E-PROCEEDINGS

INTERNATIONAL TINKER INNOVATION & ENTREPRENEURSHIP CHALLENGE (i-TIEC 2025)

"Fostering a Culture of Innovation and Entrepreneurial Excellence"

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PTDI, UiTM Cawangan Johor Kampus Pasir Gudang

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Editors

Aznilinda Zainuddin

Maisarah Noorezam

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A-ST028: CREATION OF SUSTAINABLE COASTAL SEDIMENT DATABASES FOR SCIENTIFIC, ENVIRONMENTAL, AND SOCIETAL APPLICATIONS

Nursuhaila Muhamad Fauzi[1], Nur Azlin Atikah Mohd Nasir[1], Aimie Rifhan Hashim[2], and Sharir Aizat Kamaruddin[3*]
[1]School of Physics, Faculty of Applied Sciences, Universiti Teknologi MARA, Perlis Branch, 02600 Arau, Perlis, Malaysia.
[2]School of Biology, Faculty of Applied Sciences, Universiti Teknologi MARA, Perlis Branch, 02600 Arau, Perlis, Malaysia.
[3]Marine Research Station, Faculty of Applied Sciences, Universiti Teknologi MARA, Perlis Branch, 02600 Arau, Perlis, Malaysia

Corresponding author: Author, shariraizat@uitm.edu.my

ABSTRACT

Sediment is a naturally occurring material that is fragmented by weathering and erosion, and then conveyed by the forces of wind, water, ice, and gravity acting on the particles. Information regarding the specific properties of coastal silt remains scarce, especially in the northern region of Peninsular Malaysia. The databases provide data on sediment pH, moisture content, particle size, and organic matter. The database would assist governmental and industrial entities in managing coastal region development more effectively. Sampling activities encompassed the acquisition of sediment specimens from coastal areas and agricultural fields. The development of the coastal sediment database is consistent with the Sustainable Development Goals established by the United Nations which include SDG 14: Life below water, SDG 2: Zero hunger, SDG 3: Good health and well-being, and SDG 13: Climate action.

Keywords: Organic matter, sediment pH, surface sediment

1. Product Description

The features of sediment exert a complex influence on geological, environmental, and engineering domains, offering critical insights into Earth's processes, evaluating environmental conditions, and promoting sustainable development. Moreover, soil pH significantly influences the availability of nutrients to plants. When soil pH is excessively high or low, nutritional availability to plants diminishes, potentially leading to nutrient shortages. An excess of organic matter (OM) in soil and sediment can have both beneficial and harmful impacts on the environment. It is complex and may fluctuate based on the conditions.

2. Methodology

Sediments are evaluated in the laboratory promptly after collection to ascertain their physicochemical qualities utilizing the British Standard Method.

2.1 Organic matter

The method for measuring % organic matter is illustrated in **Figure 1**. Initially, soil was collected and packaged in a properly tagged polyethylene plastic bag. Samples were desiccated in an oven at 60º C for 24 hours to eliminate any moisture from the soil sample. Upon the completion of the designated time, the samples were extracted from the oven and allowed to cool prior to being measured for their dry mass in the measuring tin. 10.0 grammes of the soil sample was weighed and ground using a grinding machine or manually with a stone mortar and pestle. Incineration of the sample in a high-temperature muffle furnace at 450ºC during a duration of four hours.

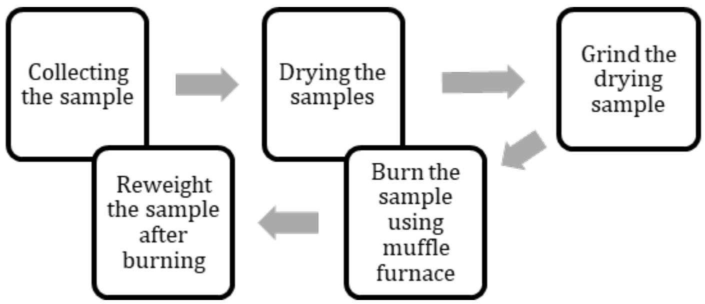

Figure 1 Workflow of percent organic matter measurement

2.2 pH

Figure 2 illustrates the procedure for measuring pH. Initially, obtain the sample and encase it in a properly tagged polyethylene plastic bag. Soil samples will be desiccated in an oven at 60º C for 24 hours to eliminate any moisture. Upon the expiration of the designated time, the samples will be extracted from the oven and allowed to cool prior to being weighed for their dry mass in the measuring tin. 10.0 grammes of soil sample were placed into a 100 ml beaker, and 25 ml of distilled water was subsequently added. The mixture will be stirred thoroughly for 60 minutes. The combination will be allowed to rest for a further 60 minutes. The pH meter's electrode will be partially suspended to measure the soil's pH.

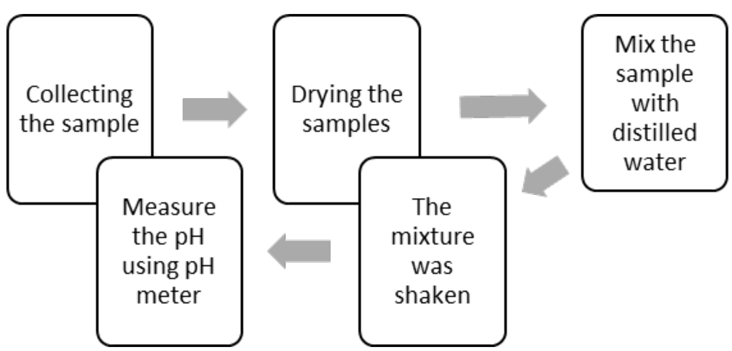

Figure 2 Workflow of pH measurement

2.3 Particle grain size

A particle size analyzer was employed to evaluate the particle size of sediments from paddy fields. The desiccated sediment samples were subjected to sieving with a 2 mm screen and treated with 15 mL of 30% Hydrogen Peroxide (H_2O_2) to remove organic material. The suspension was heated to 50°C for one hour, after which the clear supernatant was extracted using a pipette. The treatment was administered two to three times until the samples were completely bleached and all organic debris was eliminated. Prior to inserting the samples into the laser particle analyzer, 5 mL of Calgon solution was incorporated. Statistical analyses were performed utilizing the laser particle sizer control software and MS Excel, with sediment grain size transformed into phi (ϕ) units. The sediment type was categorized via a textural triangle according to the proportions of sand, silt, and clay components.

2.4 Moisture

The oven-drying method was utilized to assess moisture content. 30.0 g of soil, denoted as w, was measured from each sample bag into weighing tins. The saturated soil samples were subjected to drying in an oven at 105 °C for 24 hours to eliminate moisture content. The samples were extracted from the oven and allowed to cool prior to weighing them for their dry weight in the weighing tin.

3. Novelty and uniqueness

Soil organic matter (SOM) and marine sediment pH, which affect chemical and biological activities. The study found variation in sediment particle size distribution, classified as silty clay and silty clay loam sediment types. Soil texture is crucial for management and affects soil fertility, erodibility, conservation efforts, and vegetation production. Moisture content fluctuates greatly due to beach topography, storm-wave dynamics, and sea level fluctuations. Surface wetness helps resist erosion of sediment layers into the ocean.

4. Benefit to mankind

Research on organic matter concentrations in paddy fields and beach ecosystems can improve sustainable agricultural practices, enhance crop resilience to climatic variability, and reduce reliance on chemical fertilizers. Understanding soil pH and moisture levels can improve soil management and productivity. Understanding climate change adaptation to plant growth and ecosystem vitality can help modify agricultural practices for consistent food production.

5. Innovation and Entrepreneurial Impact

Research can improve precision agriculture technology by utilizing soil pH, moisture, and organic matter data for improved irrigation and fertilization methods. Companies can develop real-time monitoring software and IoT devices, enhancing crop yields and minimizing resource usage. Understanding organic matter could lead to eco-friendly fertilizers and soil conditioners, aligning with sustainable agriculture practices.

6. Potential commercialization

Understanding the relationship between organic matter and soil health can lead to the creation of commercial products like organic fertilizers and soil conditioners, promoting sustainable farming practices. Precision agriculture technologies can be developed using moisture and particle size data, while real-time soil monitoring can improve resource efficiency. Understanding pH and moisture levels can reduce pollution in coastal regions.

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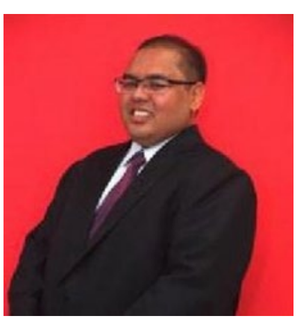
8. Authors' Biography

Nursuhaila Muhamad Fauzi is a committed final-year student in the Faculty of Applied Science, Universiti Teknologi MARA Perlis Branch. She is now pursuing a degree in Science Physics.

Nur Azlin Atikah Mohd Nasir is a dedicated final year student at the Faculty of Applied Science, Universiti Teknologi MARA Perlis Branch. She currently pursuing a degree in Science Physics.

Aimie Rifhan Hashim is a postgraduate researcher at Universiti Teknologi MARA (UiTM), Perlis. His research focuses on innovative approaches in environmental studies, utilizing jellyfish as bioindicators to monitor climate change impacts and developing database-driven solutions for sustainable marine ecosystem management.



Gs. Sharir Aizat Kamaruddin serves as a lecturer and researcher in the Faculty of Applied Sciences, Universiti Teknologi MARA Perlis Branch. He specialises in environmental sciences and studies.