



SOUTHEAST ASIA-EUROPE
JOINT FUNDING SCHEME FOR
RESEARCH AND INNOVATION

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POTENTIAL OF MARINE ALGAE AS A BIOMASS SOURCE FOR RENEWABLE ENERGY AND LIVESTOCK FOOD IN VIET NAM

Topic 2

Brokerage Event – 9th Call

03 October 2024



Potential of marine algae as a biomass source for renewable energy and livestock food in Viet Nam

My and my institution's area of expertise

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Position: Lecturer

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Expertise: Waste management, anaerobic digestion, biosecurity, metagenomic analysis, bacterial analysis.

- I have been working at the TUAF since 2013.
- I earned my Ph.D. degree in Bioengineering at the University of Missouri (USA) in 2021.
- I worked as a postdoctoral fellow at the Department of Plant Science and Technology (MU) until March 2024.
- My research focused on the analysis of soil health, the development of a biogas prediction model, and a biosecurity project aiming at a decision-support tool.



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My and my institution's area of expertise

Expertise:

- My expertise: environmental protection and renewable energy, such as additive-based treatment for manure, anaerobic digestion systems, and microbial analysis.
- I worked on several projects in microbiology and molecular biology with the use of JASP, R, and other statistical software.
- TUAFF is a teaching and research institute with several centers focusing on agriculture and forestry: the Center of Crop Research for Adaptation to Climate Change, and the Agriculture and Forestry Research & Development Center for Mountainous Region.
- We work on the preservation of endangered plants, and improving the conditions to help crops better deal with climate change, e.g., the development of a soybean strain that can grow in drought conditions.



Decision-Support Tool for Biogas Digesters

KEY VARIABLE	INPUT			(leave blank if unknown)
	Variable	Unit	Value	
	Number of Pig	head	10,000	
	Manure Production	m ³ /d	15	
	Volatile Solid of Manure	%	25	
	Volatile Solid of Oil	%	99.5	

AD VARIABLES	Variable	Unit	Recommendation		Input
			From	To	
	Digester Volume	m ³	1,339	2,679	2,679
	Temperature	°C	30	40	40
	Oil	m ³ /d	0	1.88	1.88

MODEL OUTPUT	Variable	Unit	Recommendation
			Value
	Working Volume (70% of digester's capacity)	m ³	1,875
	Predicted Manure Production	kg-VS/d	3,750
	Actual Manure Production	kg-VS/d	3,750
	Manure Loading Rate	kg-VS/m ³ /d	2.00
	Oil-to-Manure Ratio	-	0.50
	Construction Cost	USD	1,062,599
	Water Recommendation	m ³ /d	72.4
	Biogas Production	m ³ /m ³ working/d	2.67
		m ³ /d	5,014
		m ³ /kg-VS	0.892

INSTRUCTION

This is a decision-support tool to predict biogas production based on swine manure loading rate, ratio of waste kitchen oil and manure (OM), and temperature, using the following equation:

$$Y = -4265.463 + 576.750X_1 + 7973.188X_2 + 215.762X_3 - 265.715X_1^2 - 1008.368X_2^2 - 3.953X_3^2 - 3585.278X_1X_2 + 47.611X_1X_3 - 174.484X_2X_3 + 126.533X_1X_2X_3$$

Y is biogas production (mL/d) and X₁, X₂, X₃ are manure loading (g-VS/L/d), OM ratio and temperature (°C).

Note: This model uses solid manure, not total slurry manure.

1. Enter number of pig, manure production (kg/d), volatile solid (VS) of manure and oil (%).
2. Choose specific digester volume and temperature (°C).
3. Select loading rate of waste kitchen oil (m³/d).
4. Results of working volume, water recommended, biogas production (m³/d) and biogas yield (m³/kg-VS) would be available when all variables are set.

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My proposed Research Idea for the 9th JFS Call

Research Question:

How can marine algae be transformed into a valuable product for renewable energy and animal food?

Proposed Project Aims:

- ✓ Assess the potential of marine algae and its production for renewable energy and feeding livestock in Viet Nam.
- ✓ Suggest strategies to mitigate the negative impact of climate change on marine algae, and local life for sustainable development.

Proposed Research Activities:

- Preliminary study on climate change impact on algae.
- Assessment of marine algae production in the Vietnamese coastline.
- Pilot study of co-digestion of algae and other agricultural wastes for biogas production.
- Pilot test of using algae for feeding livestock.

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Among the 17 Sustainable Development Goals (SDGs), this project targets:

- Goal 7: Affordable and Clean Energy.
- Goal 13: Climate Action.
- Goal 14: Life Below Water.
- Goal 17: Partnerships for the Goal.



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Project Consortium

My organisation: Institute of Biotechnology – Food Technology, Thai Nguyen University of Agriculture and Forestry (TUAF), Viet Nam.

Role: TUAF team will be responsible for the sample collection, contacting local officials, and conducting the pilot studies.

Further existing partners:

Partner: Agricultural Engineering Extension (Dr. Teng-Teoh Lim's lab), University of Missouri (MU), USA.

Expertise: MU is designated as a Research I and AAU. Certified University. The team led by Dr. Lim has experience and knowledge regarding the environment, agricultural air emissions, and nutrient management systems to enhance the degradation of veterinary antibiotics, co-digestion modeling, and nutrient/water recycling for animal production.

Role: Propose the methodologies and consultancy for experimental designs and data analysis.

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Project Consortium

Partners that we are seeking for our project consortium:

Region: Southeast Asia or Europe

Expertise: those who have experience with marine algae, economic assessment, and processing animal food from agricultural products.

Role: The partners are expected to provide scientific insights and consultancy in terms of algae's potential to make and evaluate animal food from algae.

Region: Southeast Asia or Europe

Expertise: Data analysis, life cycle assessment (LCA).

Role: The partners are expected to enhance the research capacity of the local institute, based on visiting activities, or joint research.