An Idea Health, Safety & Environment

Research Article *Open Access*

Microplastics Identification As Bioremediation In The Tello River Makassar

Muhammad Ikhtiar*
[1]Fakultas Kesehatan Masyarakat Universitas Muslim Indonesia

***Corresponding Author**: E-mail: muhammad.ikhtiar@umi.ac.id

ARTICLE INFO

Manuscript Received: 24 Feb, 2025
Revised: 24 Mar, 2024
Accepted: 01 Apr, 2025
Date of Publication:
Volume: 1
Issue: 01

KEYWORDS

Microplastic; Bioremediation; River

ABSTRACT

Introduction: Microplastics are the smallest pieces of plastic measuring >5 mm. Microplastics that enter the environment will accumulate in the water and are not easily removed because of their persistent nature. The activity and pollutant sources strongly influence the abundance of microplastics.
Objective: identify and map microplastics and identify the existence of the bacteria Pseudomonas as microbial decomposers in the Tello River, Makassar.
Method: Methods: This study is a descriptive observational study to examine. This study was conducted from January to February 2021, in the Tello River, Makassar.
Result: The results of this study show an abundance of microplastics in the Tello River of 0.911 ± 0.022 MPs/L, The sizes of microplastics found are >1 mm and 1.00-4.75 mm, no microplastic size of >4.75 was found. with the same form and size characteristics, and in general, with a different microplastic color. Conclusion: The existence of microplastics in the river indicates that the Tello River has been polluted. The existence of the bacteria Pseudomonas in the Tello River plays a role in the degradation of plastics into microplastics
Conclusion: From the results of this study, it is suggested that the government regulate the management of plastic waste, with the involvement of law enforcers and related stakeholders so that people do not dispose of plastic waste in rivers, drainage, or sea.

Publisher: Mantaya Idea Batara

INTRODUCTION

The issue of ocean pollution by microplastic particles (MPs) has opened people's eyes. In Indonesia, around 4.8 million - 12.5 million plastic waste is disposed of into the sea every year, This has marked Indonesia as the second most contributing country for plastic waste in the oceans after China (1, 2) . Plastic is very difficult to decompose.(3) MPs are 0.05-0.5 cm in size (4) there are many potential hazards targeting marine biota and humans due to the careless disposal of plastic waste into the sea. Plastic consists of polypropylene (PP), polymethylmethacrylate (PMMA), polymers (polyethylene (PE), polyvinyl chloride (PVC), polyethylene terephthalate (PET), polycarbonate (PC), polyurethane (PU), and so on) and additives (stabilizers, flame retardants, plasticizers, fillers, and pigments)(5) Lack of waste management led to the dumping of 250,000 tons of plastic into the ocean (6)

The industry and the use of plastic packaging by humans have triggered the accumulation of plastic waste. Industry considers that plastic is light-based, durable, and corrosion-resistant packaging (7) In the last few decades, the reasons for using plastic base materials are low cost and moisture resistance (8) besides the industry players also think about the proliferation of plastic and the ease of making plastic.(9) Rochman estimates that by 2050 there

will be around 33 billion tons of plastic waste (10) this number will continue to grow if the management of plastic waste is not handled properly. According to data from the World Bank, Indonesia is capable of generating around 7.8 million tons of plastic waste every year (11) In Indonesia, plastic production also increased to 6.92% in 2018 from 2.47% in 2017.

MPs have been detected worldwide in both terrestrial and marine ecosystems (12) A widespread Greenpeace survey of 13 rivers in the UK has found that all of these rivers contain plastic pollution. Furthermore, the scientists found microplastics in 28 of the 30 locations tested. In total, 1,271 pieces of plastic were found, ranging in size—from straw and bottle fragments with a size of less than 1 mm. The highest concentration of plastic found was in the Mersey(13) One of the impacts of plastic pollution is that many marine animals consume this plastic, thus threatening their sustainability. The size of plastic pollution, which is also available in small form, can contaminate marine biotas, such as corals, zooplankton, lobsters, worms, and sea urchins.(14) and when microplastics do not decompose, it will accumulate biologically and become a food chain.(12)

According to Nugraha, a certain amount of microplastics in the human body can increase the risk of cancer. Based on these conditions, a solution is needed to reduce and eliminate the microplastic content. One of the interesting strategies and approaches to control microplastic pollution is the bioremediation technology approach.(15) Rajendran in his study found that Pseudomonas sp. has the potential as natural bioremediation in reducing microplastic pollution in aquatic ecosystems.(16)

METHOD

This study is a descriptive observational study to examine, identify, and map the content of microplastics and the existence of Pseudomonas sp. in the Tello River, Makassar with different sampling points, using a Risk Assessment. This study used a Geographic Information System (GIS) approach. The data in this study were collected using the exploratory method, namely, sampling was done directly. Exploratory research also seeks to dig up new knowledge to Identify a problem that is occurring or could occur

This study was carried out at 3 stations on the Tello River, Makassar, namely the fish pond, Kera-kera Pier, and river estuary with sampling at each point of stations for approximately 1 month from January to February 2021. Further tests were carried out, namely visual identification using a stereoscopic microscope (Euromex SB1902) in the Marine Ecotoxicology Laboratory, Faculty of Marine Science and Fisheries, Universitas Hasanuddin, Makassar. Furthermore, Isolation and Identification of Microplastic Bacteria were also carried out, Identification of bacteria used the VITEX-2 Compact automatic instrument which works based on the determination of MIC (Minimum Inhibitory Concentration) and Testing of Degrading Bacteria in the Laboratory of the Faculty of Mathematics and Natural Sciences, Universitas Hasanuddin, Makassar.

RESULTS

MICROPLASTICS IDENTIFICATION

The results of measuring the abundance of microplastics in the Tello River are presented in the following Figure 1.

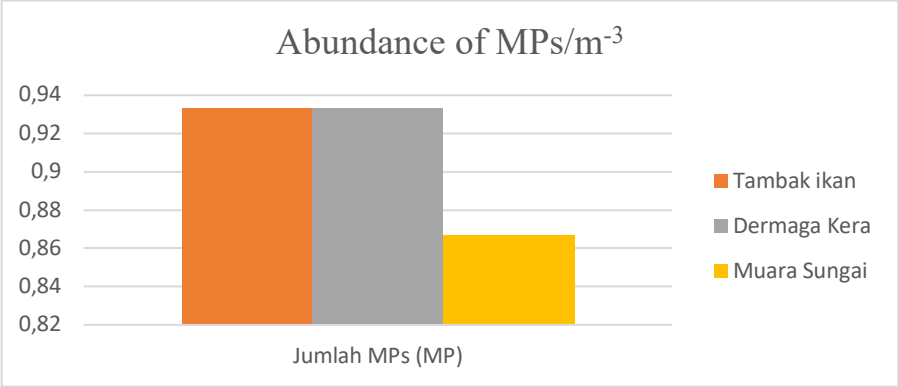

Figure 1. Abundance of Microplastics

Based on Figure 1, the average abundance of the number of microplastics found in the Tello River sample is 0.911 ± 0.022 MPs/m^{-3}.

DISCUSSION

Microplastic Identification

Makassar is the largest city center in Eastern Indonesia, so it must pay full attention to the high Anthropogenic. A report by Shuker in 2018 identified plastic waste in Makassar of as much as 1200 tons per day.(17) , and 45% of the waste found on the coast is plastic waste. The abundance of MPs in the fish pond and Kera-kera Pier is higher than in the river estuary. This is because MPs produced come from various human activities including industry, ports, fishing, or waste transported by wind and sea tides.(18) The Tello River, which is also connected to small rivers and canals that cross Makassar and Gowa Regency, has caused the number of plastic waste to increase. In the fish pond and Kera-kera Pier areas, environmental factors such as wind and current direction can impact the distribution of microplastics, tourism and fishing activities also play important roles in increasing the concentration of microplastics.(19) The abundance of microplastics in the fish pond is also caused by the production of microplastics from the activities of the community which are very diverse, including household activities, toxic metals, urban waste, and so on (20)

This is because the location of this fish pond is in the middle of the Tello River, where it is a densely populated residential area. Meanwhile, the abundance of microplastics in Kera-kera Pier is caused by boat transportation and household activities around the pier. The abundance of microplastics in the river estuary is less than in other points. One of the reasons is that the number of people around the river estuary is less than the number of people in the fish pond and Kera-kera Pier areas. In addition to the total abundance of microplastics that is different, the different results of measuring the forms, colors, and sizes of microplastics in the fish pond, Kera-kera Pier, and river estuary, can also be seen in Figure 2 to Figure 4. Judging from the forms of microplastics, the existence of microplastics in the fish pond, Kera-kera Pier, and river estuary on the Tello River is dominated by line or fiber forms.

The difference in the forms of microplastics in the two location points is due to the activities of the community. Line or fiber (shaped like thread) form of microplastics is found in the Tello River, the existence of microplastic in the form of lines or fibers can come from the fragmentation process of fishing gear such as nets or fishing lines, or come from waste clothing fibers (threads) found in the water of the Tello River in the fish pond point, as well as come from other activities. The transportation activity of sea vessels carrying passengers in the Kera-kera Pier area also causes an abundance of microplastics in the form of lines or fibers, which come from the degradation of ship ropes. The dominant findings of microplastics in Indonesian water are in the form of lines or fragments.

The dominant color of MPs in the two location points, namely the fish pond and Kera-kera Pier, is not much different. Microplastics found in the fish pond point tend to be dominated by black (42%) compared to other colors, likewise in the Kera-kera Pier point which also tends to be dominated by black (45%). Whereas, microplastics found in the river estuary are dominated by red (80%) and there are also transparent, blue, and white microplastics. According to Wicaksono (2020), the color of microplastics can be useful information to determine the source of the particles. A study conducted at the Yangtze Estuary, China, found that the color of MPs is also dominated by colored and transparent MP particles. Most of the colored and transparent MPs come from the fragmentation of clear plastic packaging, clothing, and fishing line. The abundance of microplastics of ≤5 mm in the two location points (fish pond and Kera-kera Pier) indicates that the accumulation of plastic waste in these location points is old and degraded.

CONCLUSIONS

The distribution of microplastics in the Tello River, Makassar, shows that the river body area, particularly in the fish pond and Kera-kera Pier, contains a lot of microplastic pollution, compared to the Creek area

CONFLICTS OF INTEREST

All Author Declare No. conflict of interest

FUNDING SOURCES

No. Funding

ACKNOWLEDGMENTS

Thanks to all parties who have supported this research

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