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Analysis of the Heavy Metal Levels (Cd, Fe, Hg and Pb) at Losari Beach Tourism Reclamation of Makassar

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Abstract

The process of stockpiling reclamation areas and disposing of waste streams can pollute the environment and cause the attendance of dangerous heavy metals. In this research was conducted to determine heavy metals Cd, Fe, Hg, and Pb levels in water and sediment on Losari beach. The method used was an atomic absorption spectrophotometer. The result showed that the levels of Cd and Fe in the water for the north point were 0.0278 and 0.0432 mg/L, the south point was 0.0031 and 0.0674 mg/L, the point around the platform showed 0.0028 and 0.0534 mg/L and the levels of sediment were 0.0010 and 31.2417 mg/L. The levels of Hg and Pb in water were 0.0235 and 0.0390 mg/L (north point) 0.0105 and 0.0420 mg/L (south point) 0.0027 and 0.0460 mg/L (around the platform), sediments were 0.0027 and 0.071 mg/L. The result concluded that the concentration of Cd had crossed the threshold only at the north point namely 0.01 mg/L, while the concentration of Fe that crossed the threshold was only in sediment namely 20 mg/L. The level of Hg and Pb pollution in the water and sediment of Losari beach tourism is polluted because it exceeds quality standards.

Keywords: Losari beach, Cd, Fe, Hg, Pb.

INTRODUCTION

Losari Beach is one of the centre points of Makassar city which is an alternative recreational place for residents of Makassar City who are experiencing very rapid changes. The reclamation of Losari Beach has changed the condition of Losari Beach to be more modern with the rapid construction of tourist and business attractions. The physical changes seen in the Losari Beach area are constructing three Losari beach platforms and building the Terapung Mosque. Losari Beach has developed a coastal city mitigation model (Arisaputra. 2013). Coastal reclamation is an example of human efforts to address land limitations in urban areas as in Makassar City. The reclamation activities are the construction of the *Center Point* of Indonesia in the Losari Beach Area. Makassar City Regional Regulation Number 4 of 2015 concerning Makassar City Spatial Planning for 2015-2034 designated the Center Point of Indonesia (CPI) area as an Integrated Global Business Center (Alfan, Lukman, Handoyo, & Ernas, 2021).

Various community activities in coastal areas threaten environmental damage one of which is by increasing levels of heavy metals in waters. Waste that enters the waters and settles in soil sediments can be both organic and inorganic matter. Material entering coastal waters is transported by tidal currents, dilution, coagulation and sedimentation, associated with sedimentary organic matter. and is absorbed by plankton (Djainal. 2022).

Most of the waste comes from inorganic waste materials. Inorganic waste materials derived from the remaining production of the printing industry, chemical factories, textiles, pharmaceuticals and electronics have the potential to damage the environment because they contain harmful and toxic materials, including heavy metals (Noor, Kabangnga, & Fathuddin, 2021).

Another factor that can pollute the waters on the Losari coast is the coastal reclamation process carried

out by the local government. Reclamation is an effort to increase the area of territory carried out by the government to accommodate the growing population. Beach reclamation efforts will continue to grow along with the increasing number of visitors and the area of Losari beach is now unable to accommodate so many residents or visitors (Djainal, 2022).

Reclaiming the Losari coast also hurts the survival of marine life because it can result in ecosystem changes such as changes in current patterns, erosion and sedimentation and increased turbidity in the waters. The process of hoarding on coastal reclamation and the disposal of waste that is discharged into seawater can pollute the oceans and reduce the value of environmental sustainability, which is one of the harmful heavy metal content (Puspasari, Hartati, Anggawangsa, 2017). The factor that causes heavy metals to belong to the group of contaminants is the presence of non-degradable and easily absorbable properties of heavy metals. The spread of heavy metals in the environment is mainly due to the disposal of waste products (Marzuki & Putra, 2022) (Kurnia, Kaseside, & Iwamony, 2021). The waste parameters that need to be known the most in the environment are toxic or toxic metal levels such as lead (Pb) and nickel (Marzuki & Putra, 2022; Wibowo et al. 2020).

Several researchers have conducted studies to analyze heavy metal levels in waters. The results of the analysis shows of the presence of heavy metal levels of lead (Pb), cadmium (Cd), and mercury (Hg) in the coastal tourist waters of Akkarena and Tanjung Bayang areas. Lead heavy metal (Pb) pollution has been identified in the Citarum Hulu River Dayuhkolot Segment waters to Nanjung (Desriyan, Wardhani, & Pharmawati, 2015) with reclamation activity around the coastal area. One method that can be used in determining metal levels in water is spectroscopy using an Atomic Absorption Spectrophotometer (AAS) (Rahayu, Tanasale, & Bandjar, 2020; Hasmizal. 2020). One of the requirements for metal analysis using AAS is that the sample must be a solution. So before the metal content in the sample is analysed, it is the first destruction to remove/separate the content of other ions. with the initial treatment expected that the error at the time of analysis can be suppressed to a minimum and using adsorbents (Subroto. Tarmidzi. Wati. & Armans. 2022).

Based on the description above we have conducted analyzed the content of heavy metals cadmium (Cd), iron (Fe), market (Hg), and lead (Pb) in Losari beach tourism to see the level of heavy metal pollution. The reclamation of Losari beach and compare it with the standards for seawater quality standards for marine tourism according to the decree of the Minister of Environment No. 51 of 2004 and several other regulations such as Regulation of the Governor of South Sulawesi No. 69 of 2010 to determine the level of metal pollution.

METHODOLOGY

Materials

The tools used are AAS, oven, desiccator, analytical balance sheet, hot plate, porcelain dish, 50 mL measuring flask, 10 mL volume pipette, 2.000 mL beaker, 250 mL and 500 mL beaker, 100 mL measuring cup, 250 mL Erlenmeyer, funnel, bulb. paragon pipe, electric stove and sample bottle.

The materials used are nitric acid (HNO_3) p.a. perchloric acid ($HClO_4$) p.a. bi-distilled water, filter paper Whatman no. 41, boiling stone, cadmium nitrate ($Cd(NO_3)_2$), iron sulphate (FeSO4), mercury (I) nitrate ($HgNO_3$) and Lead (II) nitrate ($PbNO_3$), distilled water, seawater and soil at Losari coastal reclamation.

Methods

Sample Preparation

At this stage observations are made at the research site to determine the sampling point and time which will then be tested at the Analytical Laboratory of the Faculty of Science and Technology UIN Alauddin Makassar. Seawater samples were taken at the study site consisting of 4 points. Seawater samples were taken at point 1 of the Northern Losari beach and point 2 of the Southern Losari beach, and point 3 was carried out around the Losari beach platform. Meanwhile, point 4 was carried out for soil sampling around the Losari beach platform.

Sampling

Sampling was carried out at Losari beach tourism with the sampling technique used was purposive sampling. The sampling technology makes it easier to determine the sampling point. Seawater samples were taken using sample bottles that had been sterilized using distilled water, the sampling distance from the shoreline was 20 meters with a depth of 50 cm. Soil sampling using paragon pipes measuring 1-1.5 m then taken to the Analytical Laboratory for analysis.

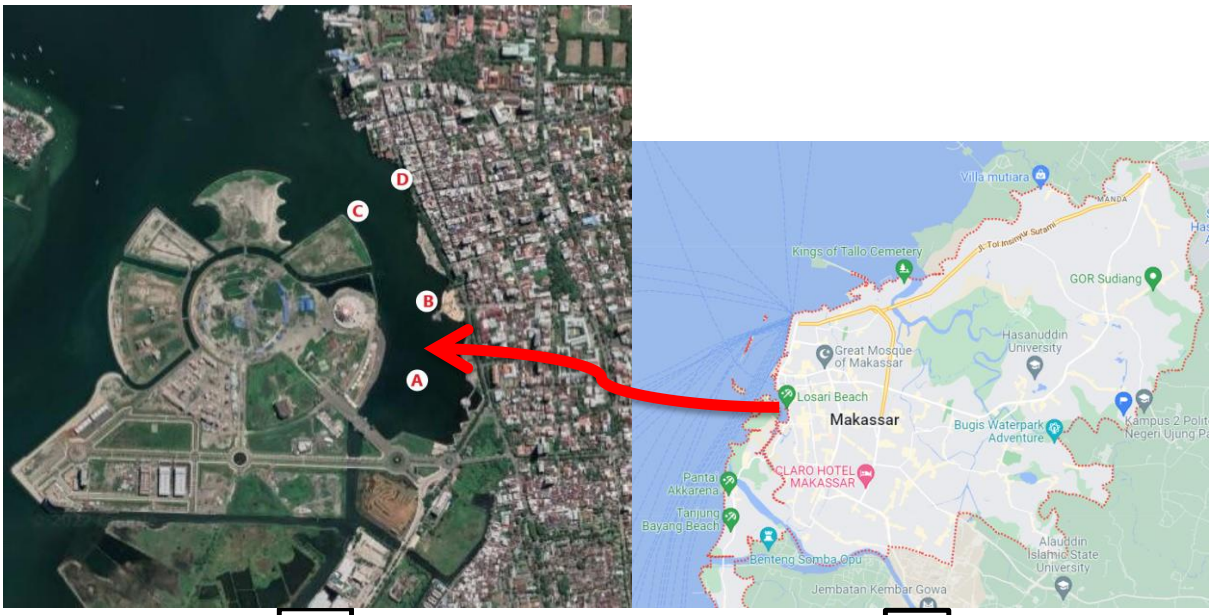

Figure 1. Sampling location A) Makassar city, B) Losari beach (Sampling point A-D)

Water sampling

Water samples taken at 3 points are each put into a bottle picketed as much as 10 mL and put in a 250 mL Erlenmeyer flask then added (distilled water) as much as 90 mL then 5 mL of HNO_3 solution is added using a drip pipette. Furthermore, the sample is heated using an electric stove for about 40 minutes until the sample undergoes a volume reduction of about 2 mL. Furthermore, the sample is cooled and put into a 50 mL measuring flask by filtering using Whatman filter paper no. 41 so that no sediment is included in the sample and bidistilled water are added to the boundary mark, then it is analyzed using AAS.

Soil sampling

The cleaned soil sample was weighed ± 3 g and put into a 250 mL beaker. Then 100 mL of bi-distilled water are added and stirred. Furthermore, 5 mL of nitric acid (HNO_3) and 1 mL of concentrated perchloric acid ($HClO_4$) were added and stirred until mixed evenly. Amount 3 grains of boiling stone are added and then heated until white smoke arises and the volume of the test sample ±10 mL, and then sample solution is cooled. It is filtered using Whatman filter paper no. 41, then the filtrate is tested on a 50 mL measuring flask and added distilled water to the limit mark. Furthermore, the filtrate of the sample test is ready to be measured using an atomic absorption spectrophotometer (SSA).

RESULTS AND DISCUSSION

The results of the analysis of cadmium metal (Cd), Iron (Fe), mercury (Hg), and lead (Pb) contained in water and soil samples reclaimed from Losari beach tourism Makassar shows in Table 1.

Table 1. The metal contents of Cd, Fe, Hg and Pb in water and soil reclaimed beach tourism Losari Makassar

Sampling Point	Cd (mg/L)	Fe (mg/L)	Hg (mg/L)	Pb (mg/L)
A	0.0278	0.0432	0.0235	0.0390
B	0.0031	0.0674	0.0105	0.0420
C	0.0028	0.0534	0.0027	0.0460
D	0.0010	31.2417	0.0027	0.0710

Note: A: North Point Water, B: Platform Area Point Water, C: South Point Water, D: Reclaimed Land

According to the Regulation of the Ministry of Environment No. 51 of 2004 and the Regulation of the Governor of South Sulawesi No. 69 of 2010 the northern point has exceeded the required Cd metal content quality standard of 0.01 mg/L. The result can threaten the sustainability of the waters on the coast of Losari Makassar because it has passed the permissible threshold. One way to reduce the level of pollutants in the form of metals is to use adsorbents such as the Chitosan-CuO combination (Firnanelty, Chadijah,

Ratna, Nurhuda, & Sittiama. 2021). At the southern point and the platform area, the results of measuring levels are still monitored safely. However, this must also remain a concern for the community and local government in becoming the balance of the ecosystem in the forest. The soil condition is still within the quality standard of 0.001 mg/L. The result does not exceed the threshold set by Permenkes No. 416/Menkes/Per /IX/1990 which is 0.005 ppm.

The threshold value set by the Regulation of the Governor of South Sulawesi No. 69 of 2010 concerning Fe metal quality standards is 0.3 mg/L. Based on the measurement of each point results are obtained that do not exceed the quality standards. This shows that the metal content especially Fe is still in a safely controlled condition. The quality standard for the presence of ferrous metal (Fe) in sediments according to the Wisconsin Department of Natural Resources in 2003 is 20 mg/L while the results of the analysis of land reclamation of Losari Makassar beach tourism are 31.2417 mg/L. This figure is very high from the predetermined threshold. This is due to the presence of heavy metals' non-degradable and easily absorbable properties. The spread of heavy metals in the environment is mainly due to the disposal of waste products and human activities (Saavedra, González, Fernández, & Blanco, 2004).

The presence of heavy metals in the environment is a grave concern for the Government because it can pollute the environment, especially in waters. Heavy metals with a high concentration can be toxic to life in the waters. Therefore, it is imperative to maintain environmental cleanliness especially in waters so that the concentration of heavy metals does not increase and becomes toxic (Boran & Altınok, 2010). The Pb metal content data analysis shows results that are still below the standard of the South Sulawesi Governor Regulation No. 69 of 2010, namely 0.05 mg/m^3. Only at this point the sediment tested has passed the quality standard. The high level of heavy metals entering the waters based on the results of observations cannot be separated from several factors, namely the existence of reclamation activities that have the potential to damage coastal arrangements, boat parking and canals that directly lead to the sea.

The mercury (Hg) quality standard based on Government Regulation 82 of 2001 concerning Water Quality Management and Water Pollution Control is 0.001 mg/L. This high level of Hg indicates that the waters are polluted. For this reason, it is necessary to have proper handling to reduce the amount of Hg. One is by using adsorbents that can degrade heavy metals using organic and inorganic materials (Firnanelty et al., 2021).

CONCLUSION

Based on the result show the status of heavy metal pollution levels namely Cd, Fe, Hg, and Pb, is relatively high at several testing points based on the quality standard values of the Decree of the Minister of Environment No. 51 of 2004 and Regulation of the Governor of South Sulawesi No. 69 of 2010. At the northern point with a Cd content of 0.0278 mg/L, the sediment contains a high Fe level of 31.2417 mg/L. Hg levels at all points show values that exceed the threshold. This is very dangerous for marine life in the waters. Pb levels obtained at one point also exceeded the threshold (0.05 mg/m^3) which was 0.0710 mg/L. Although some measurement results exceeded the threshold this is a severe concern to the community and local governments to maintain the sustainability of life in waters and people.

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