Development of an Eco-Friendly Hydrocarbon-Absorbing Robotic Fish for Community Water Quality Improvement.

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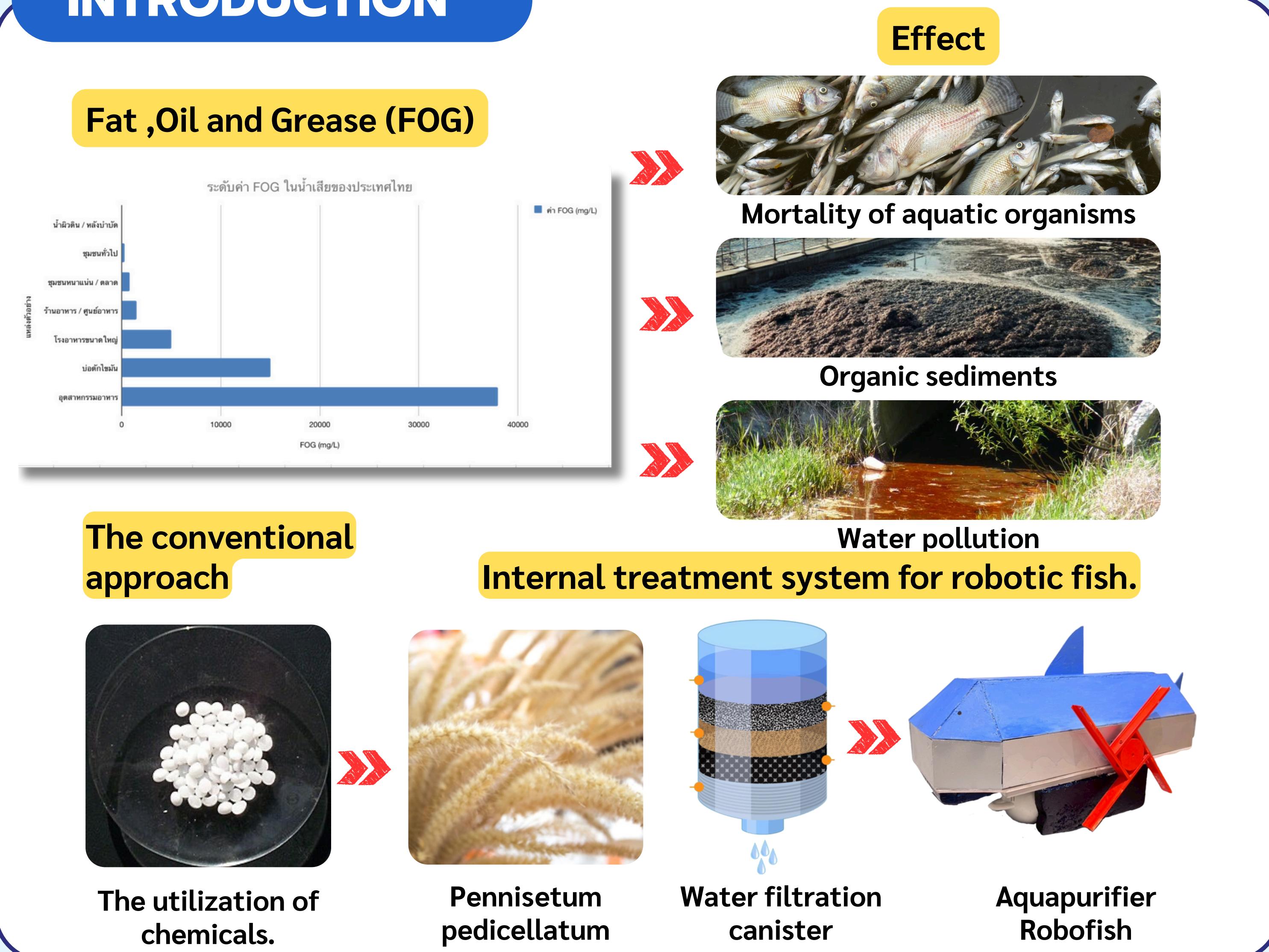Advisors : Ms.Apasri Chumchuen, Ms. Pitchaya Tipsri
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ABSTRACT

Grease-contaminated household wastewater is a major source of pollution in community water bodies. This study assessed water quality and developed a hydrocarbon-absorbing robotic fish for grease removal. Water quality was evaluated at Khlong Chang and the Nong Trut community in Trang Province, Thailand, using the GLOBE protocol. Results showed lower dissolved oxygen and transparency, with higher temperature and pH in the community area, indicating grease contamination. A robotic fish incorporating an ESP32-based control system, real-time water quality sensors, and natural hydrocarbon-absorbing materials was developed. The results demonstrated effective grease absorption and improved water quality, highlighting the potential of this eco-friendly robotic system for mitigating grease pollution in community water sources.

INTRODUCTION

Fat ,Oil and Grease (FOG)

Effect

Mortality of aquatic organisms

Organic sediments

Water pollution

The conventional approach

Internal treatment system for robotic fish.

The utilization of chemicals.

Pennisetum pedicellatum

Water filtration canister

Aquapurifier Robofish

RESEARCH QUESTION

1. Is there a difference in water quality between the two area ?
2. Can the developed robotic fish absorb grease contamination in water sources?
3. Is there a difference in water quality before and after treatment using the grease-absorbing robotic fish ?
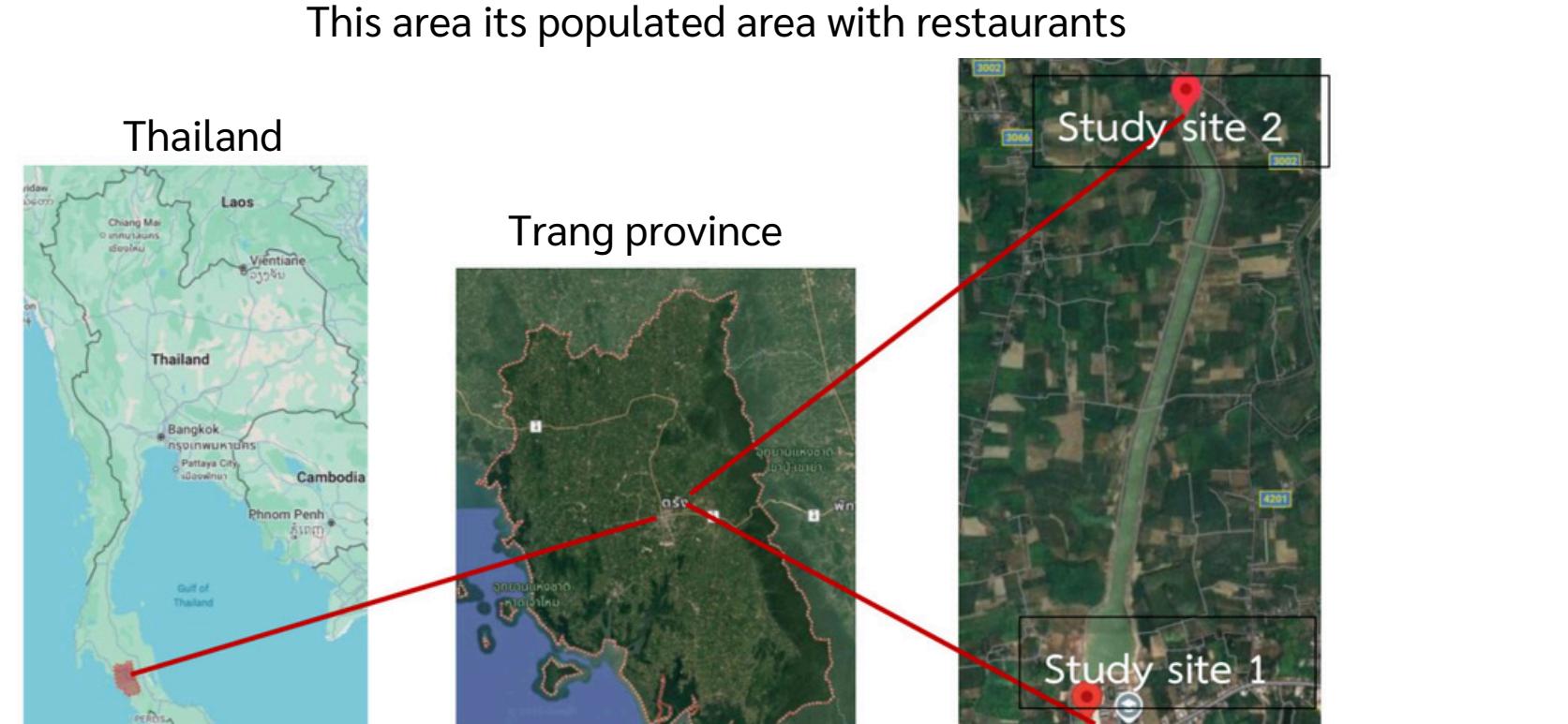
RESEARCH HYPOTHESES

1. The water quality at two area is significantly different.
2. The developed robotic fish is capable of absorbing grease contamination in water sources.
3. Water quality before and after treatment using the grease-absorbing robotic fish in community water sources is significantly different.

METHODOLOGY

1 Study Sites

Field study conducted at the Khlong Chang and Ban Nong Trut community.

Study site 2 : Ban Nong Trut Community 7.593727° N, 99.562140° E
This area its populated area with restaurants

Thailand
Trang province
Study site 2
Study site 1

Study site 1 : Klong Chang 7.553280° N, 99.555686° E
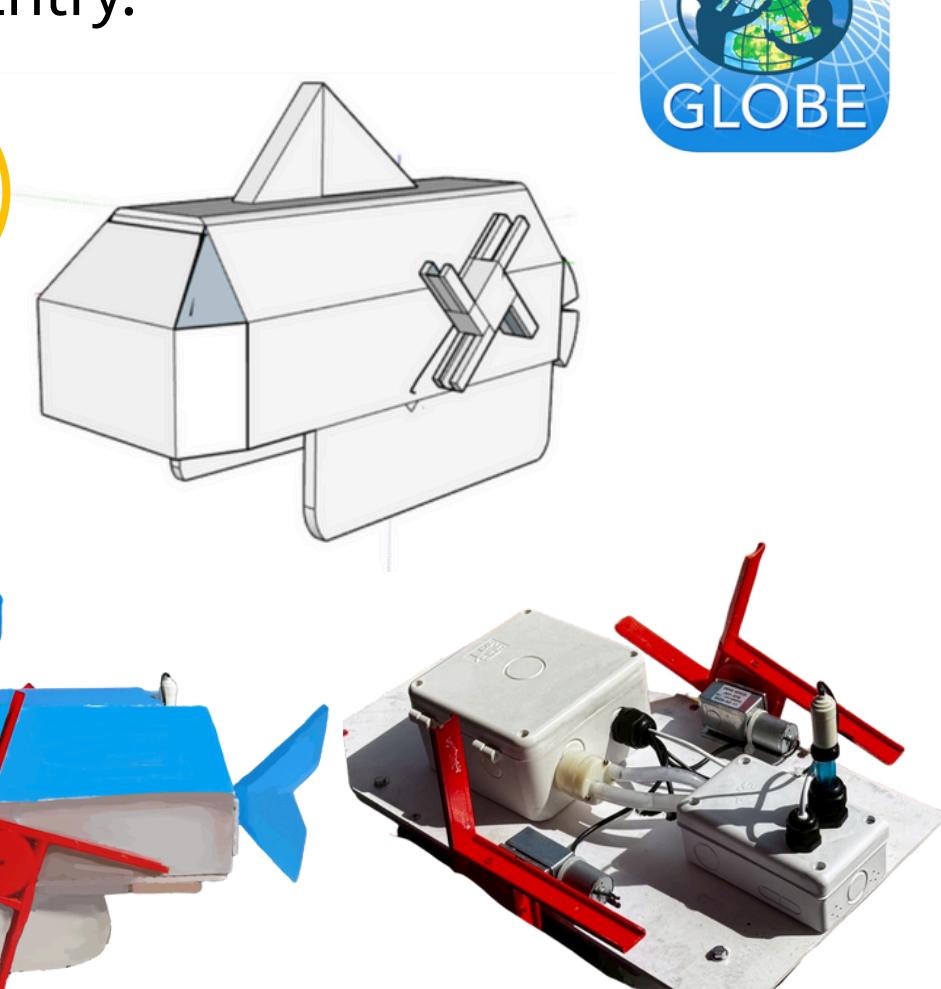This area has area with a river flowing through it.

2 Data Collection

Measure temperature, pH, DO, Transparency and Conductivity and enter the data into the GLOBE Data Entry.
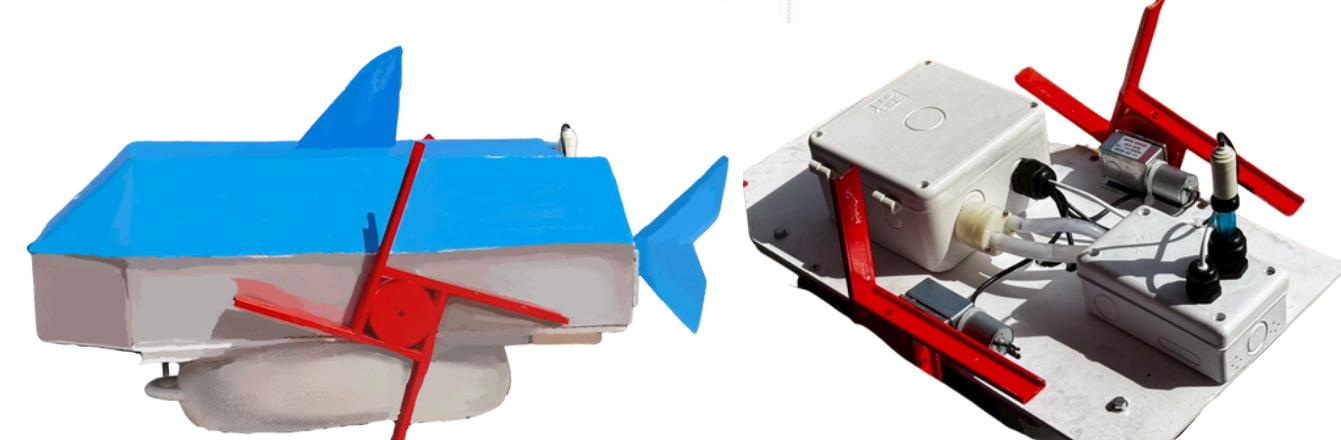
3 Design & Create Aquapurifier RoboFish

The Aquapurifier RoboFish prototype

4 Efficiency Testing

Test the Aquapurifier RoboFish's efficiency and the quality of water after passing through the Aquapurifier RoboFish

5 Data analysis

- Analyze the data for temperature, pH, DO, Transparency and conductivity.
- Compare water quality.

RESEARCH RESULT

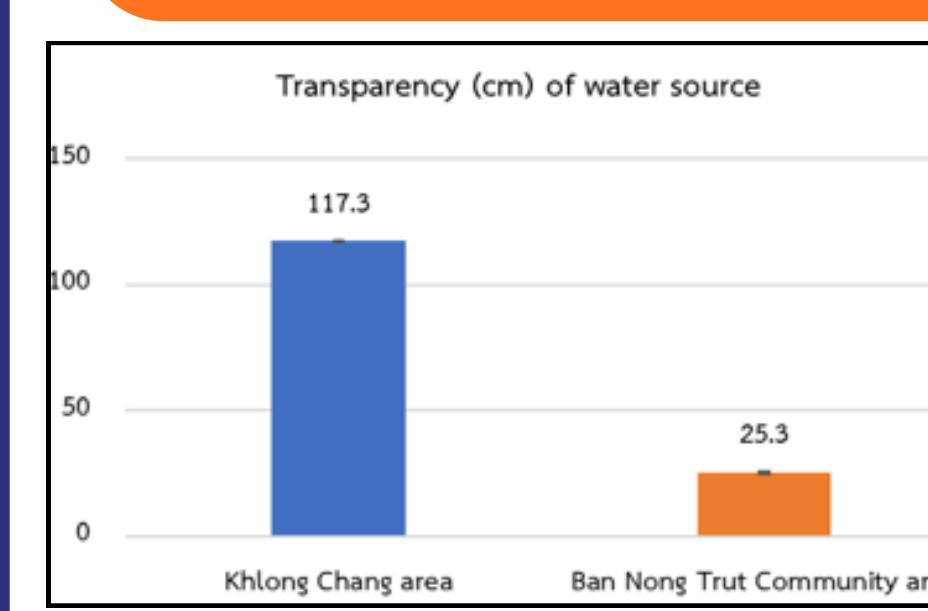### Part 1 Water Quality in Khlong Chang and Ban Nong Trut Community

Transparency (cm) of water source

Figure 1 shows the water transparency at the study site

DO (mg/L) of water source
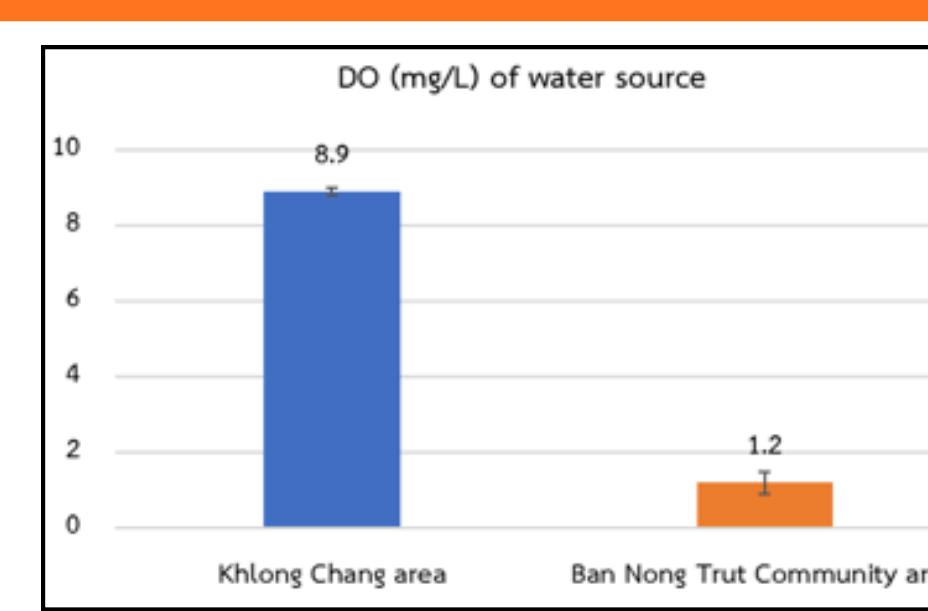
Figure 2 shows the water DO at the study site

Conductivity (μS/cm) of water source
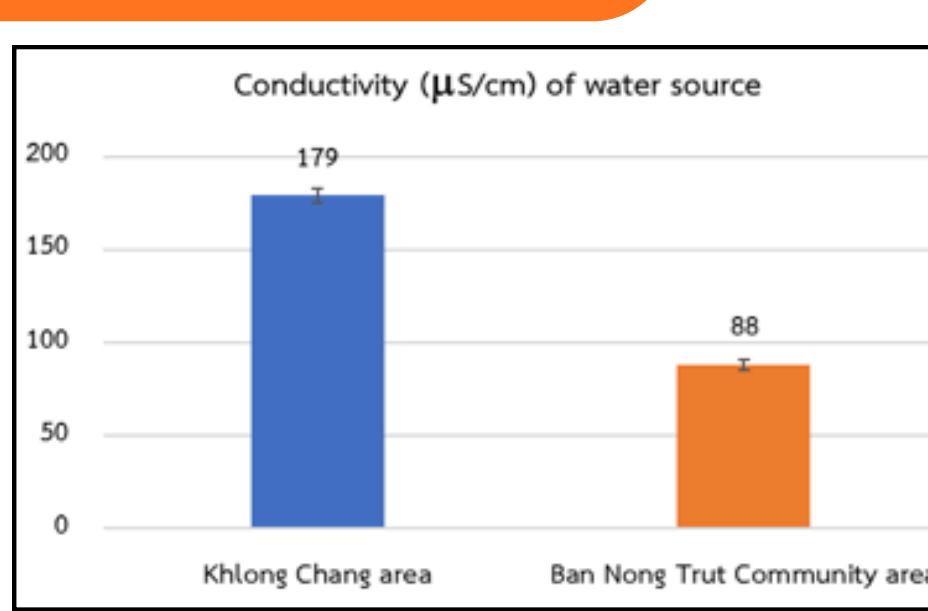
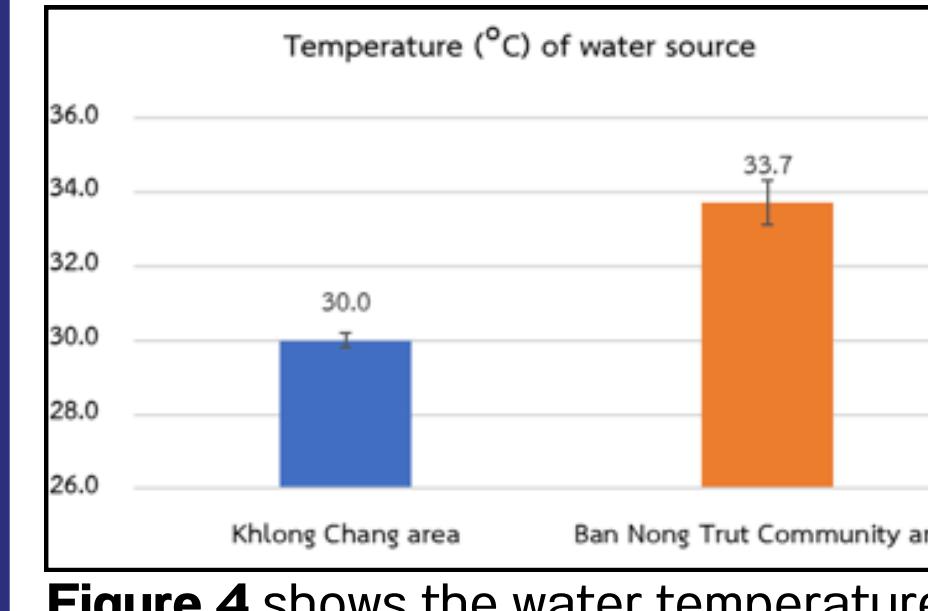**Figure 3** shows the water conductivity at the study site

Temperature (°C) of water source

Figure 4 shows the water temperature at the study site

pH of water source
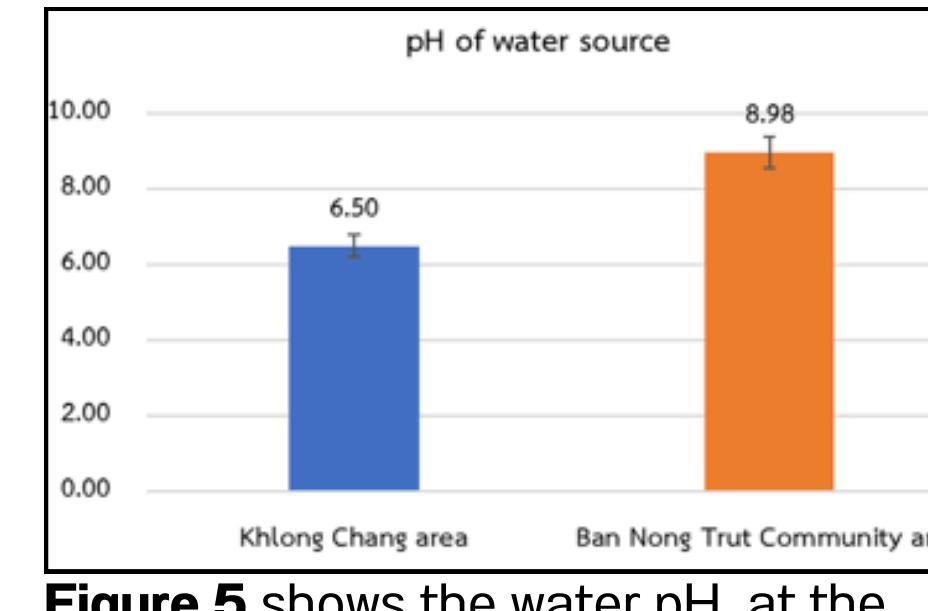
Figure 5 shows the water pH at the study site

Water quality assessment revealed that the Nong Trut community had higher temperature and pH, but lower DO, conductivity, and transparency compared to Khlong Chang. Additionally, visible grease contamination from household wastewater was observed in Nong Trut.

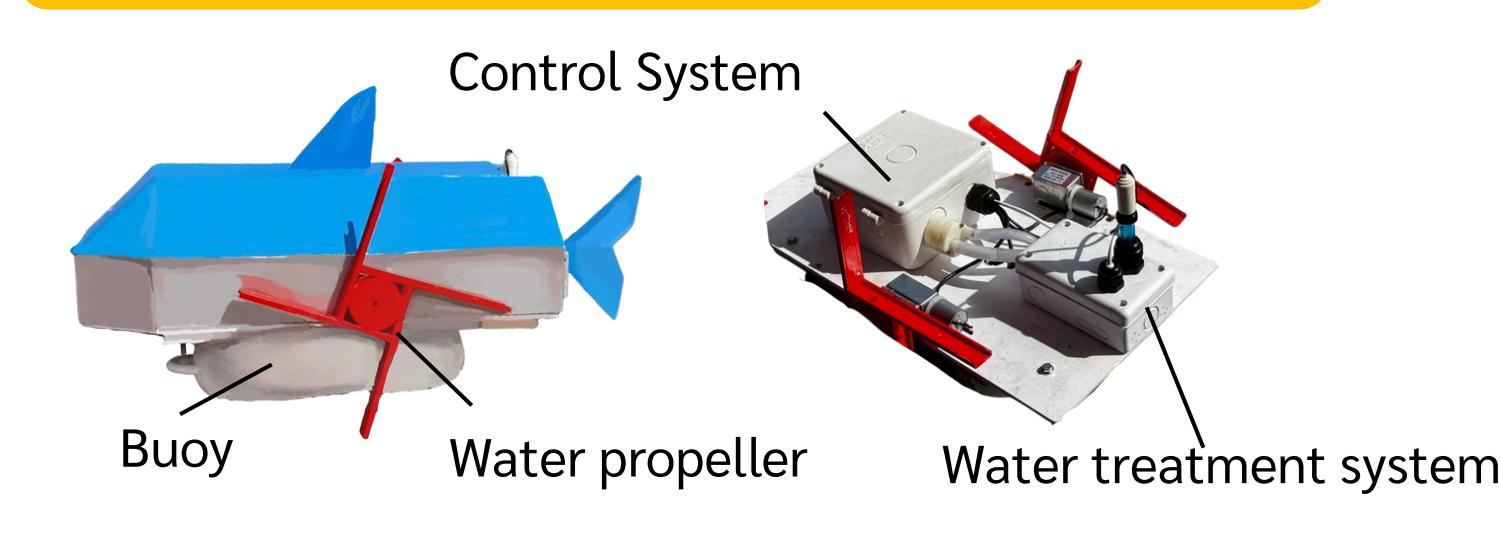Found grease stains

Part 2 Design and Construction of the Aquapurifier RoboFish

Draft of Aquapurifier RoboFish

Aquapurifier RoboFish Working diagram.

water treatment diagram
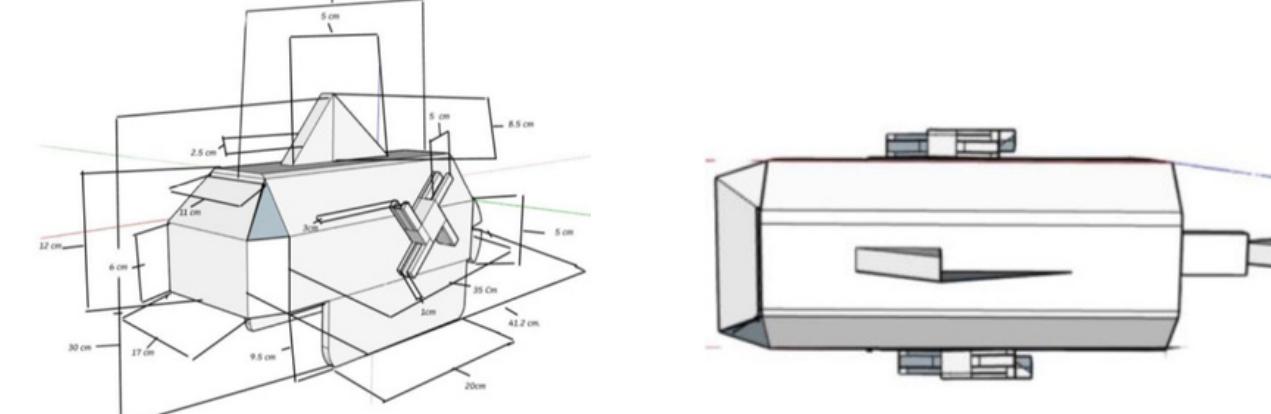
The Aquapurifier RoboFish when completed

Control System
Buoy   Water propeller   Water treatment system
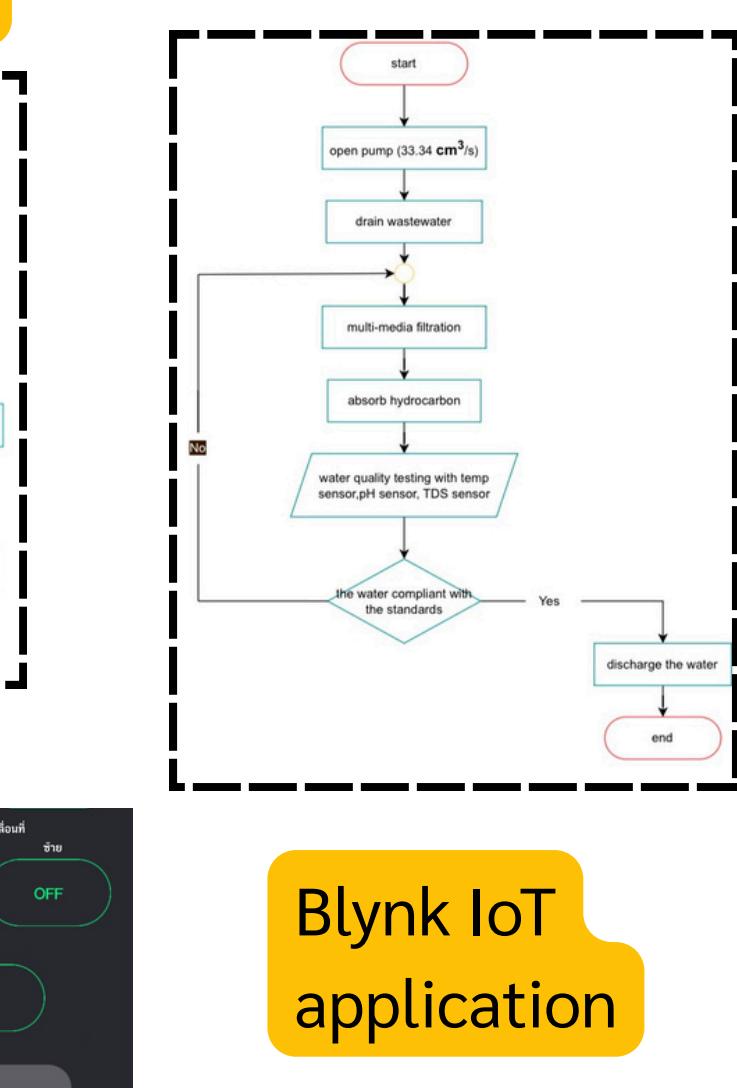
Blynk IoT application

Part 3 Efficiency Testing of the Aquapurifier RoboFish

Absorption capacity (%)
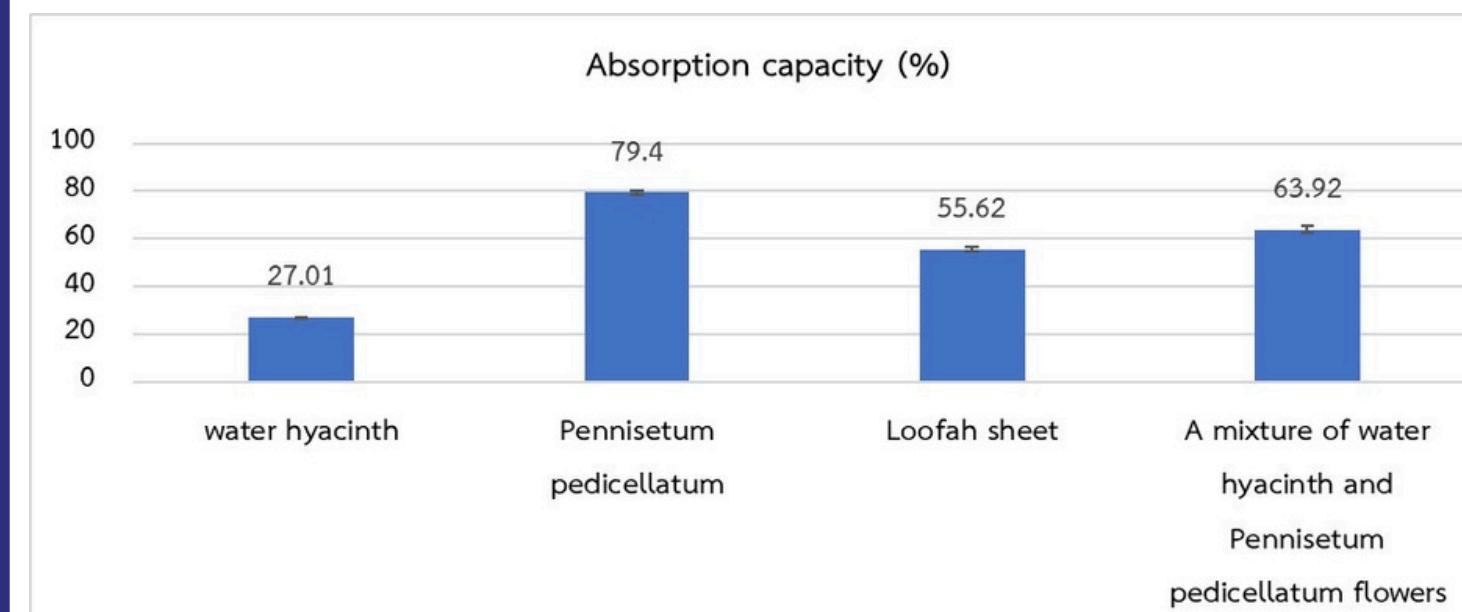
Pennisetum pedicellatum has the best grease absorption capacity

Indicators	Water quality	
	before	after
temperature (°C)	27.3±0.2	26.4±0.2
pH	8.32±0.20	7.62±0.22
DO (mg/L)	1.5±0.1	7.3±0.1
Electrical conductivity (μS/cm)	88.4±5.0	180.8±7.2
Transparency value (cm)	24.4±0.5	117.3±0.3

The water quality meets the effluent standards.

SUMMARY& DISCUSSION OF RESULTS

1. The water quality in Khlong Chang and Ban Nong Trut exhibits distinct variations; specifically, the Ban Nong Trud area shows the presence of surfacegrease.

2. The Aquapurifier robotic fish,designed for hydrocarbonabsorption, demonstrates a treatment capacity for grease-contaminated water at a rate of 2 L/min

3. The water quality treated by the robotic fish meets the official regulatory standards for effluent discharge into natural water bodies

BENEFITS

- Improved water quality
- Reduced bad odors & water pollution
- Environmental conservation
- Ecosystem restoration

SUGGESTIONS

- Enhance the rate of water intake into the treatment system.
- Develop the energy source of the oil-absorbing robotic fish by using solar power installed on the dorsal fin.

ACKNOWLEDGEMENTS

REFERENCES

Enhancement and Conservation of National Environmental Quality Act (1992). Laws, Notifications, and Reglations Related to Pollution Control Re: Establishing Surface Water Quality Standards. Retrieved from
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