

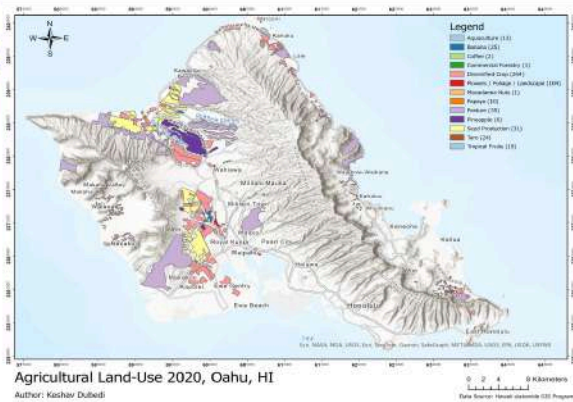
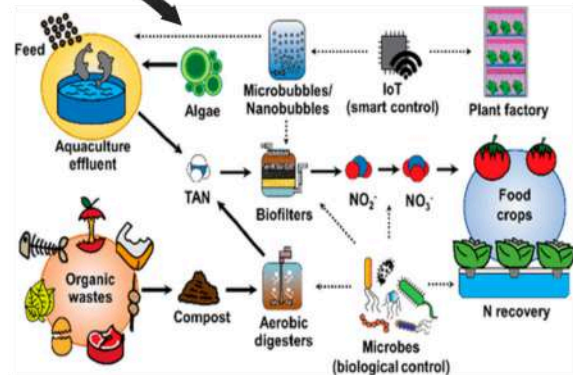
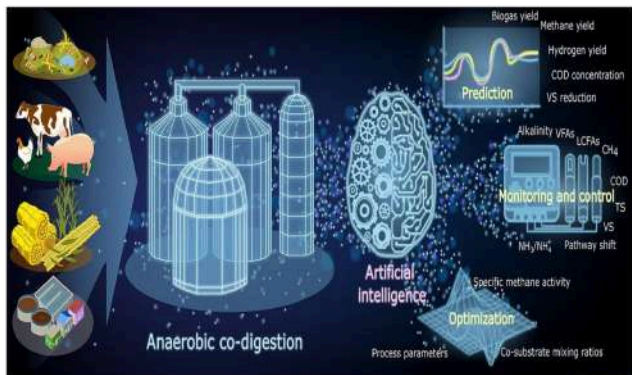


ENVIRONMENT AND BIOENERGY RESEARCH LAB NEWSLETTER 2024

Exploring Waste-to-Resources: Insights from Our Lab

The Environment and Bioenergy Research Group is dedicated to advancing sustainable solutions for environmental challenges and food security. Our work focuses on waste-to-resource technologies, turning organic and industrial wastes, and agri-residues into valuable bioresources through innovative processes like anaerobic digestion, aquaponics and nanobubble technology. We leverage the potential of micro- and macroalgae for biofuel and bioproduct development while exploring cutting-edge areas such as artificial intelligence and nanobubble technology for environmental remediation and food/feed production. Our multidisciplinary approach aims to create a cleaner, greener future through scientific excellence and practical innovations.

Samir Khanal



NEW PROJECTS FOR 2024

Project Title: *Innovation and Technology Center: From Lab to Commercialization and Community (ITC-LCC)*

Funding Agency: College of Tropical Agriculture and Human Resilience (CTAHR), UHM, (Sep 2024 – Aug 2025)

Overall Objectives: The overarching goal of this project is to develop advanced technologies-integrated modular systems for producing food, feed, and high-value products, while developing collaborative research among researchers within CTAHR and College of Engineering (COE) in close collaboration with industrial partners.

Project Title: *Carbon Dioxide (CO₂) Absorption From Biogas Using Ionic Liquids and Carbon Dioxide Utilization for Urea Synthesis*

Funding Agency: National Research Foundation of Korea, (May 2024 –Apr 2027)

Overall Objectives: The overall objective of this project is to upgrade biogas to biomethane using ionic liquids and utilize the captured CO₂ for urea synthesis.

Project Title: *Establishing an Aquaculture Workforce Development Program: Bridging the Education Gap in Hawaii (PI)*

Funding Agency: Center for Tropical and Sub-tropical Aquaculture, (Aug 2024 – Jul 2026)

Overall Objectives: The overall objective of this project is to train high-school and undergraduate students in aquaculture and aquaponic technologies.

NEW PROJECTS FOR 2024

Project Title: Nanobubble-Based Non-Chemical Strategy for Food Safety (PI).

Funding Agency: Hawai'i Department of Agriculture (HDOA), (Jun 2024 – Aug 2025)

Overall Objectives: The overall objective of this study is to examine nanobubble technology as a nonchemical means of treating food-borne pathogens in fresh produce.

Project Title: Native Hawaiian Seaweed Cultivation for High-value Products Generation with CO₂-nanobubbles: Lab-to-Pilot Scale Study (PI)

Funding Agency: Western Sun Grant Regional Center through U.S. Dept. of Agriculture, (Apr 2024 – May 2025)

Overall Objectives: The overall goal of this study is to optimize the growth of native Hawaiian seaweed and the extraction of high-value products using CO₂-nanobubble technology.

Project Title: Mapping Bioenergy Potential of Agricultural Residues/Wastes in the Hawaiian Islands (PI)

Funding Agency: Western Sun Grant Regional Center through U.S. Dept. of Agriculture, (Apr 2024 – May 2025)

Overall Objectives: The overall objective of this study is to map the temporal and spatial availability of agricultural residues and animal manure in major Hawaiian Islands, characterize the composition of those resources and determine their bioenergy/biofuel production potential.

NEW PROJECTS FOR 2024

Project Title: HDOA Aquaculture Workforce Development Study (PI)

Funding Agency: Hawai'i Department of Agriculture (HDOA), (Dec 2024 – Nov 2025)

Overall Objectives: The goal of this project is to create a holistic workforce development framework tailored to Hawaii's aquaculture industry, designed to bolster the industry's growth and sustainability. This initiative will empower the local population by providing them with the skills and knowledge necessary to thrive in diverse aquaculture sectors, such as conservation, production, research, and innovation. By focusing on training, job placement, and support services, the program aims to enhance the economic resilience of island communities, fostering sustainable economic growth and improving the quality of life for residents.

Project Title: GIS-Based Analysis for Planning Land-Based Aquaculture in Hawaii(PI)

Funding Agency: Hawai'i Department of Agriculture (HDOA), (Dec 2024 – Nov 2025)

Overall Objectives: The overarching goal of the study is to identify suitable aquaculture zones for land-based aquaculture planning in Hawaii using GIS-based tools.

NEW LAB MEMBERS

WELCOME TO OUR NEW MEMBERS!

We are excited to welcome four new members to our research team!

- **Keshav Dubedi (Master's Student):** Keshav is working on the "Bioenergy Potential Mapping of Hawaiian Islands" project, which uses a GIS-based methodology to identify and map bioenergy resources across the four major Hawaiian Islands. The project aims to optimize resource distribution, reduce waste, and support Hawai'i's target of 100% renewable energy by 2045.
- **Sachita Baniya (Master's Student):** Sachita is working on a project focused on the anaerobic digestion of crude glycerol to valorize waste from the biodiesel industry. This study involves co-digesting crude glycerol with pig manure to generate methane, which can then be converted into methanol and reused in biodiesel production.
- **Brannan Evans (Master's Student):** Brannan's research focuses on cultivating native limu species, such as *Dictyota* and *Sargassum*. He studies their composition and explores ways to enhance their growth using nanobubbles and various aquaculture techniques.
- **Caleb Jensen (PhD Student):** Caleb is engaged in anaerobic digestion biotechnology to break down plastic and convert it into usable energy products. His research aims to achieve more efficient reduction of biodegradable plastic while generating value-added products.



Keshav Dubedi



Sachita Baniya



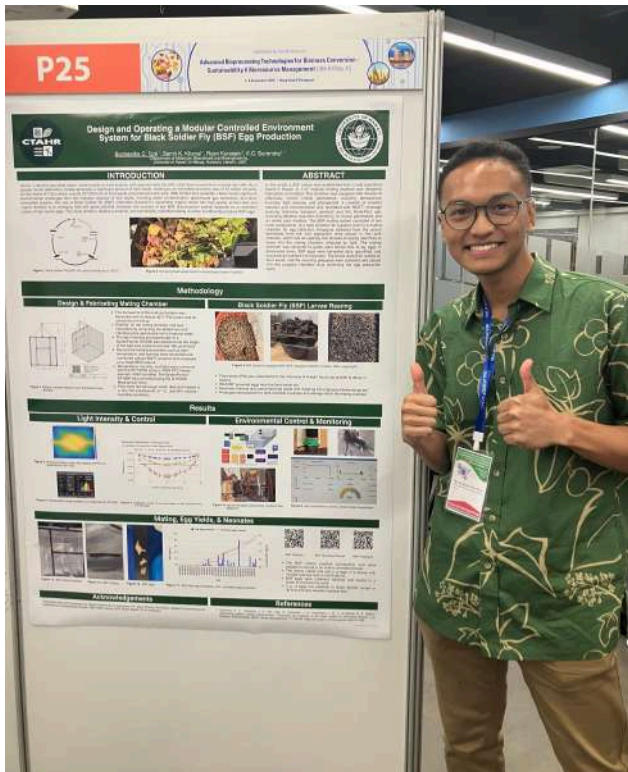
Brannan Evans



Caleb Jensen

CONFERENCE PRESENTATIONS

We are proud to share that several of our lab members recently presented their research at prestigious conferences. Below are highlights of their presentations:



Candidate name: Socheatha Tork

Presentation Title: Design and Operating A Modular Controlled Environment System for Black Soldier Fly (BSF) Egg Production.

Conference Name: International Conference on Advanced Bioprocessing Technologies for Biomass Conversion - Sustainability and Bioresource Management (IBA-IFIBiop XI, 2024)

Location: Hong Kong Polytechnic University, Hong Kong

Date: December, 2024

Candidate name: Surendra KC

Presentation Titles: Applications of Nanobubble Technology for Enhanced Organic Agriculture & Enhancing Organic Farming Through the Black Soldier Fly System.

Conference Name: 21st Organic World Congress (OWC 2024)

Location: Chiayi County, Taiwan

Date: December, 2024



CONFERENCE PRESENTATIONS

In November 2024, several members of our lab attended the **1st Global Agriculture Multidisciplinary International Conference at the University of Hawaii at Hilo**, Hilo, Hawaii, USA. The conference brought together experts and researchers from various fields to discuss the latest advancements in global agricultural practices.



Candidate name: Brannndon Evans

Presentation Title: Improving the production of Native Seaweed (Limu) using Nanobubbles

Candidate name: Sachita Baniya

Presentation Title: Anaerobic Co-digestion of Crude Glycerol and Pig manure: A Path to Sustainable Methanol Supply for Biodiesel



Candidate name: Kyle Rafael Marcelino

Presentation Title: Enhancing Media-Filled Aquaponic System Performance with Nanobubble Technology

CONFERENCE PRESENTATIONS

In October 2024, members of our lab attended **Nanobubble 2024**, held at **Kyoto University, Uji Campus, Obaku Plaza, Kyoto, Japan**. The conference provided a premier platform for discussing advancements in nanobubble technology and its applications across various fields.

- **Nanobubbles in Aquaponics**

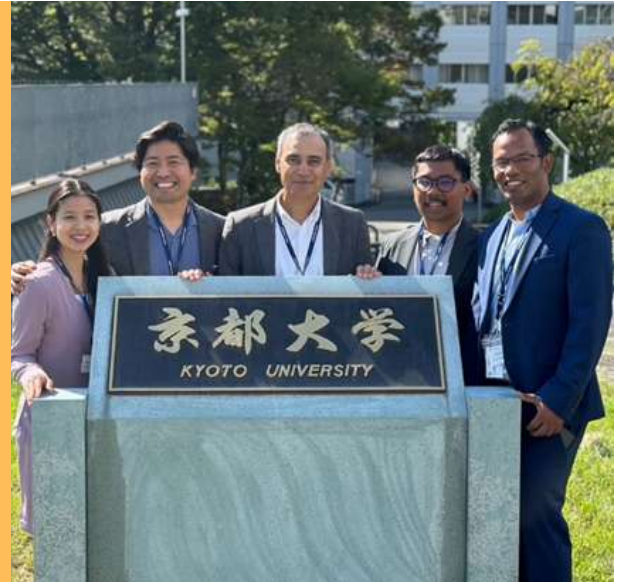
Presented by: Shreeja Lopchan Lama (Master's students) and Kyle Rafael Marcelino (PhD Student)

- Explored the role of nanobubbles in enhancing plant root development.
- Highlighted the increase in dissolved oxygen (DO) levels for improved system productivity.

- **CO₂ Nanobubbles for Algae Cultivation**

Presented by: Ty Shitanaka (PhD Student)

- Focused on the use of CO₂ nanobubbles to enhance carbon uptake.
- Demonstrated improvements in algal biomass yield and cultivation efficiency.



CONFERENCE PRESENTATIONS

Dr. Samir Khanal, a renowned expert in anaerobic digestion for bioenergy production and the innovative use of nanobubble technology in aquaponics and wastewater treatment, has made significant strides in advancing sustainable solutions. In 2024, he delivered over 30 esteemed presentations across the U.S., Korea, Japan, Thailand, China, Hong Kong, Taiwan, and Turkey.

Here are highlights of his global contributions:

- **Presentation Title:** Microaeration in co-digestion of food waste and sewage sludge.

Conference Name: 18th IWA World Conference on Anaerobic Digestion

Location: Istanbul, Türkiye

Date: June, 2024

- **Presentation Title:** Anaerobic Digestion – A New Opportunity in Anaerobic Digestion of High Solids Substrates.

Conference Name: The 2nd International Conference on Bioprocess and Sustainability (ICBS2024)

Role: Plenary speaker

Location: Shanghai, China

Date: August, 2024



Achievements and Awards

Appointment as Editor-in-Chief of BITE

In January 2024, Dr. Samir Khanal assumed the role of Editor-in-Chief of Bioresource Technology (BITE), a leading Q1 journal with an outstanding impact factor of 9.7. Under Dr. Khanal's leadership, BITE continues to rank #1 in Agricultural Engineering and handles over 10,000 manuscript submissions annually, with a selective acceptance rate of 15%.

Editor-in-Chief

[View full editorial board](#)



Samir Khanal

University of Hawai'i at Mānoa, Honolulu, Hawaii, United States of America

Clarivate Highly Cited Researcher Recognition

Dr. Khanal was recognized as a 2024 Clarivate Highly Cited Researcher, reflecting their global impact and influence, with work ranking in the top 1% by citations.

Dr. Khanal leads pioneering research at the intersection of energy and environment, with expertise in anaerobic digestion, nanobubble technology, aquaponics, and waste-to-resources. With over 160 publications and multiple books—including a best-selling work on anaerobic biotechnology and a widely used textbook on bioenergy, Dr. Khanal has made transformative contributions to these fields.

Source: UH News, 2024

(<https://www.hawaii.edu/news/2024/11/27/highly-cited-researchers-2024/>)



Achievements and Awards

Dr. Khanal was the proud recipient of the OVPRS Faculty Award for Excellence in Mentoring Undergraduate Research & Creative Work (2024). This prestigious award recognizes faculty members who have made exceptional contributions to mentoring undergraduate students in research and creative endeavors.

Dr. Khanal's dedication to creating a supportive and inspiring research environment was highlighted by the nomination submitted by an undergraduate student (Ms. Lisa Lowe), reflecting the profound impact of his mentorship on young researchers. This recognition highlights Dr. Khanal's commitment to guiding the next generation of innovators and leaders.



Source: <https://www.hawaii.edu/news/2024/05/02/2024-uh-manoa-awards/>

Welcoming Visiting Scholars to Our Lab in 2024



Nattakarn K (PhD Student, Thailand)



Jia Mingyi (PhD Student, Hong Kong)

Nattakarn K (PhD Student)

Nattakarn K. joined our lab in 2024 as a visiting scholar from King Mongkut's University of Technology Thonburi, Thailand, to conduct a six-month short-term research project.

Nattakarn specializes in wastewater treatment, focusing on heavy metal remediation in aquaculture wastewater using an aquaponics system with biochar. In our lab, she utilizes nanobubble technology to enhance plant root development and dissolved oxygen levels, improving plant growth and heavy metal absorption.

Mingyi J. joined our lab in 2024 as a visiting scholar from the City University of Hong Kong, Hong Kong, to conduct a six-month short-term research project.

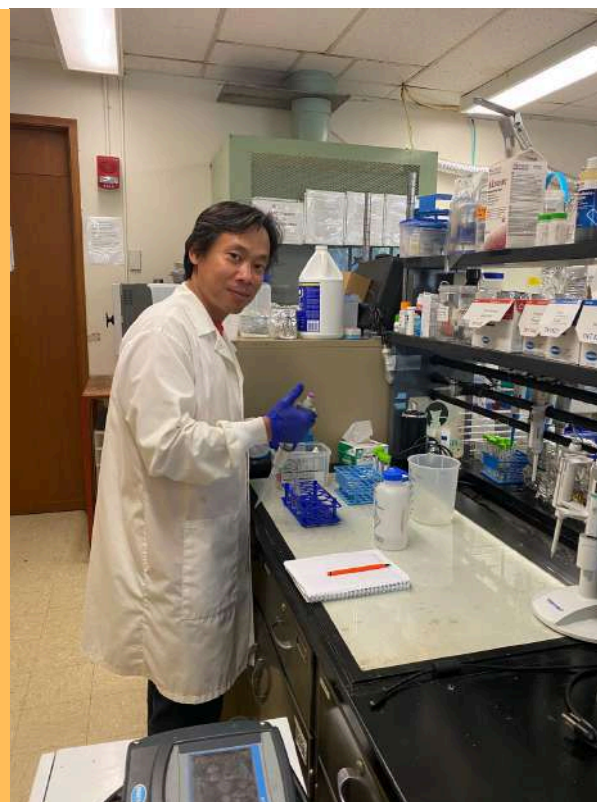
Her research focused on utilizing nanobubbles to enhance existing water treatment technologies and studying their interactions with particles. In our lab, she specifically investigated the fundamental properties of nanobubbles and applied them to the membrane distillation process, examining their effect on delaying membrane wetting.

Fulbright Scholar Advances Nanobubble Aquaculture Research

Welcoming as a Fulbright U.S. - ASEAN Visiting Scholar (Jan-May 2024)

We were honored to have Hua Thai Nhan, a Fulbright U.S. - ASEAN Visiting Scholar, join our team from January to May 2024. An Associate Professor at Can Tho University, Vietnam, he contributed his expertise to the application of nanobubble technology in climate-resilient aquaculture. His research focused on the use of CO₂ nanobubbles to enhance the aquaculture production of seaweed, helping to advance sustainable and climate-resilient practices in aquaculture.

We are grateful for his contributions during his time with us and wish him continued success in his future endeavors.



Welcoming High School Students

This summer, our lab had the privilege of hosting four exceptional high school students as part of an immersive research internship program. Each student worked on unique and impactful projects, gaining hands-on experience and valuable insights into advanced research methodologies.

- **Jay Rhymer, Punahou School, Hawai'i:** Explored the applications of artificial intelligence and machine learning in bioprocess optimization.
- **Reid Tamanaha, Mililani High School, Hawai'i:** Investigated macro-algae biomass production and its processing into sustainable bioproducts.
- **Supissara (Pai) Chirayuwat, Wells International School, Thailand:** Contributed to research on aquaponics, focusing on optimizing systems for sustainable plant and fish production. She gained valuable experience in advanced technologies and water quality analysis.
- **Kiana Novey, Kalani High School, Hawai'i:** Contributed to research on macro-algae biomass production and its transformation into innovative bioproducts.



Jay Rhymer



Reid Tamanaha



Supissara Chirayuwat



Kiana Novey

Celebrating Our Graduates

We are proud to highlight the accomplishments of two exceptional students who have recently graduated and made significant contributions during their time in our lab:

- ***Socheatha Tork***

- Graduated with a Bachelor's degree this year.
- He designed and built a modular mating chamber for Black Soldier Flies during his undergraduate studies, optimizing conditions for mating and reproduction to facilitate scaling up food waste valorization.
- Currently, Soch is a Research Technician at Jun Innovations and the Environmental and Bioenergy Research Group.



- ***Wachiranon Chuenchart***

- Wachiranon Chuenchart, affectionately known as Boss, completed his PhD in 2023 and made significant contributions to advancing anaerobic digestion research. His research focused on microaeration in the co-digestion of food waste and sewage sludge, along with comparative kinetic modeling of mono- and co-digestion processes. He also employed data-driven approaches, including meta-analysis, correlation networks, and machine learning, to enhance understanding in this area.
- He is now working as a Research Engineer at Quasar Energy Group. We commend Boss for his remarkable achievements and wish him continued success in his career.

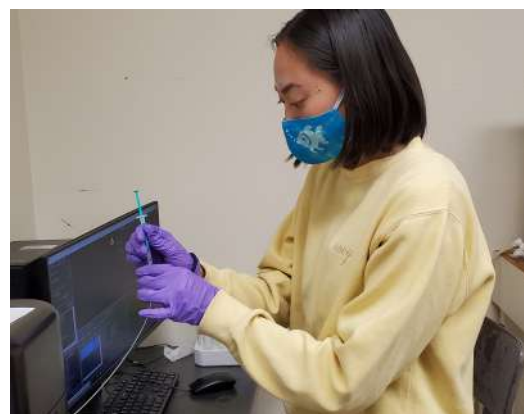
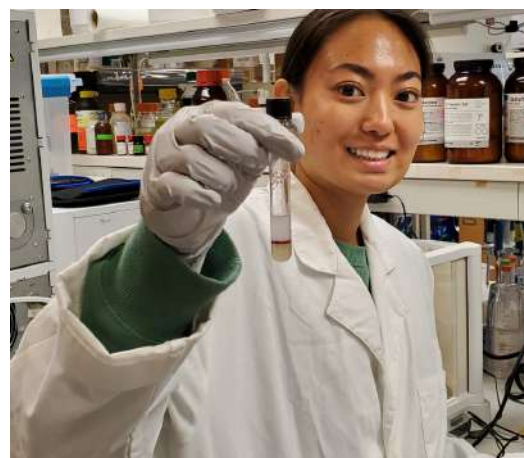


NSF Fellowship Awarded to Former Student

We are proud to share that Lisa Lowe, a former undergraduate student in the Khanal Laboratory, has been awarded the prestigious **NSF Graduate Research Fellowship**. This fellowship provides three years of funding, including an annual stipend of **\$37,000**.

During her time in our laboratory, Lisa was a key member of the nanobubble team, contributing to the characterization of air and oxygen nanobubbles and the development of innovative nanobubble technologies. Her research excellence and dedication have earned her this distinguished recognition, which she is now utilizing to pursue a PhD at **University of California, Los Angeles (UCLA)**.

Congratulations, Lisa, on this well-deserved achievement!



Our Lab Hosts International Symposium

Breaking Boundaries with Fine Bubble Technology

Our lab proudly hosted the 19th International Symposium of Fine Bubble Technology on February 20, 2024, at the University of Hawai'i at Mānoa, Honolulu, Hawai'i, USA.



This event welcomed leading scientists from Japan, renowned for their expertise in nanobubble technology, to discuss its transformative applications in agriculture, aquaponics, and more. The symposium fostered exciting collaborations and showcased cutting-edge innovations, positioning our lab at the forefront of this revolutionary field.

2024 Highlights: Pioneering Research and Publications

Our lab continues to push the boundaries of science with a remarkable lineup of publications in 2024. From groundbreaking studies in nanobubble technology to advancements in sustainable bioenergy and aquaculture, these works reflect our dedication to solving real-world challenges through innovative research.

To view our complete list of 2024 publications and access detailed summaries, scan the QR code below.



If you are interested in learning more about our lab, research projects, or collaborations, feel free to reach out:

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