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Analysis of subtract quality along the Wiringtasi River, Barru Regency, Indonesia

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Abstract

This research aims to determine the quality of the substrate of the Wiringtasi River, Barru Regency, Indonesia. The research locations include location 1, namely the location around the rice field area; location 2, namely the location around the pond area and beach; and location 3, namely the location around the river estuary where many mangrove plants grow around it. Subtract samples were taken at the research location, then the samples were taken to the laboratory for analysis. The results of laboratory analysis are made in the form of pictures and tables, then analyzed using descriptive analysis. The results of the research show that in this study the substrate quality of the Wiringtasi River, Barru Regency, Indonesia, each had a pH value of the substrate in the range of 8.05-8.64, total nitrogen was in the range. Nitrogen was in the range of 0.049-0.121%. The organic material content of the substrate is in the range of 0.33-0.59. The ammonia (NH3) content of the substrate is in the range of 0.019–0.45 ppm. The nitrite content of the research location is in the range of 0.0025-0.0064 ppm. The substrate texture of location 1 is dusty clay, while locations 2 and 3 are sandy.

Keywords: Analysis; Substrate; River; Wiringtasi

1. Introduction

River regions are useful spaces where a variety of economic activities can be conducted. Fisheries, transportation, industrial regions, tourism, residential areas, and trash disposal sites are a few of the economic activities that frequently take place (18). Efforts that can be made are to manage the land based on soil quality parameters that suit plant needs. Indicators used in assessing soil quality include physical, chemical and biological soil properties (13). Therefore, river areas have the potential to experience a decline in quality, both water quality and soil or substrate quality. Good soil quality has an impact on increasing production yields, and economic prosperity for the community, soil resistance to erosion, and human health can minimize the influence of heavy metals (34).

Rivers are a form of aquatic ecosystem that has an important role in the hydrological cycle and functions as a water catchment area for the surrounding area (31). Therefore, the condition of a river is closely related to the characteristics of the surrounding environment. The large number of activities and the presence of river flows are two of the external factors that have the potential to cause changes in water quality. External factors can come from the open sea that surrounds it or from land in the form of river flows. Meanwhile, internally, it can be influenced by the shape of the waters and the topography of the bottom of the waters (25), and these external factors not only influence the quality of the water but can also influence the quality of the substrate.

The input of organic materials carried through waste produced by human activities will enter the waters and, under certain conditions, will disturb existing waters. Too high an organic material content will cause waters to experience eutrophication. Eutrophication is water pollution caused by the emergence of excessive nutrients into the water

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ecosystem, which results in uncontrolled growth of aquatic plants (32). An increase in organic matter levels is characterized by an increase in phytoplankton and increased water growth (blooming algae) (1).

However, an environmental factor that helps maintain the quality of water and soil along rivers is mangrove plants. Mangrove ecosystems can help maintain the level of damage to ecosystems around rivers. The mangrove ecosystem is an ecosystem area that is related to land ecosystems and offshore ecosystems, which connects land areas to inland areas and coastal areas. Furthermore, the surface of the mangrove sediments is also covered with organic agricultural waste such as banana leaves, coconut leaves and banana fronds. The mangrove ecosystem area is an area rich in organic material that has exceeded its carrying capacity, thus affecting the existence of the mangrove itself (5). This accumulation of organic material makes the mangrove location rich in organic material and has an impact on the high oxygen demand for bacteria for the decomposition of organic material (26). A river estuary is a closed body of water that is located downstream of a river and is still connected to the sea, thus allowing for the mixing of fresh water and sea water (27). Based on this description, research has been carried out regarding the condition of the substrate along the Wiringtasi River, Barru Regency, Indonesia.

2. Material and methods

The tools used in this research were tools and grinders, 2 inch paralon pipe 50 cm long, 5 kg sample bags, oven, calculator, Ohaus balance, pH indicator, stationery, camera, aluminum foil, and multi-level sieve (31). Subtract sampling at the research location was carried out using purposive sampling by determining the sampling location based on the characteristics of different locations. The sampling locations were location 1, namely the location around the rice field area; location 2, namely the location around the pond area and beach; and location 3, namely the location around the river estuary where many mangrove plants grow around it. Each location represents the study area. At each predetermined location. Subtract collection was carried out using a 2 inch paralon pipe to a depth of 50 cm at each research location. The paralon pipe that has been inserted is then pulled and the sediment layer is looked at (31). Next, put the sample in a plastic bag and note down the location where the sample was taken. Next, the substrate samples were taken to the laboratory to be analyzed for pH, nitrogen, organic matter, ammonia, nitrite, and substrate texture content.

After arriving at the laboratory, the substrate was dried, and after drying it was sifted. The tiered sieves are arranged from top to bottom, starting with the sieve with the largest to the smallest sieve diameter. Samples obtained from the research location were then dried in the sun and oven at a temperature of 100-110 for ± 4 hours to remove the water content contained in the samples and produce dry samples. After that, the sample is first selected, and then the sediment chunks are crushed so they can be sifted. Next, the sample is placed on a sieve shaker (particle separating machine) and covered using the available weighted lid to press the multi-level sieve so that it does not shake and spill easily. Turn on the machine by pressing the start button, then wait until the sediment is filtered completely ± 20 minutes. After the machine stops, take the sieves out of the machine and look at the sediment results from each sieve. Next, the results of the sieve are weighed to obtain grams of results for each sieve size, and to determine the percentage and composition of the substrate, it is calculated using the formula (31):

$$\% \text{ heavy } = \frac{\text{Sieve weight}}{\text{Total weight of sample after drying}} \text{ x } 100\%$$

The results of the analysis of the substrate samples in the form of pH, nitrogen, organic matter, ammonia, nitrite, and substrate texture were then made into graphic images and analyzed using descriptive analysis.

3. Results and discussion

3.1 Substrate pH

Soil reaction is a term to express the level of soil acidity (pH), namely the negative logarithmic value of the hydrogen ion content in the soil solution. Some of these hydrogen ions are found freely in the soil solution, and some are in adsorbed form on the surface of soil colloids (7).

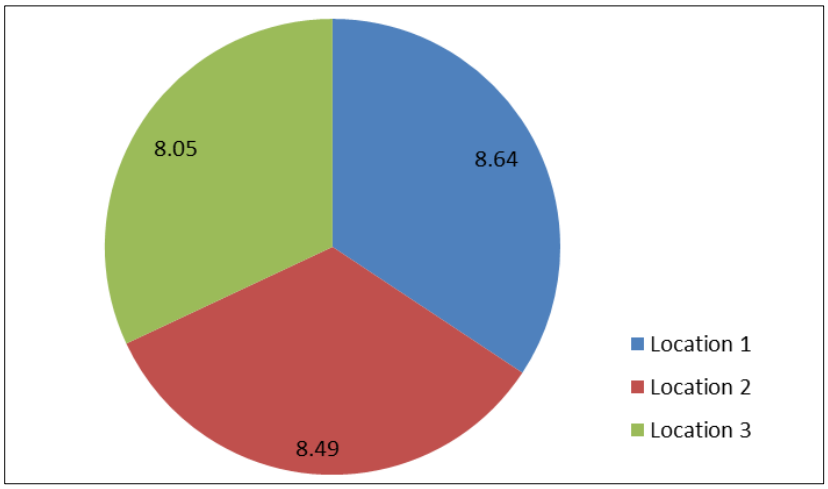

Figure 1 Substrate pH Value at the Research Location

Figure 1 shows that the pH value of the substrate in the three research locations is highest at location 1, namely the river location adjacent to the mouth of the Wiringtasi River, namely 8.64, followed by location 2, namely the location around the pond and the coast, which has a substrate pH value of 8.49, and the substrate with the lowest pH value at location 3, namely the location adjacent to rice fields, has a substrate pH value of 8.05. The high pH value of the substrate at the river estuary is because this location has a sandy substrate with little mangrove growth. Meanwhile, the low pH value of the substrate at location 3, which is located around rice fields, is thought to be caused by the frequent use of fertilizers, especially those containing a lot of nitrogen (N) in rice fields, which results in low pH values. In these acidic mineral soil conditions (low pH), the solubility of elements such as iron, manganese, and aluminum increases as hydrated metal ions in the soil solution (33). In these acidic conditions, aluminum is the dominant cation on the surface of soil colloids. This element affects the availability of phosphate; phosphate will be bound by aluminum and iron to form deposits that cannot be absorbed by plants. Besides the toxicity of these elements, acidic mineral soils often become less fertile due to a lack of Ca and Mg and high aluminum saturation. Therefore, to overcome the acidity problem, liming can be done with either calcite lime ($CaCO_3$) or dolomite ($CaMg(CO_3)_2$) to reduce the negative influence of these toxic elements and to increase the pH so that the nutrients become available (15). Determination of soil pH is often done in two ways, namely with water solvent to measure free hydrogen ions and KCL solvent to measure exchangeable and free hydrogen ions in soil solution (7).

3.2 Total Nitrogen (%)

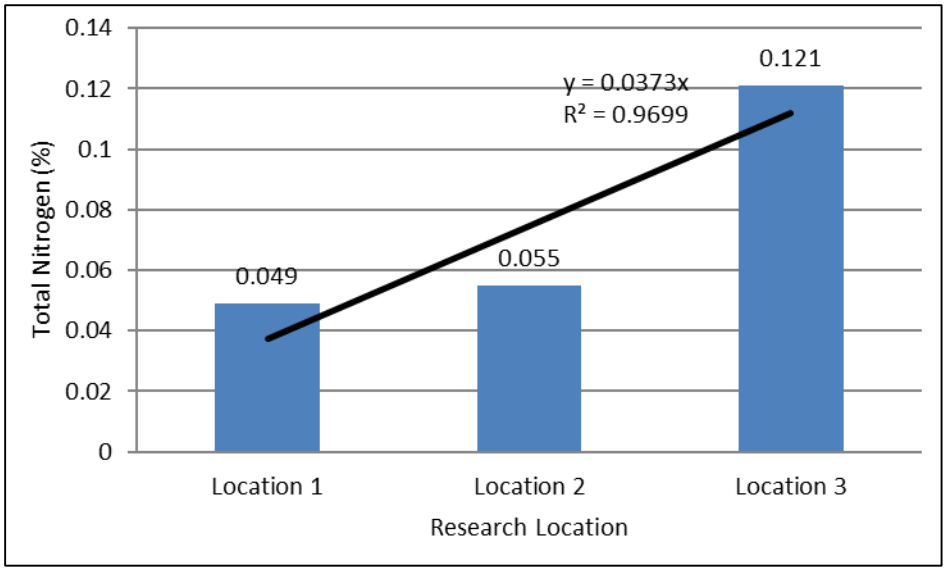

Figure 2 Total Nitogen Value of Substrate at the Research Location

Nitrogen is an essential element that plants need in large quantities. Meanwhile, soil nitrogen content varies greatly and is influenced by other factors such as climate, vegetation, topography, and the physical and chemical properties of the soil (23). The highest total nitrogen value at the research location was obtained at location 3, namely the research location adjacent to rice fields, namely 0.121%, followed by locations in rivers around ponds and beaches, namely 0.055%, and the lowest nitrogen content at location 1, namely the location adjacent to an estuary. The high total nitrogen value at location 3 is due to the fact that this location is close to rice fields where fertilizers are widely used, especially fertilizers containing nitrogen such as urea. In previous research, it was stated that an evaluation of soil chemical properties based on distance from the river in the tidal area of Kota Besi District, East Waringin City, showed that total nitrogen at the research location was classified as low to medium with a range of 0.03-0.23% (7). Nitrogen makes up about 1.5% of plant weight and functions mainly in protein formation (14).

3.3 Organic Material (%)

Organic material comes from the decomposition of plant and animal tissue that remains in the soil. Soil organic matter content is determined by measuring the organic carbon (C) content in the soil. Soil organic C content varies quite widely from low to high. This variation in organic C content from low to high is partly due to differences in vegetation conditions, which can influence the level of organic material accumulation on the soil surface, and also due to differences in topographic conditions, which can influence the intensity of the organic material oxidation process on the soil surface (7).

Figure 3 shows that the highest substrate organic matter content is at location 3, namely the river location around rice fields, namely 0.59%, and the research location with the lowest organic material content is the location around ponds and beaches, namely 0.33%. The high content of organic materials in location 3 is thought to be due to the high level of community activity in terms of utilizing various materials in agricultural businesses such as providing fertilizer and/or using pesticides. Meanwhile, the low content of organic matter around ponds or beaches is because in coastal areas there is an exchange of sea water, which is influenced by the tides. Soil organic C content increased with increasing distance from the river bank. The increase in organic C content with increasing distance from the river bank is due to the fact that as you move towards the river bank, the influence of deposition due to overflowing river water becomes more pronounced. The deposition process that continues to occur every time the river overflows results in the soil developing on the riverbanks being alluvial soil (7).

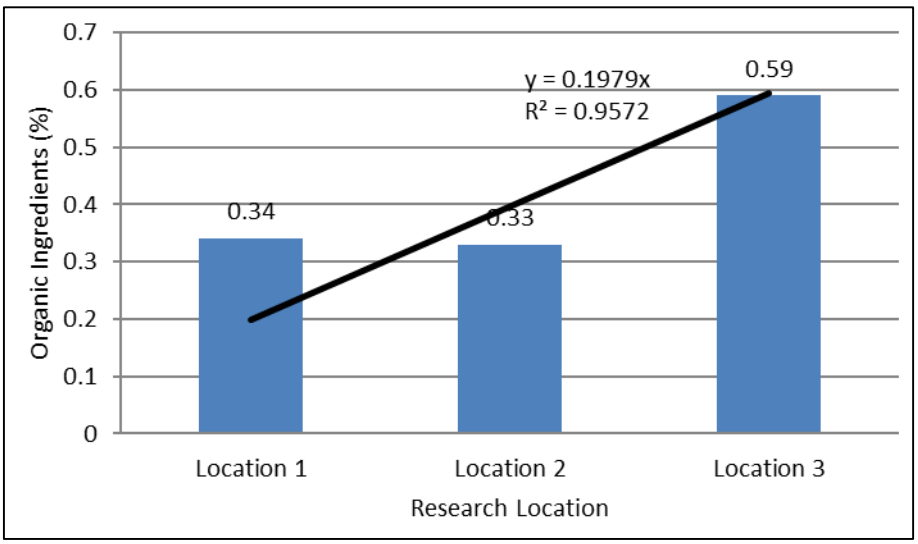

Figure 3 Organic Substrate Material at the Research Location

Variations in organic C content in the soil can influence the growth of plants on it through their influence on the physical, chemical, and biological properties of the soil. The physical functions of organic matter include stimulating the formation of good soil structure, improving aggregate stability, porosity, aeration, water retention, reducing soil erodibility, and influencing the bulk density and color of the soil (19). Meanwhile, biologically, organic matter acts as a carbon source and energy source for the activity of most microorganisms in the soil. Some sources of soil N include the decomposition of organic nitrogen such as proteins and amino acids found in organic matter, biological anchorage (symbiotic and non-symbiotic), deposition from the atmosphere, deposition of erosion sediments, and fertilization (28).

Soil organic matter plays a role in nutrient cycling, cation exchange capacity, soil acidity, buffer capacity, salinity, and has the ability to form ligand complexes (19).

3.4 Ammonia (ppm)

One of the water pollution parameters is ammonia (NH_3). The presence of ammonia in river water that exceeds the threshold can disrupt aquatic ecosystems and other living creatures. Ammonia is highly toxic to almost all organisms. The presence of ammonia in river water that exceeds the threshold can disrupt aquatic ecosystems and other living creatures. Ammonia is highly toxic to almost all organisms (6). Ammonia in waters is divided into 2 forms, namely ionized ammonia (NH_3) and ionized ammonium (NH^{4+}). The presence of non-ionized ammonia is strictly avoided because it can be toxic to waters (21). Ammonia can be toxic to humans if the amount that enters the body exceeds the amount that the body can detoxify. In humans, the greatest risk is from inhaling ammonia vapor, which results in several effects, including irritation to the skin, eyes, and respiratory tract. At very high levels, inhalation of ammonia vapor is fatal (6).

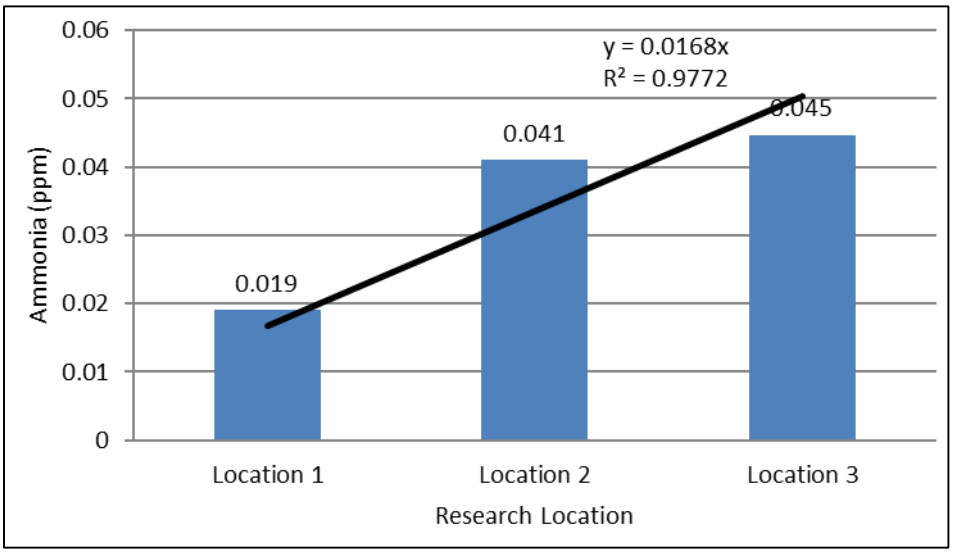

Figure 4 Substrate Ammonia Content at the Research Location

Figure 4 shows that the highest ammonia content in the Wiringtasi river flow is highest in locations close to rice fields, namely 0.45 ppm, and the lowest ammonia content is in locations around the river mouth, namely 0.019 ppm. The high ammonia content in location 3 is thought to be caused by high community activity in using various kinds of fertilizers and/or pesticides, while the low substrate ammonia content in location 1 is because location 1 is close to ponds and beaches, so water changes frequently occur through tides. Ammonia can be toxic to humans if the amount that enters the body exceeds the amount that can be detoxified by the body, namely no more than 100 mg/kg every day (33.7 mg of ammonium ions per kg of body weight per day), which can affect metabolism by changing acid-base balance in the body (12). Apart from that, ammonia with a concentration of 130–200 ppm in gas form is irritating to the skin, eyes, and respiratory tract. At higher concentrations, namely 400-700 ppm, it can cause permanent damage due to irritation of the eyes and respiratory organs (9).

The conditions for the ammonia test are alkaline conditions; therefore, high precision in making the test reagent is required so that conditions conducive to the reaction can be achieved. The measurement linearity of a method is proportional between the analyte concentration in the test sample and the concentration area given with a linearity acceptance value, namely linear regression >0.995 (2). There are several communities that use urea fertilizer for agriculture so that the runoff from land containing urea is relatively large. If dissolved in water, it will increase the concentration of ammonia, which causes poisoning for almost all aquatic organisms (20). The large amount of urea content and the ammonification process originate from the decomposition of organic material by microbes. Apart from that, in residential areas, the majority of the population still carries out their daily activities using river water (2).

3.5 Nitrite (ppm)

Nitrite (NO_2) is a type of nitrogen that is only partially oxidized; nitrite is not present in fresh wastewater but is found in old or expired wastewater (11). Nitrate is a compound that dissolves in water; this compound is a stable form of

nitrogen. The presence of nitrate in rivers is caused by ammonia, which can come from nature itself or waste from humans. Excess nitrate can cause lack of oxygen, reduced fish populations, unpleasant odors, and bad water. Phosphates come from human, animal, domestic, industrial, and so on. High phosphate content can increase algae growth and reduce the amount of sunlight entering the water (22).

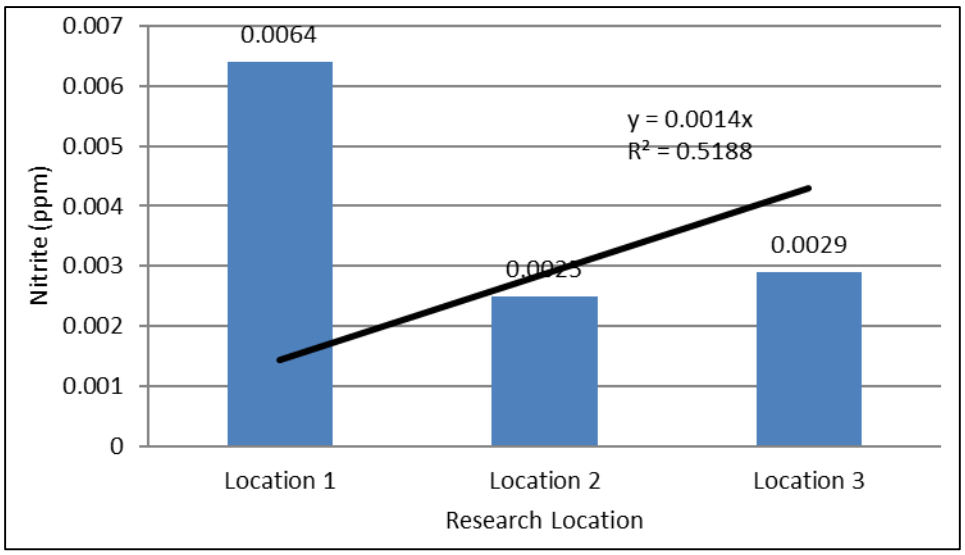

Figure 5 Nitrite (NO_2) content of the substrate at the research location

Figure 5 shows that the substate nitrite content at the research location is highest at location 1, namely the location around ponds and beaches, namely 0.0064 ppm, while the research location with the lowest nitrite content is the research location close to the river mouth, namely 0.0025 ppm. The high nitrite content in location 1 is thought to be caused by community activities at that location, namely aquaculture businesses, and at this location many fishing boats are moored. Meanwhile, the low nitrite content in location 2, namely the location close to the river mouth, is thought to be caused by high water exchange at that location due to tides. In waters, nitrite (NO_2) can usually be found in much smaller quantities than nitrate because it is unstable in the presence of oxygen. Nitrite is an intermediate form between ammonia and nitrate (nitrification) (4). The quality standard allows a nitrite value of 0.06 ppm, so that the nitrite value in these 8 segments is still in accordance with the quality standard (10).

3.6 Substrate Texture

and clay fractions in the soil mass determined in the laboratory (3). Texture is the relative ratio between sand, dust, and clay fractions, namely soil particles whose effective diameter is <2 mm; organic matter in soil texture is not taken into account (17). Table 1 shows that at location 1, namely the research location, which is close to the river mouth, and location 2, which is close to ponds and beaches, both have a substrate texture, namely sandy texture, while at location 3, namely the location with a river close to rice fields, the substrate texture is dusty clay. Soil texture is a ratio of the proportions of soil fractions, namely sand, silt, and clay. These fractions have different physical, chemical, and biological properties. Apart from that, there are also factors that influence soil texture, such as water, time, parent material, organisms, and topography (16). The fine fraction has characteristics, namely small particle size, large surface area, and large water holding ability (30). Soil texture has a role in the soil erodibility index value.

Table 1 Substrate Texture at the Research Location

Location 1	dusty clay
Location 2	Sandy
Location 3	Sandy

Table 1 shows that of the three sampling locations, only location 1, namely the location around the rice fields, has a dusty clay texture, while the other locations, namely location 2, namely the location around ponds and beaches, and location 3, namely the location around the river mouth, have a sandy texture. Coarse-sized sediment will be transported or deposited in open-water areas connected to the open sea. Meanwhile, fine sediment will be deposited in areas that

have calm currents, especially in shallow and closed waters (24). If a sediment deposit is dominated by coarse sediment grain size, then this indicates that the power of the flow to transport the sediment is quite large, whereas the fine grain size indicates the weak strength or energy that transports the sediment (29). At location 3, which is a river estuary, the substrate texture is sandy. The large supply of sediment that enters mangrove forests certainly has different fractions, sizes, and types, such as waste originating from mining, industrial development, household waste, and so on. This can certainly damage and result in a decline in the function and benefits of mangrove forests because one of the supporting factors for mangrove vegetation to continue to grow well is the mangrove substrate (8).

4. Conclusion

In this study, the pH value of the substrate in the three research locations was highest at location 1, namely the river location adjacent to the mouth of the Wiringtasi River, Barru Regency, namely 8.64, and the substrate with the lowest pH value at location 3, namely the location adjacent to rice fields, has a substrate pH value of 8.05. The highest total nitrogen value at the research location was obtained at location 3, namely the research location close to the rice fields, namely 0.121%, and the lowest nitrogen content at location 1, namely 0.049%. The highest substrate organic material content was at location 3, namely the river location around rice fields, namely 0.59%, and the research location with the lowest organic material content was the location around ponds and beaches, namely 0.33%. The highest ammonia content in the Wiringtasi river flow was highest in locations close to rice fields, namely 0.45 ppm, and the lowest ammonia content, namely 0.019 ppm. The substate nitrite content at the research location was highest at location 1, namely 0.0064 ppm, while the research location with the lowest nitrite content was the research location close to the river mouth, namely 0.0025 ppm. Furthermore, the texture of the substrate is generally sandy except at location 1, namely the location adjacent to the rice fields, which has a dusty clay texture.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

[1] Alfionita, A.N.A., Patang., & Ernawati S.K. 2019. Effect of Eutrophication on Water Quality in Jeneberang River. Journal of Pendidikan Teknologi Pertanian. 5(1): 9 – 23

[2] Apriyanti. D, V. Indria Santi & Y.D. Inayati Siregar. 2013. Study of Ammonia Analysis Methods in Water Using the Salicylate Test Kit Method. Ecolab. 7(2): 49-108.

[3] Arabia, T., & I. Royani. 2012. Characteristics of Salin Krueng Raya Land, Mesjid Raya District, Aceh Besar Regency. Journal of Manajemen Sumberdaya Lahan, 1(1): 32–42.

[4] Arlina, Upriatna & Malia, D. 2022. Analysis of Nitrite (NO2-N) Levels in Surface Water and Ground Water Samples in the Cilacap Regency Area Using the Uv-Vis Spectrophotometer Method. Gunung Djati Conference Series, Available at: Proceedings of the National Chemistry Seminar. 77(2): pp. 1-7.

[5] Audina, M., S. H. Siregar., & B. Amin. 2021. Relationship of Organic Content in Sediment with Morphometric Mangrove Leaves (*Rhizophora apiculata*) in the West Mangrove Ecosystem, Dumai City, Riau Province. Journal of Fisheries and Marine Affairs. 26(1): 54-61.

[6] Azizah, M & M. Humairoh. 2015. The analysis ammonia (NH_3) in the river Cileungsi. Journal of Nusa Sylva. 15: 47-54

[7] Basuki., Zubaidah, S., & Husin. 2018. Evaluation of Soil Chemical Properties by Distance from the River in The Tidal Land Area of Kota Besi District, East Kotawaringin, Central Borneo. Jurnal of Agri Peat. 19(1): 1-14.

[8] Bengen, D. G. 2004. Guidelines for the Introduction and Management of Mangrove Ecosystems. PKSPL IPB. Bogor.

[9] Effendi, H. 2003. Water Quality Studies for Management of Aquatic Resources and Environment. Kanisnus Publishers. Yogyakarta.

[10] Effendi, H., Kristianiarso, A.A. & Adiwilaga, E.M. 2013. Water Quality Characteristic of Cihideung River, Bogor Regency, West Java. Ecolab, 7(2): 49–108.

[11] Emilia, I. 2019. Refill Drinking Water Using UV-Vis Spectrophotometry Method. Journal of Indobiosains, 1(1): 38–44. Available at: https://jurnal.univpgripalembang.ac.id/index.php/biosains/ article/view/2441/2245.

[12] Fawel, J.K., Lund, U., & Mintz, B. 1996. Guidelines for Drinking Water Quality. 2nd ed Vol.2. Health Criteria and other Supporting Information, WHO, Geneva.

[13] Febriana, A., N. M Trigunasih., & M. S. Sumarniasih. 2024. Soil Quality Analysis and Management Direction on Land in the UNDA Watershed of Bali Province, Indonesia. Agro Bali : Agricultural Journal7(1): 227-245. https://doi.org/10.37637/ab.v7i1.1309

[14] Hanafiah K A. 2007. Basics of Soil Science. Jakarta : PT. Raja Grafindo Persada.

[15] Hardjowigeno, S. 1992. Soil Science (3th Ed.). Mediyatama Sarana Perkasa. Jakarta. 233p.

[16] Hardjowigeno, S. 1995. Soil Classification and Pedogenesis. Edisi Pertama.

[17] Haryati, U. 2014. Physical Characteristics of Soil in Highland Vegetable Cultivation Areas, Their Relationship with Land Management Strategies. Jurnal Sumberdaya Lahan, 8(2): 125–138.

[18] Junaidi, M. 2015. Estimation of Organic Waste from Crayfish Cultivation in Floating Net Cages on the Water Quality of Ekas Bay, West Nusa Tenggara Province. Journal of Biologi Tropis. 6(2): 345

[19] Murphy, B.W. 2015. Impact of soil organic matter on soil properties - a review with emphasis on Australian soils. Soil Research 53(6) 605-635 https://doi.org/10.1071/SR14246

[20] Murti, R. Setiya & C. Maria H.P. 2014. Optimization of Reaction Time for the Formation of a Stable Indophenol Blue Complex in the N-Ammonia Test of Leather Tanning Industry Wastewater Using the Phenate Method. Magazine of Kulit, Karet, & Plastik. 30(1): 29-34.

[21] Nadapdapa, N.S., I.Y. Perwiraa., & N.M. Ernawatia. 2020. Analysis of Carbon, Nitrogen and Total Bacteria in the Bottom Substrate of Vannamei Shrimp (*Litopenaeus vannamei*) Ponds in the Middle of the Planting Period in Sanggalangit Village, Buleleng, Bali. Current Trends in Aquatic Science, III(1): 97-105

[22] Ngibad, K. 2019. Analysis of Phosphate Levels in Ngelom River Water, Sidoarjo Regency, East Java. Journal of Pijar MIPA. 14(3): 197–201.

[23] Nopsagiarti, T., D. Okalia., G. Marlina. 2020. Analysis of C-Organic, Nitrogen and Soil C/N on Beken Jaya agrotourism land. Journal of Agro Sains dan Teknologi. 5(1).

[24] Nugroho, S.H., & Basitt, A. 2014. Sediment Distribution Based on Grain Size Analysis in Weda Bay, North Maluku. Pusat Penelitan Laut Dalam, LIPI,Ambon

[25] Patty, S. 2013. Distribution of Temperature, Salinity and Dissolved Oxygen in Kema Waters, North Sulawesi. Journal of Ilmiah Platax. 1(3).

[26] Pinontoan, M.P., James, J.H., Paulus., Stenly, W., Rizald, M. R., Elvy, L. G., & Wilmy E. P. 2023. Dissolved Oxygen and pH of Mangrove and Coastal Sediment Prepared Water in Bulutui Village, West Likupang District. Jurnal Pesisir dan Laut Tropis. 11(1): 132-138

[27] Rahman, F.A. 2009. Macrozoobenthos Community Structure in the Estuarine Waters of the Brantas River (Porong and Wonokromo Rivers), East Java. IPB, Bogor. 98 pp.

[28] Rezig, A. M. R., Elhadi, E. A. and Mubarak, A. R. 2012. Effect of incorporation of some wastes on a wheat-guar rotation system on soil physical and chemical properties. International Journal of Recycling of Organik Waste in Agriculture, 1:1. doi:10.1186/2251- 7715-1-1.

[29] Rifardi. 2012. Modern Marine Sediment Ecology. Riau University Press. Riau.

[30] Rosyidah, E., & R. Wirosoedarmo. 2013. Effect of Soil Physical Properties on Saturated Hydraulic Conductivity in The 5 Land Use (A Case Study in Sumbersari Malang). *Agritech*, *33*(3), 340–345.

[31] Sari, A.N., E. H. Kardhinata., & Hanifah, M.Z. N. A. 2017. Analysis Substrate in The Nipa Village Ecosystem Sei Nagalawan Serdang Bedagai North Sumatera. BioLink. 3(2): 163-172

[32] Simbolon, A.R. 2016. Organic Material Pollution and Eutrophication in Cituis Waters, Tangerang Coast. Jurnal ProLife. 3(2).

[33] Tan, K.H.. 1982. Principles of Soil Chemistry. Marcel Dekker, Inc. New York. Tester

[34] Wander, M. M., Walter, G. L., Nissen, T. M., Bollero, G. A., Andrews, S. S., & Cavanaugh-Grant, D. A. (2002). Soil quality: Science and process. Agronomy Journal, 94(1): 23–32.