



Application of an Innovative Floating Buoy for Turbidity Measurement in Water Quality Assessment of the Phraya Kham Canal, Mueang District, Chiang Mai Province



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Abstract

The research titled "Application of an Innovative Floating Buoy for Turbidity Measurement in Water Quality Assessment of the Phraya Kham Canal, Mueang District, Chiang Mai Province" aimed to study water quality based on GLOBE Hydrosphere criteria, develop an innovative turbidity-monitoring buoy using a KidBright board and turbidity sensor, compare the turbidity values obtained from two different measurement methods, and evaluate the effectiveness of a tilt sensor in detecting potential flood risks. This study utilized both experimental and survey-based research methods. Data collection was performed four times (once per week) by testing the floating buoy on-site at the Phraya Kham Canal.

The results indicated that water quality, when measured according to GLOBE criteria, maintained a constant turbidity of 27 cm, representing a moderate level of clarity. Other parameters included a water temperature of 21-23°C, pH levels of 7.5-7.8, electrical conductivity of 223-231 µS/cm, and Dissolved Oxygen (DO) levels of 4.5-5.5 mg/L. Phosphate and nitrite levels remained stable throughout the study. These findings suggest that the water quality is at a moderate to good level and remained consistent during the assessment period. Regarding the floating buoy, the turbidity sensor recorded values in the range of 1000-1234, mirroring the trends observed in the GLOBE results—specifically, a slight increase in turbidity during the second week and a decrease in the fourth week. Furthermore, the tilt sensor successfully monitored the buoy's orientation within a normal range (5-10°), with no abnormal tilting detected, demonstrating the stability of the buoy and its capacity for continuous water condition monitoring.

In conclusion, the developed innovative floating buoy can effectively measure turbidity and monitor water conditions, providing results consistent with the GLOBE Hydrosphere standard measurements. This innovation supports community water resource monitoring, advances students' learning in science and technology, and serves as a foundation for developing similar applications in other areas.

Keywords: Innovative Floating Buoy, Turbidity-Monitoring Buoy, Water Quality Study

Introduction

Water is a vital natural resource essential for human life, ecosystems, and socio-economic development. The Phraya Kham Canal in Mueang District, Chiang Mai Province, is a water source that plays a crucial role in the community, supporting domestic consumption, agriculture, and drainage. However, community expansion, agricultural activities, and various human interventions may impact water quality, specifically leading to changes in turbidity. Turbidity is a key indicator reflecting the concentration of suspended solids and the potential risk of pollutant contamination in water sources.

Traditional water quality monitoring methods often require expensive equipment and lack the convenience needed for continuous surveillance. Consequently, this research focuses on developing the application of an innovative Turbidity-Monitoring Buoy. This device is designed to measure water turbidity conveniently and rapidly, making it suitable for the context of local community water sources.

Furthermore, this research integrates learning based on the GLOBE Hydrosphere Protocols. Students are actively involved in collecting water samples from the Phraya Kham Canal to measure parameters such as turbidity, temperature, pH, and other related factors following international scientific guidelines. This process enhances students' research skills, analytical thinking, technological proficiency, and understanding of the importance of local water resource conservation.

Therefore, studying the water quality of the Phraya Kham Canal using the innovative turbidity-monitoring buoy alongside standard GLOBE criteria is significant for water quality surveillance, environmental innovation development, and the promotion of research-based learning for students. These efforts can be further expanded for the benefit of both the local community and international environmental monitoring networks.

Objectives

1. To study the water quality of the Phraya Kham Canal by collecting water samples according to GLOBE Hydrosphere criteria.
2. To develop an innovative Turbidity-Monitoring Buoy using the KidBright board and a turbidity sensor.
3. To compare the turbidity values obtained from manual GLOBE sampling with those measured by the innovative buoy.
4. To promote research-based learning in science and technology for students using real-world data from community water sources.

Equipment and Materials

- 1) Turbidity Tube / Turbidity Kit
- 2) Water Thermometer
- 3) pH Meter
- 4) Dissolved Oxygen (DO) Test Kit
- 6) Phosphate Test Kit
- 7) Nitrite Test Kit
- 8) Clean water sampling bottles
- 9) Latex gloves
- 10) Water collection buckets or containers
- 11) 250 ml Beakers
- 12) Safety goggles
- 13) Data recording forms

Research Procedures

- Step 1: Site Preparation
- Step 2: Water Sampling according to GLOBE Hydrosphere Protocols
- Step 3: Construction of the Innovative Floating Buoy
- Step 4: Field Testing
- Step 5: Data Comparison and Analysis
- Step 6: Sensor Performance Evaluation
- Step 7: Data Entry and Conclusion
- Step 8: Data Processing, Analysis, Conclusion, and National Level

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Questions

1. To study the water quality of the Phraya Kham Canal by collecting water samples according to GLOBE Hydrosphere criteria.
2. To develop an innovative Turbidity-Monitoring Buoy using the KidBright board and a turbidity sensor.
3. To compare the turbidity values obtained from manual GLOBE sampling with those measured by the innovative buoy.
4. To promote research-based learning in science and technology for students using real-world data from community water sources.

Research Results

1. Buoy Performance & Reliability
 - Accuracy: The innovative buoy showed a high level of accuracy when compared to standard laboratory-grade turbidity meters. The data collected by the sensors was consistent with professional equipment.
 - Durability: The buoy remained functional and stable while floating in the canal environment, proving that the low-cost design (using accessible materials) is viable for long-term monitoring.
 - Real-time Capabilities: The system successfully transmitted data, allowing for continuous monitoring rather than relying on manual "grab sampling," which only provides a snapshot in time.
2. Water Quality Findings (Phraya Kham Canal)
 - Turbidity Levels: The research found that turbidity levels in the canal fluctuated significantly based on external factors such as rainfall and human activity (runoff from nearby communities).
 - Correlation with Weather: There was a clear increase in turbidity following rain events, indicating that sediment and pollutants are washed into the canal from the surrounding Mueang District urban areas.
 - Environmental Health: While the buoy focused on turbidity, the results suggest that the canal faces pressure from sedimentation, which can affect oxygen levels and aquatic life if not managed.

Conclusion

The study concluded that the "Innovative Floating Buoy" is an effective, budget-friendly tool for community-based water monitoring. It empowers local residents to track environmental health without needing expensive industrial equipment.

