policies that support informal care, culturally grounded lifelong learning, flexible labor systems, and participatory approaches that respect older adults' agency and diversity.

Keywords: Aging, lifelong learning, relational belonging, autonomy, Karen ethnicity, Ibasho

References:
Journal of Social Sciences, Chiang Mai University. Volume 37 number 1 (2025), 103-187.

Funding Source: Fundamental Fund (2024), Thailand Science Research and Innovation



Accuracy of the Model Derived From Red Blood Cell Indices in Predicting α0-Thalassemia Trait Among Non-Anemic Pregnant Women

Atiphoom Thiamkaew[1], Pimlak Charoenkwan[2,3], Theera Tongsong[1], Phudit Jatavan[1*]
[1] *Department of Obstetrics and Gynecology, Thailand* [2] *Department of Pediatrics, Thailand* [3] *Thalassemia and Hematology Center, Faculty of Medicine, Chiang Mai University, Chiang Mai, 50200, Thailand*
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The study aims to establish prediction model derived from red blood cell indices to improve the accuracy of α0-thalassemia trait screening in non-anemic pregnant women. Method: A diagnostic study as secondary analysis on the prospective database was conducted. The participants were pregnant women, undergoing α0-thalassemia screening at first visit antenatal care using red blood cell indices with confirmation by PCR method. Diagnostic performance of each of red blood cell parameter and their combination derived from logistic regression analysis in predicting α0-thalassemia trait were determined. The total 587 Thai pregnant women were included in the analysis, consisting of 136 cases of α0-thalassemia trait and 451 normal controls. Diagnostic performance analysis revealed that, the mean corpuscular volume (MCV) provided a sensitivity of 98.5 % and a false positive rate of 20.2 %. While The mean corpuscular hemoglobin (MCH) provided a sensitivity of 99.3 % and a false positive rate of 15.7 %. The combined-parameters prediction model including hemoglobin (Hb), MCV, MCH, mean corpuscular hemoglobin concentration (MCHC), red cell distribution width (RDW), and red blood cell (RBC) count, demonstrated excellent diagnostic performance with an area under the curve (AUC) of 0.992, sensitivity of 99.3 %, and much lower false positive rate of 4 %. Interpretation: The combined-parameter prediction model provided excellent diagnostic performance with low false positive rate. The application of the prediction model could decrease unnecessary PCR method for α0-thalassemia testing, thereby decreasing the cost of investigation. Our proposed model can possibly have a great impact or significant change in clinical practice, especially in Southeast Asia.

Keywords: alpha0-thalassemia, Mean corpuscular volume, Mean corpuscular hemoglobin, Red blood cell indices, Thalassemia screening

References:

N. Engl. J. Med., 371 (2014) 1908–1916.
BMC Pregnancy Childbirth, 23 (2023) 100.

Funding Source(s): Chiang Mai University Research Fund CMU-2567

Application of Digital Polymerase Chain Reaction (dPCR) in Non-Invasive Prenatal Testing (NIPT)

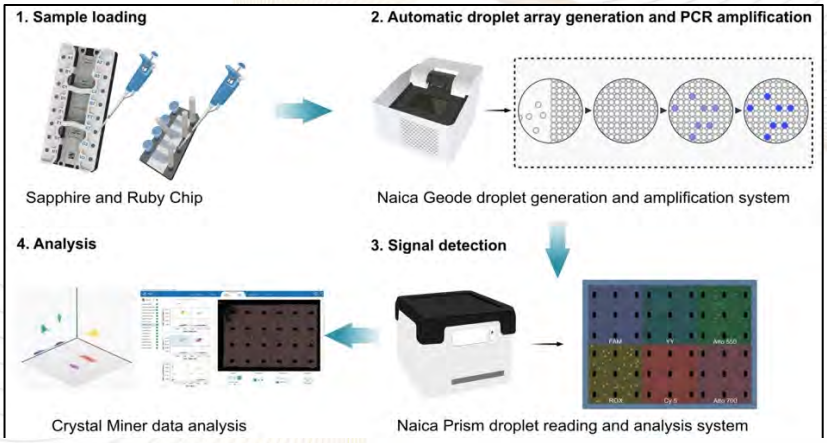
Ying Guo[1,2], Pimlak Charoenkwan[3,4], Kuntharee Traisrisilp Muenphinit[1], Wirawit Piyamongkol[1], Fuanglada Tongprasert[1,*]

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The objective of this article is to review the current applications of the digital polymerase chain reaction (dPCR) in non-invasive prenatal testing (NIPT) and explores its potential to complement or surpass the capabilities of Next-Generation Sequencing (NGS) in prenatal testing. The growing incidence of genetic disorders in maternal–fetal medicine has intensified the demand for precise and accessible NIPT options, which aim to minimize the need for invasive prenatal diagnostic procedures. Cell-free fetal DNA (cffDNA), the core analyte in NIPT, is influenced by numerous factors such as maternal DNA contamination, placental health, and fragment degradation. dPCR, with its inherent precision and ability to detect low-abundance targets, demonstrates robustness against these interferences. Although NGS remains the gold standard due to its comprehensive diagnostic capabilities, its high costs limit widespread use, particularly in resource-limited settings. In contrast, dPCR provides comparable accuracy with lower complexity and expense, making it a promising alternative for prenatal testing.

Keywords: digital PCR (dPCR), non-invasive prenatal testing (NIPT), chromosomal aneuploidy, chromosomal microdeletions and microduplications, monogenic disease

Funding Source(s): Chiang Mai University



Graphic Abstract: Overview of the Stilla Technologies' Naica Crystal Digital PCR system (Stilla Technologies, Villejuif, France) workflow. Adapted from the Stilla Naica System Brochure, with permission from Stilla Technologies

Performance of the Fetal Medicine Foundation (FMF) Model in the Third Trimester for Predicting Late-Onset Pregnancy-Induced Hypertension Among Thai Pregnant Women

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2 Fetal Center, Faculty of Medicine, Chiang Mai University, Thailand
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To evaluate the accuracy of third-trimester screening for late-onset pregnancy-induced hypertension (PIH) using the Fetal Medicine Foundation (FMF) prediction model, based on mean arterial pressure (MAP), uterine artery pulsatility index (UtPI), placental growth factor (PlGF), and their combinations. A prospective diagnostic study was conducted in singleton normotensive pregnancies. MAP, UtPI, and PlGF were measured between 30 and 34 weeks. The primary outcome was the development of PIH. The diagnostic performances of each marker, and their combinations, were evaluated using both the FMF model and Thai models specifically derived from this study. Of the 213 participants meeting the inclusion criteria, 18 (8.45%) developed PIH. Based on the FMF model, MAP, UtPI, and PlGF yielded areas under curve (AUCs) of 0.827, 0.631, and 0.857, respectively. The combination of MAP and PlGF achieved the highest AUC of 0.890, with a sensitivity of 66.7% at a 10% false-positive rate, better than 55.7 % and 44.4% provided by PlGF alone and MAP alone, respectively. Although UtPI alone demonstrated significant predictive value, it did not provide additional benefit when combined with other markers. Thai predictive models developed from the same dataset showed diagnostic performance comparable to that of the FMF model. The FMF model for predicting PIH, using the combination of PlGF and MAP in the early third trimester, demonstrated better diagnostic performance than MAP alone. This finding suggests that the FMF algorithm can be applied to the Thai population, although its performance is not as robust as that reported in Western populations.

Keywords: Fetal-Medicine Foundation; Mean arterial pressure; Placental growth factor; Pregnancy-induced hypertension; Uterine artery pulsatility index

References:

Am J Obstet Gynecol 215 *(*2016) e1-87.
Ultrasound Obstet Gynecol 52 (2018) 501-506.

Funding Source(s): Chiang Mai University/ R68IN00160

Advancing Psychiatric Care through Biopsychosocial Research: Breakthroughs from Chiang Mai University's Collaborative Network (2024-2025)

Benchalak Maneeton,* Narong Maneeton, Manit Srisurapanont, Chawisa Suradom, Sirijit Suttajit, Assawin Narkpongphun, Pichaya Pojanapotha, Nuntaporn Karawekpanyawong, Awirut Oon-Arom, Punjaree Wiriyacosol, Surinporn Likhitsathian, Suttipong Kawilapat

[1]*Department of Psychiatry, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand*

The summary of 11 research studies, published in 2024-2025, highlights the outstanding achievements of our research group in advancing the field of psychiatry. Uniting expertise in education, mental health service, and translational research, our work exemplifies a commitment to excellent outcomes and social impact for Chiang Mai University in the 21st century. Employing robust methodologies—including systematic reviews, meta-analyses, surveys, and qualitative research—these studies address four core themes: (1) drug efficacy and safety in neuropsychiatric conditions such as Parkinson's disease, autism, and ADHD; (2) the influence of environmental and social factors on mental health, particularly for vulnerable groups like children during the COVID-19 pandemic and those with chronic diseases; (3) identification and support of psychological risks among medical students; and (4) the lived experiences, challenges, and needs of LGBTQ+ individuals in both clinical and academic settings. Our research group thrives not only on internal expertise but also on robust collaborations with leading universities and healthcare organizations throughout Thailand and beyond. Many studies feature joint authorship and partnership with academic and medical institutions, allowing for more diverse participant recruitment, a broader range of clinical perspectives, and the sharing of innovative methodologies. This collaborative approach ensures our findings are relevant, generalizable, and directly applicable to clinical practice and policy. Collectively, these efforts contribute to Chiang Mai University's mission of excellence, delivering up-to-date knowledge, improving mental health outcomes, promoting equality, and ensuring measurable social benefits for the university and wider community.

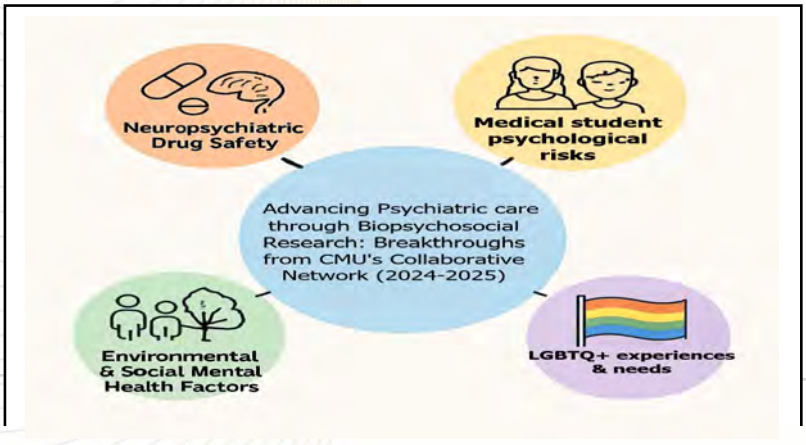
Keywords: Biopsychosocial, Mental health, Translational research, Neuropsychiatric disease, Psychiatric education

References:

Limveeraprajak N, Makkapavee W, Likhitsathian S, Srisurapanont M. Risk of agranulocytosis and neutropenia in patients with Parkinson's disease psychosis receiving clozapine treatment: A systematic review and meta-analysis. Gen Hosp Psychiatry 92 (2025) 4-11.

Maneeton P, Maneeton B, Winichaikul Y, Kawilapat S, Kienngam N, Maneeton N. Efficacy and tolerability of viloxazine compared to placebo on emotional, behavioral, and executive functioning in children and adolescents with ADHD: A systematic review and meta-analysis. Neuropsychiatr Dis Treat 21 (2025) 1029-1045.

Funding Source(s): Faculty of Medicine, Chiang Mai University, Thailand (Grant No. RG 2567)



The Impact of Particulate Matter in Chiang Mai on Human Inflammatory Responses and Vital Organ Functions

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[2]*Department of Biology, Faculty of Science, Chiang Mai University, Thailand,*
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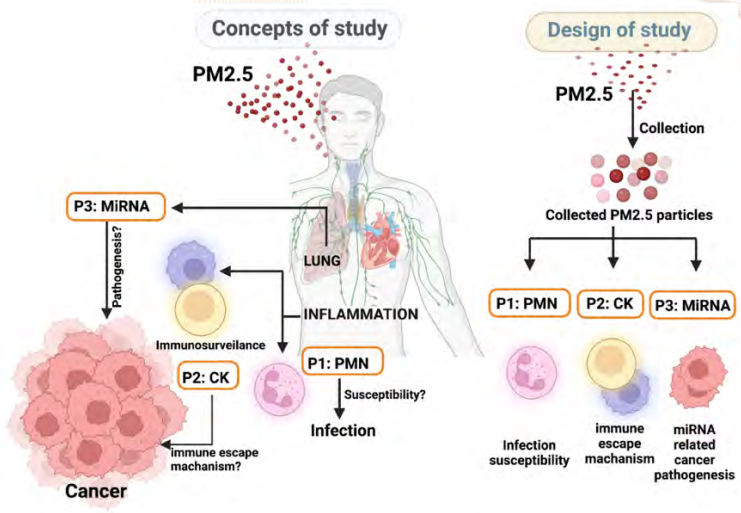
Chiang Mai's severe Particulate Matter (PM) 2.5 air pollution poses significant health risks, particularly concerning inflammatory responses and potential lung cancer exacerbation. Understanding PM-triggered inflammation is crucial for regional public health strategies. This study investigated three areas: 1) PM's impact on elderly human primary neutrophils exposed to bacterial infection; 2) PM2.5's effects on cancer immunosurveillance; and 3) air pollution's influence on microRNA profiles and lung cancer development. Our findings indicate that urban particulate matter (UPM) significantly increases neutrophil oxidative burst in healthy individuals, especially with bacterial co-exposure, stimulating pro-inflammatory cytokine production (IL-6, IL-8). While UPM didn't notably affect phagocytosis or bacterial killing, prolonged exposure in diabetics could worsen inflammation. We also observed that UPM might indirectly impair immune cell destruction of lung cancer cells (A549). Critically, UPM exposure altered blood microRNA profiles, with specific miRNAs (e.g., miR-542-3p, novel miRNA 203, miR-1-3p, miR-23a) showing changes similar to those in lung cancer patients, particularly after chronic exposure. These findings suggest certain miRNAs could serve as valuable biomarkers for chronic PM2.5 exposure and increased cancer risk. This research highlights the urgent need for targeted interventions to mitigate air pollution's health impacts in Chiang Mai.

Keywords: particulate matter, health, inflammatory responses, infection, lung cancer, Chiang Mai

References:

Atmosphere. (2023) https://doi.org/10.3390/atmos14020261

Funding Source: This research project was supported by Fundamental Fund 2024, Chiang Mai University.



Impacts of Particulate Matters on Elderly Health and Rehabilitation in Diabetes, Lung and Brain Functions

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[1]*Department of Medical Technology, Faculty of Associated Medical Sciences, Chiang Mai University, Thailand,*
[2]*Department of Physical Therapy, Faculty of Associated Medical Sciences, Chiang Mai University, Thailand,*
3Department of Occupational Therapy, Faculty of Associated Medical Sciences, Chiang Mai University, Thailand.
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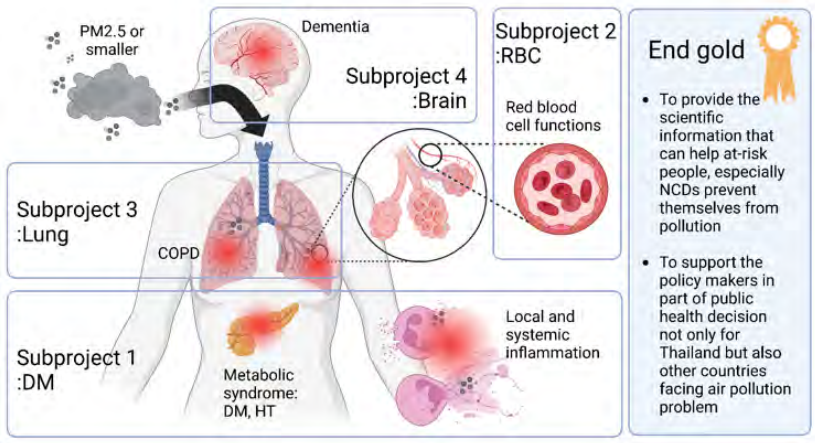
PM2.5 significantly impacts older adults' health, exacerbating chronic conditions and impairing cognitive functions. This longitudinal study in Sannameng, Chiang Mai, investigates varying PM2.5 exposure effects on diabetes markers, red blood cell parameters, lung function, and cognitive health in an aging population. Health data correlated with air quality records delineate the precise relationship between PM exposure and health outcomes. Our findings reveal PM2.5's clear adverse effects. A direct link emerged between PM2.5 and glycemic index or elevated inflammation markers (IL-8) in both diabetic and non-diabetic participants. Unexpectedly, moderate-to-high intensity lung rehabilitation, while enhancing expiratory muscle strength, significantly increased bronchial obstruction during high PM2.5 periods, suggesting heightened pollutant inhalation with increased activity. Brain activity analysis indicated older adults require greater cognitive effort to maintain performance in high PM2.5 conditions, implying reduced cognitive reserve. Ongoing RBC analysis explores anemia-related factors. These results underscore the urgent need for targeted public health interventions and stricter air quality regulations to protect vulnerable populations from air pollution's detrimental effects.

Keywords: community elderly, PM2.5, diabetes mellitus, red blood cells, pulmonary function, brain health

References:

1.*Biomolecules* (2023) https://doi.org/10.3390/biom14010035
2.*Environmental Research.* (2023) https://doi.org/10.1016/j.envres.2023.116519

Funding Source: This research was partially supported by Chiang Mai University.



Aptamer-Functionalized Gold Nanoparticle Assay for Rapid Visual Detection of Norovirus in Stool Samples

Maytawan Thanunchai [1,2,*], Sirikwan Sangboonruang [1,2,3], Natthawat Semakul [4], Kattareeya Kumthip [5,6], Niwat Maneekarn [5,6], Khajornsak Tragoolpua [1,2]

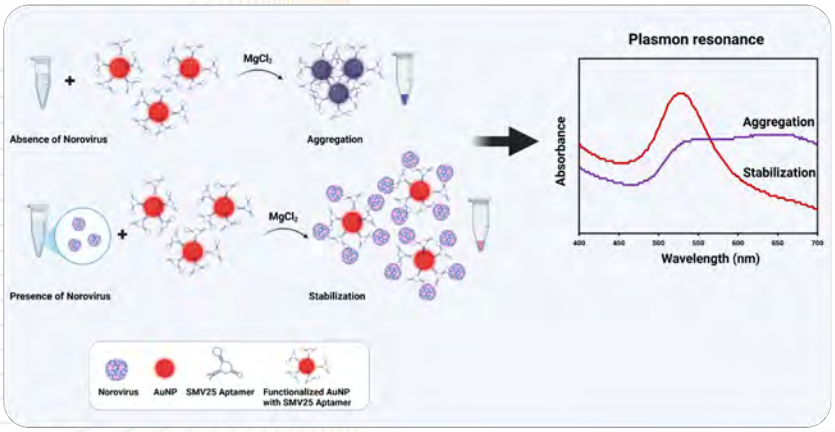
[1]Division of Clinical Microbiology, Department of Medical Technology, Faculty of Associated Medical Sciences, Chiang Mai University, Chiang Mai 50200, Thailand [2]Infectious Diseases Research Unit (IDRU), Faculty of Associated Medical Sciences, Chiang Mai University, Chiang Mai 50200, Thailand [3]Office of Research Administration, Chiang Mai University, Chiang Mai 50200, Thailand [4]Department of Chemistry, Faculty of Sciences, Chiang Mai University, Chiang Mai 50200, Thailand [5]Department of Microbiology, Faculty of Medicine, Chiang Mai University, Chiang Mai 50200, Thailand [6]Center of Excellence in Emerging and Re-Emerging Diarrheal Viruses, Chiang Mai University, Chiang Mai 50200, Thailand.
[*]E-mail: maytawan.tha@cmu.ac.th

Norovirus (NoV), a leading cause of acute gastroenteritis worldwide, imposes significant morbidity and economic burdens across all age groups. Timely and accurate laboratory diagnosis is crucial for effective outbreak control and patient management. However, current diagnostic methods often require specialized equipment, technical expertise, and considerable time. To address these challenges, we developed a visual detection method utilizing gold nanoparticles (AuNPs) functionalized with the SMV25 aptamer specific to the NoV capsid protein. Detection relies on $MgCl_2$-induced changes in the color and absorbance of these aptamer-functionalized AuNPs. The assay exhibited a good linear relationship between the A630/A520 absorbance ratio and NoV capsid protein concentration. Specifically, in a buffer system, this linearity ($R^2 = 0.9026$) was observed over a 0–32 ng/µL range with a limit of detection (LOD) of 9.65 ng/µL. Similarly, for NoV spiked into stool suspensions, a strong linear correlation ($R^2 = 0.9170$) was found across a 0–100 ng/µL range, with an LOD of 37.11 ng/µL. Evaluation with real stool samples yielded 77% sensitivity and 65% specificity. Notably, the assay demonstrated the highest sensitivity towards NoV GII.2 (100%), followed by GII.4 (78%). Scanning transmission electron microscopy confirmed the underlying aggregation and dispersion patterns of the aptamer-functionalized AuNPs. This colorimetric assay provides a simple, rapid, and visual method for NoV detection. Nevertheless, further enhancements are necessary to improve its performance in the direct testing of complex specimens, paving the way for future on-site detection applications, especially in resource-limited settings.

Keywords: Norovirus, gold nanoparticles, aptamer-based assay, colorimetric detection, point-of-care diagnostics

Funding Source(s): This research was supported by the CMU Research Fellowship Program.

Graphical Abstract



This work was published in Biosensors (Basel) in 2025.
Thanunchai M, Sangboonruang S, Semakul N, Kumthip K, Maneekarn N, Tragoolpua K. Aptamer-Functionalized Gold Nanoparticle Assay for Rapid Visual Detection of Norovirus in Stool Samples. Biosensors (Basel). 2025 Jun 16;15(6):387. doi: 10.3390/bios15060387.

Platelet-Lung Cancer Cell Interactions: Exploring Proliferation and Migration

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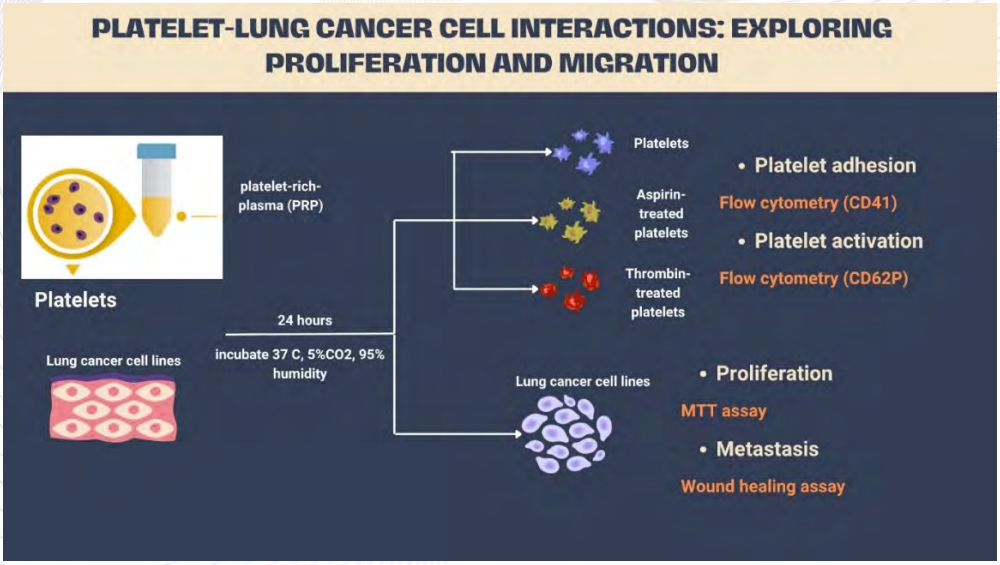
[*]*E-mail: yupanun.wuttiin@cmu.ac.th*

Lung cancer remains a leading cause of death globally, including in Thailand, with most patients diagnosed at advanced, metastatic stages. While platelets within the tumor microenvironment are linked to clinical outcomes, their precise impact on treatment response is unclear. This study investigated interactions between platelets and lung cancer cells, aiming to elucidate their relationship with cell migration and proliferation. Experiments used A549, H460, H1975, H2228, and HCC827 lung cancer cell lines. Platelet activation and adhesion were examined by flow cytometry under normal, aspirin-inhibited, and thrombin-activated conditions. Surprisingly, while all five lung cancer cell lines stimulated platelets, this did not universally promote cancer cell proliferation; A549 and H1975 cell growth were significantly enhanced, but not that of the other three. Aspirin significantly reduced platelet activation by A549 and H460, while platelet adhesion on the other three cell lines showed consistent cancer-mediated activation. After 24 hours of co-cultivation, treated lung cancer proliferation and migration were assessed by MTT and wound healing assays. Platelets demonstrated differential adhesion and activation across cell types, with varying effects on migration. Further research is needed to identify specific molecular mechanisms and to explore antiplatelet agents as adjunct therapy to improve lung cancer treatment outcomes.

Keywords: Lung cancer, Platelets, Tumor microenvironment, Cell proliferation, Cell migration

Funding Source(s): This research was supported by the Supported by CMU Junior Research Fellowship Program (R66IN00487).

Graphical Abstract



Factors Influencing Preventive Behavior Towards Particulate Matter 2.5 (PM 2.5) Among Pregnant Women

Sirirat Chaithaworn[1*], Nantaporn Sansiriphun[1], Jirawan Deeluea[1], Preeyakamon Krikitrat[1], Daniel Bressington[2]
[1]*Department of Obstetrics and Gynecology Nursing, Chiang Mai University, Thailand*
[2]*Nursing Department, Maharaj Nakorn Chiang Mai Hospital, Thailand*
[*]*E-mail: sirirat.sonted@cmu.ac.th*

Maternal exposure to PM2.5 has been shown to be associated with numerous adverse health outcomes affecting both the mother and the newborn. This study aimed to predict the relationship between individual perception, modifying factors and preventive behavior regarding PM 2.5 exposure among pregnant women. A cross-sectional survey was conducted among 325 pregnant women attending antenatal clinics at Maharaj Nakorn Chiang Mai Hospital and the Regional Health Promotion Center 1 Chiangmai, Thailand, from October to December 2024. Research instruments included a Demographic Data Questionnaire, the Perceptions Regarding PM 2.5 Questionnaire, and the Preventive Behavior Regarding PM 2.5 Exposure Questionnaire of pregnant women. Data were analyzed using descriptive statistics and stepwise multiple regression. The findings revealed that perceived susceptibility, perceived severity, perceived benefits, and education were significantly associated with preventive behavior ($p < 0.001$), collectively explaining 29.10% ($R^2 = 0.291$) of the variance in preventive behavior scores. In contrast, perceived barriers, age, occupation, income, extended family, parity, gestational age, complication during pregnancy were not significantly associated with preventive behavior ($p > 0.05$). These results suggest that interventions focusing on enhancing risk, severity, benefits, and education awareness may foster more effective PM 2.5 preventive behaviors among pregnant women.

Keywords: Preventive Behavior, Perceptions, Particulate Matter 2.5, Pregnant Women

References:

Songklanagarind Journal of Nursing 42 (2022) 35-62.
Journal of The Health Education Professional Association 35 (2022) 41-107.

Funding Source(s): Name of funding source(s)/grant(s) that support the reported work

CMU
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18-19 August 2025
CHIANG MAI UNIVERSITY

Factors Influencing Preventive Behavior Towards Particulate Matter 2.5 (PM 2.5) Among Pregnant Women

Sirirat Chaithaworn[1*], Nantaporn Sansiriphun[2], Jirawan Deeluea[3], Preeyakamon Krikitrat[4], Daniel Bressington[5]
[1-4]*Department of Obstetrics and Gynecology Nursing, Chiang Mai University, Thailand*
[5]*Nursing Department, Maharaj Nakorn Chiang Mai Hospital, Thailand*

Background

Maternal exposure to PM2.5 has been shown to be associated with numerous adverse health outcomes affecting both the mother and the newborn.



Objective

This study aimed to predict the relationship between individual perception, modifying factors and preventive behavior regarding PM 2.5 exposure among pregnant women.

Result

The findings revealed that perceived susceptibility, perceived severity, perceived benefits, and education were significantly associated with preventive behavior ($p < 0.001$), collectively explaining 29.10% ($R^2 = 0.291$) of the variance in preventive behavior scores.

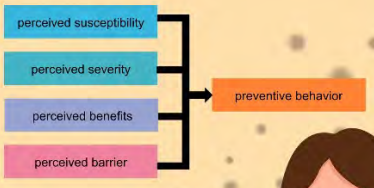
Predictive Factors	b	SE	t	p
perceived susceptibility	.354	.169	2.100	.036
perceived severity	.871	.160	5.450	<.001
perceived benefits	.481	.115	4.170	<.001
Above secondary education	2.832	1.279	2.220	.027

Constant = 37.167, SE = ±3.888, R^2 = .2910, adj. R^2 = .2822, F = 32.84, p < .001

Methods

A cross-sectional survey was conducted among 325 pregnant women attending antenatal clinics at Maharaj Nakorn Chiang Mai Hospital and the Regional Health Promotion Center 1 Chiangmai, Thailand, from October to December 2024. Research instruments included a Demographic Data Questionnaire, the Perceptions Regarding PM 2.5 Questionnaire, and the Preventive Behavior Regarding PM 2.5 Exposure Questionnaire of pregnant women. Data were analyzed using descriptive statistics and stepwise multiple regression.

Framework



Conclusion

These results suggest that interventions focusing on enhancing risk, severity, benefits and education awareness may foster more effective PM 2.5 preventive behaviors among pregnant women.



Reference

Songklanagarind Journal of Nursing Volume 42 No. 3 (2022) page 35-page 62.
Journal of The Health Education Professional Association Volume 35 number 1 (2022) page 41-page 107.

$PM_{2.5}$ impacts on health: Occurrence to sustainable outcomes for the Northern Thai population (Project PHOON)- Preliminary results

Tippawan Prapamontol[1*], Kongsak Boonyapranai[1], Sakaewan Ounjaijean[1], Surat Hongsibsong[1], Wason Parklak[1], Kanokwan Kulprachakarn[1], Hataichanok Chuljerm[1], Sothida Nantakool[1, 2], Busaba Chuatrakoon[2], Linda Aurpibul[1], Arunrat Tangmunkongvorakul[1], Patumrat Sripan[1], Anurak Wongta[1], Sawaeng Kawichai[1], Chanatip Choengphasuwan[1], Nattawadee Promkam[1], Nathaporn Thongjan[1], Kawinwut Somsunun[1], Kanyapak Kohsuwan[1], Kittipan Rerkasem[1], Kriengkrai Srithanawiboonchai[1], Khuanchai Suparatpinyo[1]

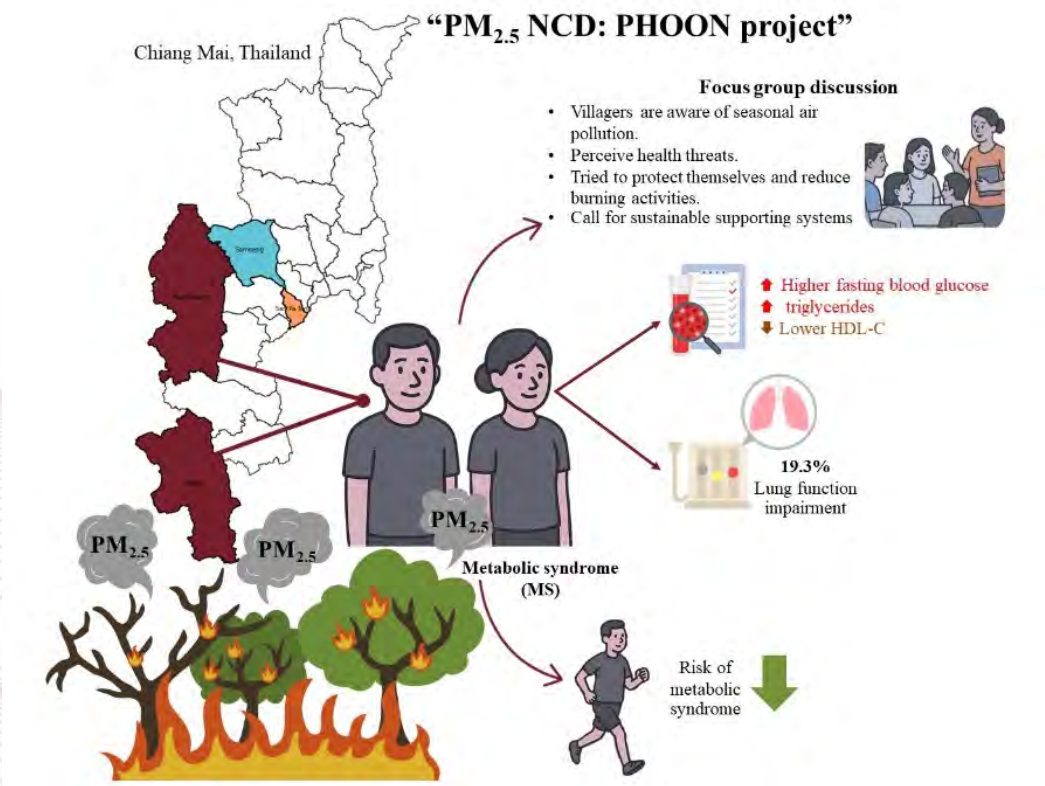
[1] *Research Institute for Health Sciences (RIHES), Chiang Mai University, Chiang Mai 50200, Thailand*
[2] *Associated Medical Sciences, Chiang Mai University, Chiang Mai 50200, Thailand*
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Upper northern Thai population have faced significant health challenges related to air pollution for decades. Exposure to particulate matters with aerodynamic diameter ≤ 2.5 micrometers ($PM_{2.5}$) has been globally reported associating to respiratory and cardiovascular issues but health related research study in northern Thailand is still scarce. The main objective of the study was to clarify the association of $PM_{2.5}$ exposure and non-communicable diseases (NCDs) among adult population in Chiang Mai Province. During the study period, March-April 2024, ambient $PM_{2.5}$ in Mae Chaem was elevated [median:77.1 (min-max: 29.6-135.5) $\mu g/m^3$). From the focus group study showed that the villagers were knowledgeable and aware of seasonal air pollution and the health threats. Lung function impairment was observed at 19.3% (n=207, aged 23 to 60 years old). In addition, we found that individuals living in high $PM_{2.5}$ with high level of physical activity had decreased risk of metabolic syndrome when compared to their counterparts (OR 0.19, 95%CI 0.06-0.63, $p<0.05$). Another sub-study of metabolic syndrome group showed significantly higher fasting blood glucose, and triglycerides, and lower HDL-C than controls ($p < 0.01$). More results will be presented.

Keywords: $PM_{2.5}$, Non-communicable Diseases (NCDs), Metabolic syndrome, Lung function test, Physical activity

References: -

Funding Source(s): Chiang Mai University [$PM_{2.5}$ and other Pollutants Related NCDs from Field to Cell to Bedside (FCB)].


"PM2.5 NCD: PHOON project"
Chiang Mai, Thailand
Focus group discussion
Villagers are aware of seasonal air pollution.
Perceive health threats.
Tried to protect themselves and reduce burning activities.
Call for sustainable supporting systems
Higher fasting blood glucose
triglycerides
Lower HDL-C
19.3%
Lung function impairment
PM2.5
PM2.5
PM2.5
Metabolic syndrome (MS)
Risk of metabolic syndrome

Enhancing local leaders and village health volunteers (VHVs) on reduction of exposure to $PM_{2.5}$, increasing community productivity and health impact protection: Preliminary results

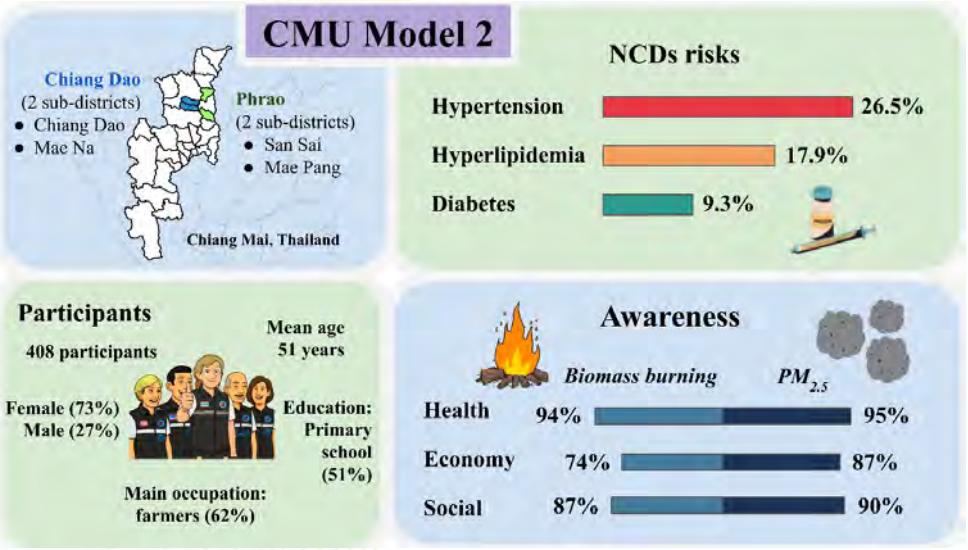
Tippawan Prapamontol[1]*, Sawaeng Kawichai[1], Anurak Wongta[1], Teetawat Santijitpakdee[1], Chanatip Choengphasuwan[1], Namthip Jaiinta[1], Yupa Chromkaew[2], Rattanaphon Chaima[3], Choochad Santasup[2]

[1] *Research Institute for Health Sciences (RIHES), Chiang Mai University, Chiang Mai 50200, Thailand*
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This project was implemented in two districts of Chiang Mai Province including, Chiang Dao and Phrao Districts with the objective of evaluating the knowledge, understanding, and health impacts of $PM_{2.5}$ (particulate matter with diameter ≤ 2.5 µm) among the Village Health Volunteers (VHVs). A total of 408 VHVs participants, the majority of whom were female with an average age of 51(min-max; 21-65) years old. Most participants were farmers (62%) and exhibited a high risk of developing non-communicable diseases such as hypertension (26.5%), hyperlipidemia (17.9%), and diabetes (9.3%). We found that the majority of VHVs perceived biomass burning as harmful to health (94%), the economy (74%), and social activities (87%). Similarly, $PM_{2.5}$ emissions resulting from burning were regarded as detrimental to health (95%), the economy (87%), and social activities (90%). These findings indicated a strong awareness among VHVs regarding the negative impacts of air pollution, particularly $PM_{2.5}$, on community well-being. In addition, the project also developed a community-based learning mechanism to disseminate information on $PM_{2.5}$ and health protection and introduction of DIY air purifiers, and training in safe agriculture practices aimed at reducing burning, improving soil health, and encouraging the cultivation of safe, sustainable crops.

Keywords: Air pollution health impacts, Non-Communicable Diseases (NCDs), Village Health Volunteers (VHVs), Good Health and well-being, Sustainable Agriculture

Funding Source(s): Chiang Mai University ($PM_{2.5}$ and other Pollutants Related NCDs from Field to Cell to Bedside (FCB))



CMU

Annual Research Summit 2025

Poster Presentation



Tourism, Hospitality & Creative Economy

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Gap Analysis and Development of Low Carbon Tourism in Chiang Mai Province Towards Sustainable Tourism Goals

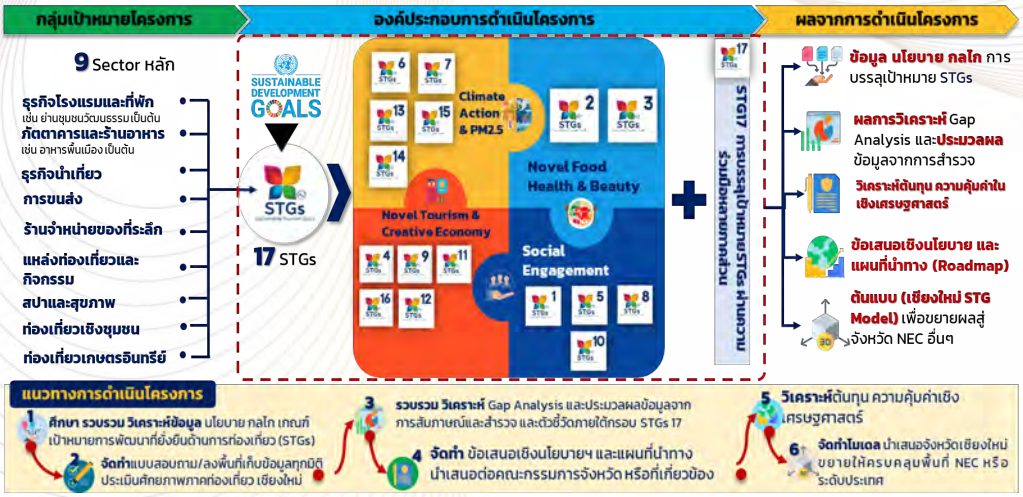
Wongkot Wongsapai[1,2*], Korawan Sangkakorn[3], Tassawan Jaitiang[3], Sudarat Auttarat[3], Thitinadda Chinachan[3], Sansanee Krajangchom[3], Ratchapan Karapan[3], Pachernwaat Srichai[3], Wasin Wongwilai[3], Nattasit Srinurak[3], Janjira Sukwai[3], Suwipa Champawan[3], Pongsathorn Dhumtanom[3], Det Damrongsak[2], Kanokwan Khiaolek[4,5], Walinpich Kumpiw[5]

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[2]*Department of Mechanical Engineering, Faculty of Engineering, Chiang Mai University, Chiang Mai, Thailand*
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**Email: wongkot@eng.cmu.ac.th*

This project aims to analyze gaps and assess the potential for reducing greenhouse gas emissions (GHGs) in Chiang Mai's tourism sector, contributing to the sustainable tourism goals (STGs). Chiang Mai, a key province in the Northern Economic Corridor (NEC), welcomed 11.49 million tourists in 2024, generating 103.82 billion THB, representing 46.97% of northern tourism revenue and 3.73% of national tourism revenue. Gap analysis will be conducted across four dimensions: (1) management, (2) socio-economy, (3) culture, and (4) environment. The study includes surveys and interviews with 90 tourism-related establishments across 9 sectors including hotels, food and beverage, tour agencies, transportation, souvenirs, attractions and activities, spa and wellness, community-based tourism, and farm tourism. The total GHGs from these sectors amount to 15,303.72 tCO_2eq. To transition to low-carbon tourism, approximately 21,866.84 kWp of solar power would be needed, requiring 96,214.10 m^2 of land. Promoting renewable energy use in tourism can drive Chiang Mai toward net-zero emissions and environmentally conscious travel.

Keywords: Sustainable Tourism Goals; Greenhouse Gas Emission; Low Carbon City; Chiang Mai; Net Zero City

Funding Source(s): Targeted Research, Chiang Mai University, grant number TGCMU2566P046/2566



Survey on Roof Structures and Construction of Western-Influenced Buildings for Accurate Architectural Documentation and Local Heritage Awareness: A Case Study of Five Significant Western-Influenced Buildings in Phrae City

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Phrae Province is home to numerous valuable wooden buildings shaped by Western influences during the logging era of King Rama V, alongside the arrival of foreign merchants, Chinese traders, and Western missionaries. These buildings represent a fusion of Western styles and local traditions, forming a unique architectural identity. Although widely studied, most research has focused on appearance or historical and social aspects, with limited attention to structural systems or materials rooted in cultural exchange. This study explores the roof structures of five wooden buildings in Phrae that exhibit Western, Eastern, and Lanna influences. Using qualitative methods—including measured drawings, photography, and 3D modeling—it analyzes construction techniques, materials, and their cultural meanings. The findings aim to enhance historically grounded architectural conservation and promote community awareness. Ultimately, the research supports sustainable heritage tourism by offering a deeper understanding of the buildings' structural and cultural significance.

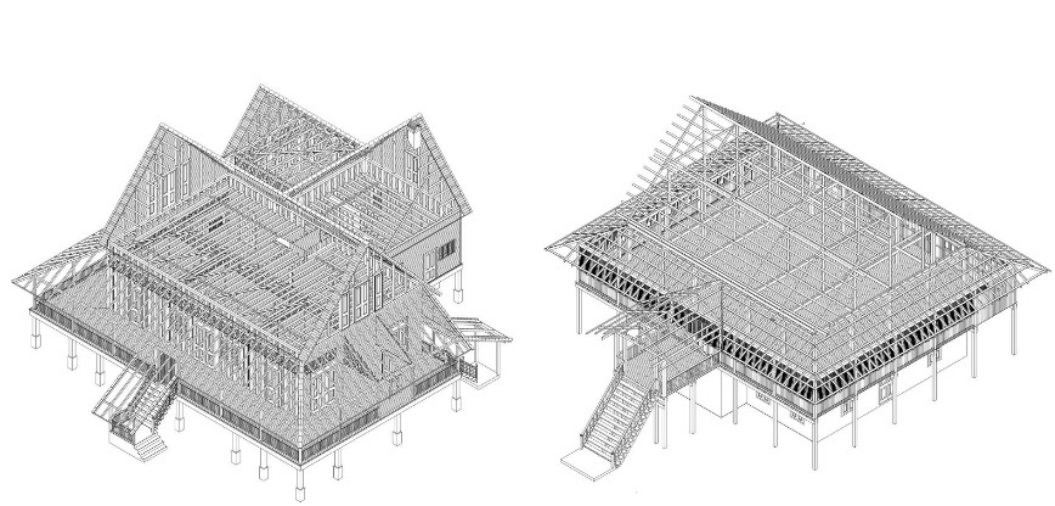
Keywords: Western-influenced architecture, Architectural conservation, Colonial buildings, Historic buildings in Phrae Province

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Funding Source(s): Junior Researcher Grant 2024, Chiang Mai University



The Carbon Neutral Platform Development of Tourism Industrial Sector : A case of Chiang Mai's Pilot Area.

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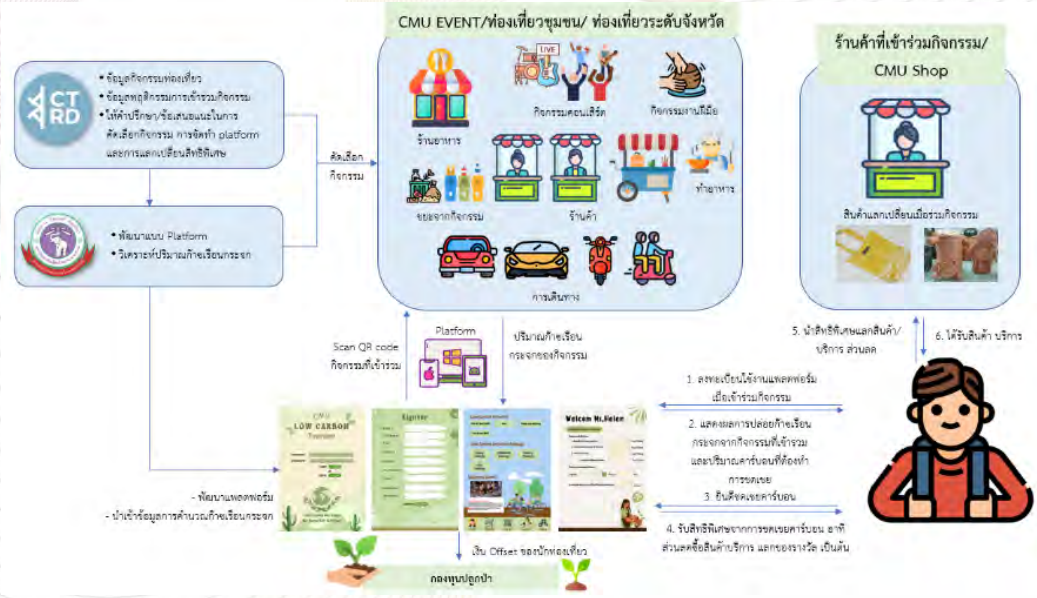
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The project aims to develop a Carbon Neutral Platform for the tourism sector in Chiang Mai as a pilot area. It aligns with Chiang Mai University's 13th Education Development Plan (2023–2027) and supports the university's Sustainable Development Goals (SDGs 8, 12, and 13). The platform will enable tourists to participate in carbon offsetting through self-guided tourism activities. It is expected to serve as a tool to raise awareness, knowledge, and understanding of greenhouse gas emissions among tourism operators and tourists, encouraging behavioral change towards emission reduction and promoting Carbon Neutral Tourism. The project will also explore incentive mechanisms to encourage tourist participation in carbon offsetting, offering rewards or privileges in exchange for their contributions. In addition, it will identify challenges and obstacles in platform development, extract lessons learned and propose guidelines for improving and expanding the platform's use in future tourism activities. The goal is to foster sustainable tourism using digital tools that support carbon neutrality in the tourism sector.

Keywords: Carbon Neutral Platform, Carbon Neutral Event, Sustainable Tourism Goal, Carbon Offset, Sustainable Development Goals

Funding Source(s): Targeted Research, Chiang Mai University, grant number TGCMU2566P042/2566 that support the reported work.



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Poster Presentation



Social Engagement

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Digitizing Intangible Lanna Culture: XR Approaches to Traditional Dance Preservation

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[*] *E-mail: Kitti.p@cmu.ac.th*

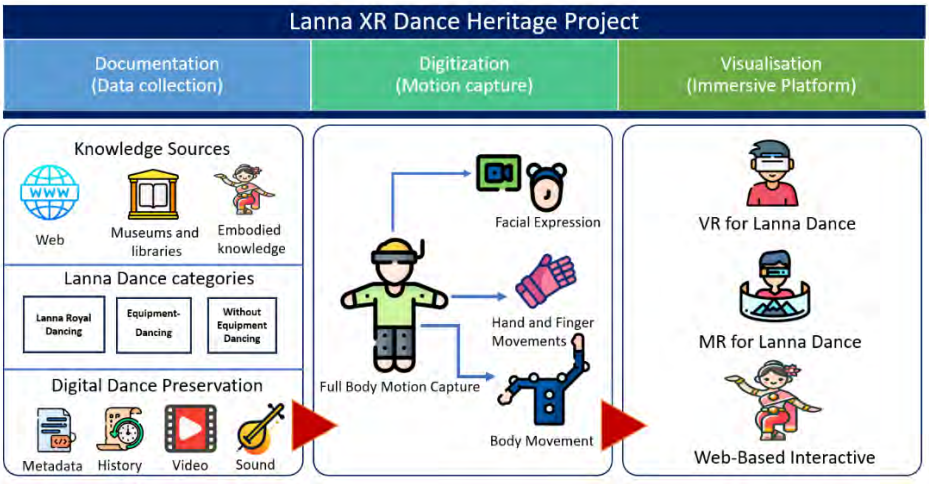
The preservation of intangible cultural heritage (ICH), such as traditional dance, faces growing challenges due to globalization and generational decline. This study introduces the Lanna XR Dance Heritage Project, which leverages Extended Reality (XR) technologies namely Virtual Reality (VR), Mixed Reality (MR), and web-based platforms to digitally preserve and promote Lanna Dance, a traditional art form from Northern Thailand. Using motion capture, the project records full-body, hand, and facial movements to ensure cultural authenticity. Twenty-four Lanna Dance forms are categorized into three groups: Equipment-Dancing, Without-Equipment Dancing, and Lanna Royal Dancing. The study evaluates the usability and engagement of the XR platforms with 90 university students using the System Usability Scale (SUS) and User Engagement Scale (UES). Results indicate that XR technologies offer immersive and interactive methods for preserving and learning traditional dance, enhancing accessibility and cultural sustainability. This research demonstrates how digital tools can support the transmission of traditional knowledge in contemporary contexts.

Keywords: Traditional Dance Preservation, Lanna Dance, Extended Reality, Intangible Cultural Heritage, Dance Visualization Systems

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Intawong, K., Worragin, P., Khanchai, S., & Puritat, K. (2025). Transformative Metaverse Pedagogy for Intangible Heritage: A Gamified Platform for Learning Lanna Dance in Immersive Cultural Education. Education Sciences, 15(6), 736.

Funding Source(s): Chiang Mai University



Status and Needs of Resource Room Services for Elementary Students with Learning Disabilities in Chiang Mai Inclusive Schools

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This study aims to synthesize key components of resource room management for students with disabilities, using data from Thailand, Japan, Turkey, Indonesia, and the United States. It examines general and specific conditions related to inclusive primary schools, with a focus on 27 model schools in Chiang Mai. The study involved 93 participants, including experts, administrators, teachers, and supervisors. Instruments included focus group guidelines, questionnaires, observation forms, and classroom surveys. Results showed that legal frameworks, collaboration, teacher qualifications, and school contexts influence resource room practices. In Chiang Mai, most schools used part-time resource room services and relied heavily on care providers with limited training. Teaching formats varied, with small groups or one-on-one sessions being most common. Major challenges included lack of trained teachers and limited instructional materials. The study also synthesized 15 essential components for effective resource room management, including legal foundations, screening practices, individualized education plans (IEPs), collaborative teaching, and professional support networks. These findings highlight the need for policy consistency, professional development, and tailored resources to support inclusive education.

Keywords: Learning Disabilities, Resource Rooms, Inclusive Education, Inclusive Model Schools, Teacher Needs

References:

Journal of Special Needs Education 12 (2022) 31–51.
International Journal of Inclusive Education 27 (2023) 1592–1610.

Funding Source(s): Targeted Research Development Grant, Chiang Mai University, Fiscal Year 2023



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Poster Presentation



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Synthesis of Indicators and Needs Assessment for Strengthening Teachers' Competencies to Incubate Students' Higher-Order Thinking and Innovation Competencies Aligned with Learning Ecosystem of Chiang Mai Education Sandbox Pilot Schools

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This research aimed to 1) synthesize indicators for developing teachers' learning management competencies to foster students' higher-order thinking skills and innovation competencies aligned with school learning ecosystems, and 2) assess developmental needs for these competencies. The study involved two groups: 9 experts for indicator synthesis and 372 teachers from pilot schools in Chiang Mai province, selected through multi-stage sampling from a population of 4,684 teachers. Research instruments included analysis forms for competency components synthesis, focus group discussions, and needs assessment questionnaires with 82 items across 4 components using a 5-point rating scale (reliability α = 0.991-0.993). Data analysis employed content analysis for indicator synthesis and PNI modified index for needs assessment with priority ranking. Findings revealed four main competency components: 1) learning design ability, 2) student-centered learning management, 3) innovative technology utilization and development, and 4) learning measurement and evaluation. Teachers demonstrated highest developmental needs in student-centered learning management (PNI modified = 0.373), followed by learning design ability and assessment (PNI modified = 0.342). The five highest-priority indicators were: developing school-parent-community learning networks, organizing activities for higher-order and innovative thinking, providing student participation opportunities in learning design, creating appropriate assessment tools, and utilizing diverse teaching models/techniques.

Keywords: Teachers' Competencies, Higher-Order Thinking Skills, Learning Innovation, Learning Ecosystem, Education Sandbox

Funding Source(s): This research was partially supported by Chiang Mai University

Lanna Wisdom and Creativity in Watershed Management Media Innovation through Contemporary Performing Arts

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This research explores the integration of traditional Lanna performing arts with community-based environmental knowledge to foster sustainable watershed management in Northern Thailand. Focusing on Ban Ko village in Lamphun Province, the study employs qualitative and practice-led methodologies—ethnographic interviews, field observation, and artistic collaboration—to investigate how local wisdom, memory, and creativity can be translated into meaningful environmental communication. Two creative works were developed. The first draws from forest beliefs and uses bodily movement, traditional instruments, and silence to evoke spiritual ties with nature. The second centers on a newly composed *phleng so* (Lanna poetic song) titled *"Ban Ko's Stream of Renewal,"* which combines community interviews, images, and performance to narrate the village's watershed conservation efforts. Both works incorporate Lanna dance as a primary expressive medium. These creative processes reveal that Lanna performing arts can function as a "language of nature"—a sensory, embodied mode of storytelling rooted in rhythm, sound, and place. By combining traditional ecological knowledge with digital media and artistic research, the study proposes a replicable model for using art to raise environmental awareness and engage communities. It also opens space to question the role of digital platforms, sustainability of artistic intervention, and the transformative potential of localized performance in times of ecological change.

Keywords: Lanna Performing Arts, Watershed Conservation, Artistic Research, Community Engagement, Cultural Ecology

Acknowledgement:

This research was supported by the Young Researcher Development Grant, Chiang Mai University, fiscal year 2023. It is part of the creative research project titled *"The Wisdom Intelligence and Creativity in Watershed Management of Lanna Community: The Media Presentation of Contemporary Lanna Performing Arts."*

Research Project on Law and Society

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Passakorn Yeenang[1], Watcharapol Siri[1], Watchalawalee Kumboonreung[1],
Siripailin Singin[1], Phanuphong Chueliang[1], Terdpoom Detchumnouyphon[1]
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The research presents a theoretical framework to explain social phenomena, analyze legal issues, and synthesize solutions to problems, which are appropriately consistent with the research methodology through verification with data collected using verifiable methods.
1. The Law and Sociology group presents a diagram of field research to show various qualitative research methods but chooses to collect data from empirical target groups through participant observation as the main focused.
2. Law and Anthropology Group selects research methods in the field of population studies, demonstrating the life cycle of law from the formation of ideas about the ethical philosophy of law.
3. Law and Humanities Group: Choose a way to interpret media and people's creations that express their thoughts, reactions, and values toward the laws that clash with their lives in order to reflect the efforts of various groups of people who use various forms of art as a means of negotiating power relations with both capitalists and state power.

Keywords: Law, Sociology, Anthropology, Humanities, Research Methodology

References:

Songkrant Pongboonjun, "Legal Anthropology: Methodologies and Contributions to Legal Studies," CMU Journal of Law and Social Sciences 18:1 (2025) 1-31.
Kitpatchara Somanawat, "Soft Power of Law: Cultural Politics in Law," CMU Journal of Law and Social 18:1 (2025) 32-56.

Funding Source: Chiang Mai University/ 600,000 THB


Title: Research Project on Law and Society

Nuthamon Kongcharoen,* Tossapon Tassanapan, Songkrant Pongboonjun,
Kitpatchara Somanawat, Passakorn Yeenang, Watcharapol Siri,
Watchalawalee Kumboonreung, Siripailin Singin, Phanuphong Chueliang,
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Keywords: Law, Sociology, Anthropology, Humanities, Research Methodology

City diplomacy and city-to-city relationships in focus: Insights from the US, UK, Japan, and New Zealand

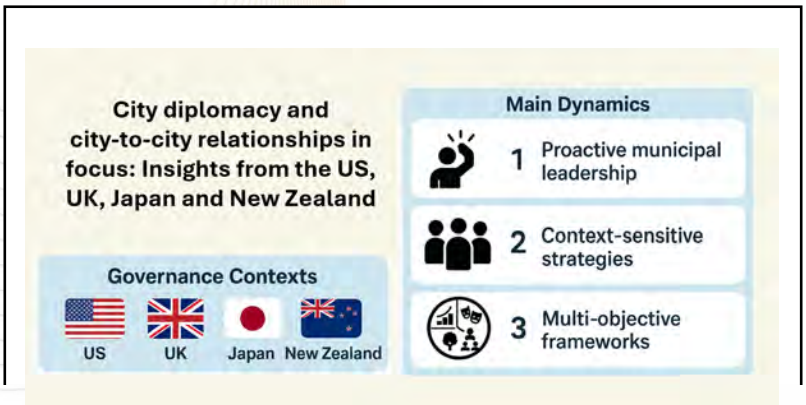
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This study investigates the evolution and operation of sister city partnerships in four distinct governance contexts: the United States, the United Kingdom, Japan, and New Zealand. By integrating insights from the literature on paradiplomacy, city diplomacy, and sister city relationships with empirical findings, the study highlights the aspects of autonomy, coordinated organizations, and combined multiple goals that shape the effectiveness of these collaborations. The findings highlight three main dynamics:1) Proactive municipal leadership that aligns partnerships with local priorities instead of solely following national directives. 2) Strategies that are sensitive to context, influenced by governance structures. 3) Multi-objective frameworks that combine economic growth, cultural exchange, environmental resilience, and social inclusion under unified agendas. To offer guidance for cities in other countries, the study extracts key principles and best practices that municipal leaders globally can adapt to enhance and maintain their own sister city initiatives. The research emphasizes the crucial role of liaison associations in streamlining administration and maintaining initiatives through leadership transitions. The major conclusions highlight that contemporary sister city programs have evolved into strategic tools of subnational governance, capable of surpassing state-level limitations, fostering people-to-people diplomacy, and addressing transnational challenges. These insights provide practical guidance for municipal leaders and policymakers aiming to utilize city-to-city connections for inclusive and sustainable development.

Keywords: city diplomacy, sister city relationships, subnational governance, paradiplomacy, town twinning

References:

Funding Source: CMU Junior Research Fellowship Program



Net-Zero Pledges and the Governance Gap: Challenges in Implementation and Enforcement

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An increasing number of countries have pledged to achieve net-zero greenhouse gas emissions by the mid-21st century, signaling a strong global commitment to climate action. However, turning these ambitions into tangible outcomes remains a major challenge—especially for developing countries. The core barrier lies not in the lack of political will, but in weak governance structures, limited institutional capacity, and insufficient enforcement mechanisms. Many nations lack the ability to monitor progress, coordinate across sectors, and ensure compliance with climate policies. This ambition–action gap is particularly stark where governance is fragmented and resources are scarce. While Nationally Determined Contributions (NDCs) and long-term low-emission strategies have been adopted, they often lack the necessary frameworks for accountability and transparency. This paper argues that achieving net-zero requires more than pledges—it demands robust institutions and effective governance systems. Monitoring, reporting, and verification (MRV) mechanisms, along with empowered regulatory bodies, are essential to enforce and guide implementation. Without these, net-zero commitments risk remaining symbolic. Strengthening governance capacities is therefore critical to transforming climate goals into measurable progress. Only through coherent and enforceable governance can countries bridge the gap between aspiration and achievement in the pursuit of net-zero emissions.

Keywords: Net-Zero Emissions, Governance, Implementation, Developing Countries, Climate Change

Funding Source(s): Junior Research Fellowship Program, Chiang Mai University.



Local Wisdom and Natural Resource Management in an Intermontane Basin: A Case Study of Communities in Muang Khong Subdistrict, Chiang Mai Province

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Sustainable natural resource management in intermontane basins poses unique challenges due to geographic conditions enclosed by mountain ranges, which influence water flow, air circulation, and agricultural land use. Muang Khong Subdistrict in Chiang Dao District, Chiang Mai Province, is situated in such a fragile ecosystem where local livelihoods rely heavily on natural resources. Consequently, local wisdom plays a crucial role in daily life and resource management. This qualitative research explores the application of local wisdom in managing water, forests, and soil within six communities in Muang Khong. Data were collected through semi-structured interviews and spatial surveys from 36 participants, selected using purposive and quota sampling methods. Findings reveal three core strategies: (1) water management through traditional *muang fai* irrigation systems adapted to slope and valley flow; (2) forest management via community-defined zoning and participatory reforestation; and (3) soil management emphasizing crop rotation and organic composting to mitigate degradation and reduce chemical use. The outcomes include ecological restoration, increased household income from agriculture and ecotourism, and strengthened social cohesion. The study recommends integrating local knowledge with modern technology and developing policy support tailored to the geographic and cultural context to enhance long-term sustainability in community-based resource management.

Keywords: local wisdom, natural resource management, intermontane basin, community-based conservation, sustainable development

References:

Academic Journal Uttaradit Rajabhat University 20(1) (2025) 17-30.
Silpakorn University e-Journal (Social Sciences, Humanities, and Arts) 45(3) (2025) 267-281.

Funding Source(s): Junior Researchers


Local Wisdom and Natural Resource Management in an Intermontane Basin: A Case Study of Communities in Muang Khong Subdistrict, Chiang Mai Province
Water Management (Muang Fai)
Forest Management (Zoning & Rehab)
Soil Management (Compost & Crop Rotation)
Positive Impacts on Community
Environmental Restoration
Economic Improvement (Farming & Ecotourism)
Social Cohesion & Participation

Capitalism amidst natural resources competition in the highlands of northern Thailand

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The main objectives of this research project aim to investigate the historical development of capitalism, adaptability of highlanders to market economy, and contemporary conflict of capitalism on utilizing natural resources in the highlands of northern Thailand. Much of previous studies on economy in the highlands of northern Thailand emphasize on economic sufficiency and promotion on cash crops for replacing opium cultivation. Since early 1980s, highland farmers had fully engaged with commercial crops cultivation, due to law enforcement on opium growing in highland ethnic communities. Capitalism, therefore, had been gradually climbed up the mountains in northern Thailand since then. Therefore, I conduct a qualitative study, using document research, in-dept interview, and non-participant observation methods to gather information among four highland ethnic groups in five villages of Chiang Mai, Chiang Rai, and Petchabun province, during August 2023 to July 2024. The main finding is that through the long-term development context, which emphasizes economic promotion, young generations of highlanders nowadays have fully engaged in capitalism by initiating enterprises aiming for richness while natural resources are scarce, highly competitive, and restricted by state authorities.

Keywords: capitalism, natural resources competition, highland, northern Thailand

Funding Source(s): Chiang Mai University, Mid-career research, grant MRCMU2566R_024



Integrated Plan for Sustainable Community Development in Sukhothai Province

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Integrated Plan for Sustainable Community Development in Sukhothai Province aims to promote holistic and sustainable growth by addressing environmental, social, cultural, and economic dimensions through collaboration across sectors. The project includes seven sub-projects using a participatory research approach to create new knowledge and innovative development paradigms that respond to dynamic changes. The findings emphasize the importance of leveraging each community's existing assets—local wisdom, cultural heritage, and accumulated experiences—as the basis for enhancing community strengths and ensuring long-term adaptability. The integrated development plan is driven by three key strategies: Spatial Design – Enhancing public spaces for cultural expression, disaster resilience, and added value to local products rooted in Sukhothai's unique identity. Community Participation – Engaging stakeholders through workshops to guide inclusive and responsive development. Policy Development – Focusing on heritage conservation, tourism infrastructure improvement, and the promotion of cultural landscape knowledge. Post-COVID-19, digital technologies are also employed to support sustainable tourism and cultural dissemination. In conclusion, the success of sustainable community development in Sukhothai lies in the integration of local assets, participatory processes, culturally informed spatial planning, and adaptive policy frameworks enhanced by digital innovation.

Keywords: Community, Sukhothai Province, Existing Assets, Cultural Spaces, Community Participation Integration

References:

International Journal of Heritage Studies (The article is currently under peer review.)

Funding Source(s): Fundamental Fund 2024, National Science, Research and Innovation Fund (NSRF) and Chiang Mai University



If A History Had Happened Otherwise: Exploring Debates on Counterfactual History

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Counterfactual history, or what-if history, is a form of historical inquiry that imagines alternative scenarios—what might have happened differently. Relying on imaginative speculation, this method has long been debated as to whether it is worthy of serious historical analysis. This presentation examines the history of these debates and how scholarly communities have largely accepted it. It argues that, since the late 1990s, counterfactual historiography has developed in ways that have enhanced its legitimacy. This development has reached two key milestones: popularization and academic credibility. The latter requires certain criteria to distinguish between 'good' and 'poor' counterfactuals. Moreover, the boundary between entertainment and academia needs to be drawn. These processes have made the counterfactual approach more acceptable and have fostered greater, though not absolute, consensus. Furthermore, the presentation explores and evaluates counterfactual history in some Thai historiographical accounts, a relatively new field within Thai scholarship.

Keywords: Counterfactual history, What-If history, Historiography, Philosophy of History

References:
Thammasat Journal of History 12 (2025) 36-68.

Funding Source(s): CMU Junior Research Fellowship Program (2023)

The History of Atoms for Peace in Thailand from the 1950s to the 1990s: Science Diplomacy, Atomic Policy, and Nuclear Physics

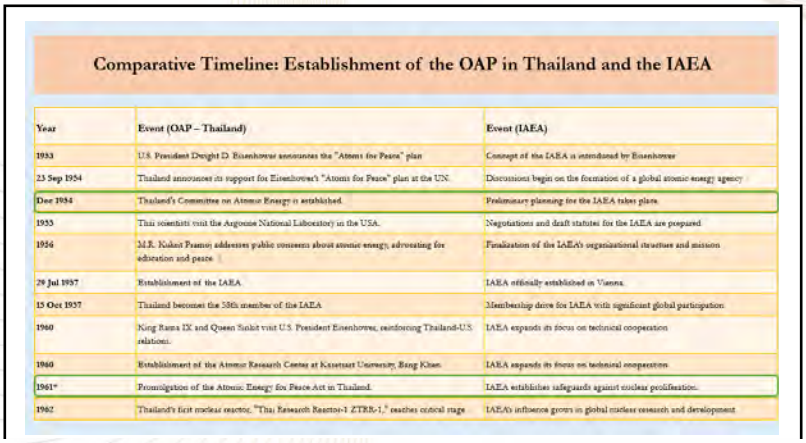
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This study examines the rise and transformation of atomic diplomacy in Thailand from the 1950s to the 1990s, focusing on the Office of Atoms for Peace (OAP) and the Department of Physics and Materials Science at Chiang Mai University (CMU). It challenges dominant state-centric narratives that have overlooked decentralized, scientist-led engagements with nuclear science. Situated within the broader context of Cold War Thailand, the research highlights the role of science diplomacy in shaping national atomic policy and advancing nuclear physics as a strategic field of knowledge. Drawing on both documentary research and oral history interviews, the findings reveal that, while the OAP initially facilitated a one-way transfer of nuclear knowledge from the United States and Western partners, political shifts in the 1970s created space for a more decentralized and dynamic model of atomic diplomacy. CMU physicists emerged as key actors in this transformation, forging international collaborations that strengthened domestic research capacity. The study concludes that atomic diplomacy in Thailand was not a top-down, uniform process, but a fragmented and evolving practice shaped by local scientific agency and shifting political landscapes. The findings underscore the discontinuities and dynamic transformations in Thailand's atomic diplomacy, offering a more complex and multilayered perspective than previously acknowledged.

Keywords: atomic diplomacy, science diplomacy, Office of Atoms for Peace (OAP), Chiang Mai University, nuclear physics

References: N/A

Funding Source: Chiang Mai University Junior Researcher Grant for the Fiscal Year 2024



Comparative Timeline: Establishment of the OAP in Thailand and the IAEA

Year	Event (OAP – Thailand)	Event (IAEA)
1953	U.S. President Dwight D. Eisenhower announces the "Atoms for Peace" plan	Concept of the IAEA is introduced by Eisenhower
23 Sep 1954	Thailand announces its support for Eisenhower's "Atoms for Peace" plan at the UN	Discussions begin on the formation of a global atomic energy agency
Dec 1954	Thailand's Committee on Atomic Energy is established.	Preliminary planning for the IAEA takes place.
1955	Thai scientists visit the Argonne National Laboratory in the USA.	Negotiations and draft statutes for the IAEA are prepared
1956	M.R. Kukrit Pramoj addresses public concerns about atomic energy, advocating for education and peace.	Finalization of the IAEA's organizational structure and mission
29 Jul 1957	Establishment of the IAEA.	IAEA officially established in Vienna.
15 Oct 1957	Thailand becomes the 38th member of the IAEA	Membership drive for IAEA with significant global participation
1960	King Rama IX and Queen Sirikit visit U.S. President Eisenhower, reinforcing Thailand-U.S. relations.	IAEA expands its focus on technical cooperation
1960	Establishment of the Atomic Research Center at Kasetsart University, Bang Khen.	IAEA expands its focus on technical cooperation
1961*	Promulgation of the Atomic Energy for Peace Act in Thailand.	IAEA establishes safeguards against nuclear proliferation.
1962	Thailand's first nuclear reactor, "Thai Research Reactor-1 (TRR-1)," reaches critical stage.	IAEA's influence grows in global nuclear research and development

Interdisciplinary Community Based Learning through Media Ecology of World War II to Global Perspective Thinking

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This research on interdisciplinary community-based learning through the media ecology of World War II towards global dimensional thinking is a qualitative study. The objective is to explore the phenomenon of media ecology related to World War II learning sites that influence the perceptions of audiences in Northern Thailand. Document analysis was employed to examine spatial identity, the geo-historical context of World War II, media ecology, and global thinking. The study focused on four provinces—Chiang Mai, Lamphun, Lampang, and Mae Hong Son—to collect documents, photographs, and local learning resources. Key historical informants contributed oral histories through in-depth interviews. Perceptions and perspectives regarding the events were gathered from teachers and students through focus group discussions. Fieldwork was conducted to synthesize learning resources in the context of geo-history. The findings revealed several geo-historical learning sites: Chiang Mai: Japanese War Museum, Wat Muen Sarn, Japanese Soldier Memorial, Ban Kad Wittayakhom School, Wat Pha Lat (Sakatakami). Lampang: Ratchadaphisek Bridge (White Bridge), Vitchanaree School, Wiang Nuea Subdistrict, Black Bridge of Mueang Lampang. Mae Hong Son: Tha Pai Historical Bridge, Wat Tor Pae, Wat Muay Tor, Nong Pa Kor Camp, Wat Huay Pha, Ban Huay Pha School, Wat Chong Kham and surrounding areas, Mae Sariang District and Nam Mang River, the route of the Japanese military in Ban Tor Pae, Khun Yuam District, and the Thai-Japanese Friendship Memorial. Lamphun: White Bridge. These sites are relevant to all five strands of the Social Studies, Religion, and Culture learning area: Religion, Morality and Ethics; Civic Culture and Ways of Life; Economics; History; and Geography.

Keywords: Interdisciplinary, Community-based learning, Media Ecology, World WarII

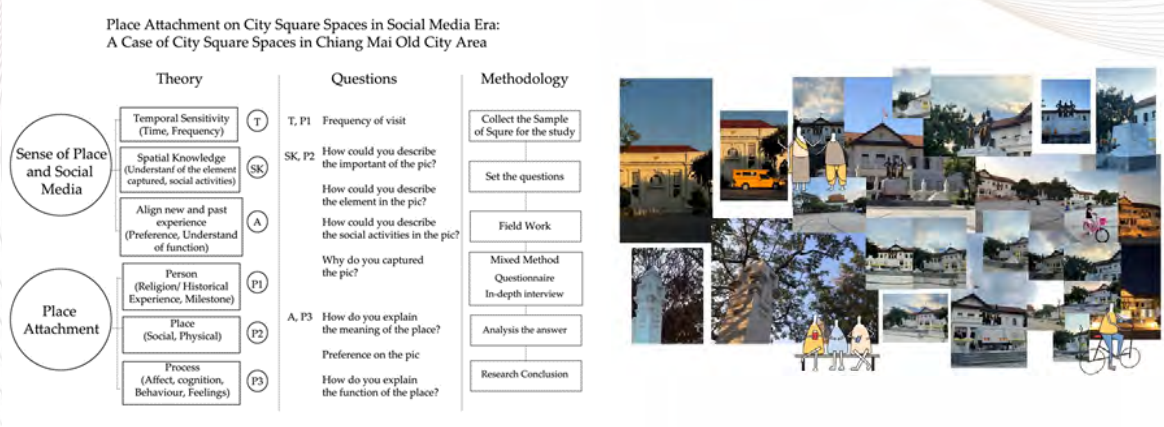
Place Attachment on City Square Spaces in Chiang Mai Old City in Social Media Era

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This study examines the place attachment as conveyed through social media, specifically focusing on significant square spaces in Chiang Mai, Thailand. Analyzing social media posts related to the Three Kings Monument Square, Tha-Pare Gate Square and Chiang Mai Gate Square through Instagram application. —evaluating seven factors: demographics, frequency of visits, importance of place (IM), meaning of place (ME), functions and social activities (FU), knowledge of place, and insights from photographic analysis. The study utilized multiple-choice questionnaires, in-depth interviews, and Photo Elicitation Interviews (PEI). A total of seventy-five participants were recruited on-site, including residents of Chiang Mai Old City, aged over twenty, with a balanced representation of genders. The data collection involved interviews lasting over twenty minutes each, during which participants were prompted to share their perceptions and memories related to the photographs they had taken and gave captions in a social media platform. This study finds that place attachment is more strongly influenced by practical use and daily activities than by historical awareness, particularly on social media. While long-term residents demonstrate deeper connections through greater local knowledge, short-term residents often lack historical context, risking a loss of heritage value. Social media emerges as a valuable tool for understanding evolving urban identities shaped by public perception and functionality. These insights highlight the significance of memory and use in fostering attachment, contributing to discussions in urban planning, heritage preservation, and digital engagement with place identity.

Keywords: Place Attachment, social media, Chiang Mai, Square Spaces

Funding Source(s): Chiang Mai University



The Study Effects of PM 2.5 Dust to Reflect through Performing Arts

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The creation of the contemporary Thai dance performance titled “The PM 2.5 in Chiang Mai” was accumulated from the research titled “The Study on the Impact from PM 2.5 through the Art Performance” which was the trial of the choreography focusing on the symbolic gestures only. Nevertheless, the creation of the contemporary Thai dance performance named “The PM 2.5 in Chiang Mai” aimed to design 8 elements of art performance which were 1.) the design of performing roles, 2.) the audition for performers, 3.) the choreography, 4.) The design of costumes, 5.) the design of music and sound, 6.) the design of performing tools, 7.) the design of lighting and 8.) the design of performing space for establishing the flawless performance. For conducting the research, the researcher studied the information from the documents, textbooks, the related papers as well as the interviews to know and understand the problems and the impacts of PM2.5 to analyze for designing the contemporary Thai Dance performance titled “The PM2.5 in Chiang Mai”. The researcher finally established the Thai Dance performance which presented the idea and concept about the PM2.5 in Chiang Mai, the researcher needed to reflect the problems of the PM2.5 and broadly convey the awareness to the society and the related government sections to expedite for the solution that solved the PM2.5 problems efficiently.

Keywords: PM 2.5, Performing Arts,Contemporart Dance

References:

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Funding Source(s): ทุนนักวิจัยรุ่นใหม่ ปีงบประมาณ 2566



Constructing Lanna food: The process of constructing local specialty and cultural tourism in Northern Thailand

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This study investigates the construction of Lanna food from the perspective of cultural tourism in Northern Thailand. Ethnographic fieldwork, including non-participant observations and in-depth interviews across eight provinces, was conducted to examine the distinctive features of Lanna cuisine and the active participants involved in selecting local specialties. The findings identify three defining characteristics of Lanna food: an ecological foundation based on natural ingredients, the influence of neighboring regional cuisines, and the emergence of fusion dishes that incorporate local elements. The Thai government plays a dominant role in shaping the image of Lanna food through processes of authorization and decision-making, which in turn strengthen community resilience and economic prospects. However, the study also reveals that the strong influence of government policy can restrict the diversity of local food and limit local agency in selecting local specialties to present to tourists.

Keywords: Lanna food, local food, local specialty, cultural tourism, Northern Thailand

Funding Source(s): CMU Junior Research Fellowship Program (ID: R66IN00265) Chiang Mai University, Thailand.



Environmental inequality: Change in labor allocation during PM2.5 exposure on the Northern part of Thailand

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Air pollution from fine particulate matter (PM2.5) has become a growing concern in developing countries, particularly in Northern Thailand, where seasonal agricultural burning intensifies exposure. This study investigates how socioeconomic status influences individuals' labor allocation decisions during periods of high PM2.5 exposure. Using survey data from 400 individuals across eight provinces during the dry season of April–May 2024, we apply a Logit model to estimate the probability of reducing working hours in response to air pollution. Results show that individuals in higher in-come strata and with more years of education are significantly more likely to reduce work time, suggesting greater capacity for avoidance behavior. Additionally, those working outdoors and individuals with respiratory health issues exhibit higher likelihoods of reducing work. These findings reveal environmental inequality in coping capacity, with lower-income groups being less able to avoid exposure, thereby facing greater health risks and potential income loss. The study underscores the need for tar-geted policy interventions that support vulnerable populations during pollution episodes to reduce long-term socioeconomic disparities and promote environmental justice.

Keywords: Air pollution, Labor allocation, Environmental Inequality, PM2.5

Funding Source(s): Chiang Mai University

Probability of reducing work during PM2.5 period

Variable	Reducing work	Marginal effect
Being in 2nd income strata (1=Yes)	2.386**	0.070
	(1.159)	
Being in 3rd income strata (1=Yes)	2.635**	0.087
	(1.196)	
Being in 4th income strata (1=Yes)	2.393**	0.070
	(1.173)	
Year of education	0.132**	0.007
	(0.061)	
Outdoor workplace (1=Yes)	1.771***	0.096
	(0.521)	
Have respiratory health issue (1=Yes)	2.038***	0.110
	(0.682)	
Income consistency (1=Yes)	-0.880	
	(0.678)	
Age	-0.154	
	(0.106)	
Age^2	0.002	
	(0.001)	
Female (1=Yes)	0.513	
	(0.525)	
Being head of household (1=Yes)	0.375	
	(0.498)	
Living in municipality (1=Yes)	0.517	
	(0.473)	
Constant	-4.322	
	(2.703)	
Observations	400	

Notes: 1) Standard errors in parentheses 2) *** p<0.01, ** p<0.05, * p<0.

Rethinking Playground Design through Local Context and Natural Elements in Chiang Mai's Public Parks

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This research examines public play areas for children in public parks and sports grounds within Chiang Mai Municipality, emphasising their integration with local contexts and the potential of natural materials in design. Field studies were conducted across eight selected sites using morphological surveys and content analysis, guided by child development and learning environment design for children aged 3–12. The findings reveal that most playgrounds rely on prefabricated equipment that meets international safety standards yet often overlook the potential of local natural elements and diverse play activities that support holistic child development. Management practices of park authorities, alongside parental attitudes prioritising safety, significantly influence both the spatial design and the types of play activities available. These factors tend to limit opportunities for creative and contextually rooted play. The study proposes a conceptual framework for designing child-friendly play environments that integrate local identity and natural materials, promoting experiential learning and deeper connections between children and their surroundings. By aligning public playground design with local culture, ecology, and community needs, this research contributes to the development of more inclusive, sustainable, and livable urban environments for children.

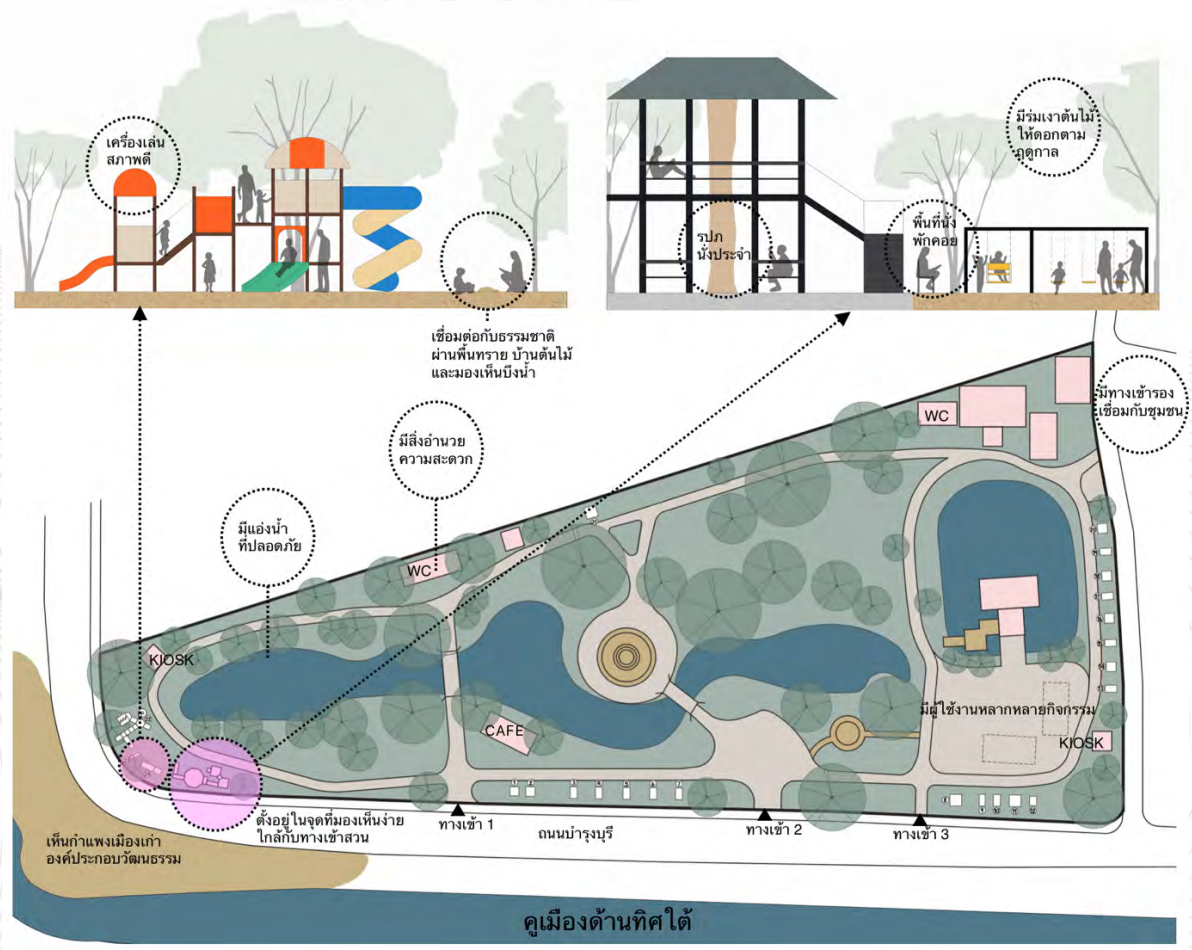
Keywords: Child-friendly city, natural play environments, playground design, local context integration, well-being

References:

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Graphical abstract



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