



**IDENTIFICATION OF THE PHYSICAL CHARACTERISTICS OF
MICROPLASTICS IN BIOTA IN MUSI RIVER WATERS**

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ABSTRACT

Microplastics are plastic waste in the environment which, over a long period of time, will decompose into micro particles or smaller sizes. Microplastics have various types of shapes, sizes and colors which are influenced by various factors. Over time, microplastics in river waters will pollute the biota in the river. Humans who consume microplastics indirectly by consuming fish from rivers that have been polluted with microplastics have the potential to cause side effects. This research aims to identify microplastics in fish biota in the waters of the Musi River in Banyuasin Regency. This research is descriptive analytical in nature with a sampling technique, namely random sampling, namely the technique of taking fish at random. The sample research went through several stages, namely sample preparation, digestion, filtration and research with a trinocular microscope. This research is descriptive analytical in nature with a sampling technique, namely random sampling, namely the technique of taking fish at random. The sample research went through several stages, namely sample preparation, digestion, filtration and research with a trinocular microscope. Identification of microplastics in biota in the waters of the Musi River (downstream) in the Banyuasin Regency area found microplastics in the form of fiber, foam and fragments which were dominated by fiber form. The colors of the microplastics found were green and brown. The largest size of microplastic is 1068.92µm and the smallest is 306.46µm.

Keywords: biota (fish); microplastics; musu river; marga village

How to cite (in APA style)

Casmita, K. S., & Windusari, Y. (2024). Identification of the Physical Characteristics of Microplastics in Biota in Musi River Waters. *Indonesian Journal of Global Health Research*, 6(S5), 687-692. <https://doi.org/10.37287/ijghr.v6iS5.4768>.

INTRODUCTION

Currently, plastic is a global concern because it poses a significant threat to the environment. Plastic is a synthetic or man-made polymer composed of various monomers, typically produced from the extraction of oil and gas (Güven et al., 2017). It is estimated that around 220 million tons of plastic waste will be generated by 2024. Since 2021, plastic waste production has increased by 7.11% (Plastic Overshoot Day: Report 2024, 2024).

Indonesia is the second-largest contributor of plastic waste in the world after China, with an estimated 0.48 to 1.29 million tons of plastic out of a total 4.8 to 12.7 million tons of plastic waste being dumped into the ocean globally (Seftianingrum et al., 2023). In 2023, 19.2% of Indonesia's total waste consisted of plastic waste (Kementerian Lingkungan Hidup dan Kehutanan, 2024). Rivers serve as the main pathways for plastic to enter the ocean (Kataoka et al., 2019). Plastics, being composed of polymers, are difficult to decompose in nature, making them one of the largest contributors to environmental waste (Johan et al., 2020). Plastic waste that contaminates rivers for a long period of time will break down into smaller particles called microplastics (Cole et al., 2011).

Microplastics are contaminants derived from the degradation of plastic into micro or smaller particles (Mauludy et al., 2019). The process of plastic degrading into microplastics occurs

through degradation processes. Microplastics can degrade into even smaller particles called nanoplastics, which are larger than 100 nm (Lusher et al., 2017). Polymers undergo degradation when exposed to sunlight, air humidity, and catalysts (Lusher et al., 2017). During degradation, plastic waste becomes softer and easier to break apart over time. Other mechanical factors that can influence degradation include wind currents, ocean waves, and the activities of animals and humans (Hapsari Ekosafitri et al., n.d.). These particles cannot be seen with the naked eye (Nur Al Marwah Asrul et al., 2022). Based on their morphological characteristics, microplastics are classified by size, shape, and color (Kara Lavender Law & Richard C. Thompson, 2014). The Musi River is one of the rivers that has the potential to be polluted by microplastics, with various forms of microplastics found, including fibers, films, fragments, and granules, measuring around 5 mm (Kurniawan et al., 2023).

The danger posed by microplastics can be seen from research conducted in the deepest ocean trenches, which showed that 65% to 72% of the 90 samples of marine biota living at depths of 6,000 to 11,000 meters contained 1 microplastic particle in their digestive tracts. This proves that human-generated pollution has contaminated even the deepest parts of the ocean (VOA, 2019). Initially, microplastics float on the water's surface, but over time, they sink and settle as sediment. Microplastics start off floating because they are lighter than water, but as they accumulate particles and organisms, they eventually sink to the riverbed, polluting aquatic biota (Piran, n.d.). Microplastic pollution in aquatic biota affects the food chain (Bergmann et al., n.d.). Aquatic organisms, ranging from the smallest to the largest, can consume microplastics, ultimately impacting the food chain and human health when people consume fish contaminated with microplastics (Sari Dewi et al., 2015). When humans ingest microplastics, these particles are absorbed and distributed throughout the body via the circulatory system, entering cells and tissues, potentially causing various side effects (Barboza et al., 2018). Consuming microplastics can lead to cancer and obesity, and in women, they may increase the risk of breast cancer (GESAMP, n.d.).

Microplastics that enter the human body can affect various systems, including the digestive, respiratory, endocrine, reproductive, and immune systems. If a person consumes food contaminated with microplastics, they may experience physical irritation and inflammation of the digestive tract, along with other symptoms (Lee et al., 2023). Based on the above information, this study aims to identify microplastics in fish biota in the Musi River, Banyuasin Regency.

METHOD



Source: Indonesia Geospacial & Citra Satelit Google Earth 2022&2023

Figure 1. Map of research locations

This study was conducted in the Musi River, Banyuasin Regency, South Sumatra Province, from June to November 2023. The research area map can be seen in Figure 1. This study is experimental and was conducted on a laboratory scale. The biota used for the study was local fish, specifically *Seluang* fish, which were taken from the study location and stored in a cooler box with ice to prevent tissue damage during transportation. Sample preparation was carried out at the Integrated Laboratory of the Faculty of Public Health, where the biota's digestive organs were digested by adding 100 ml of KOH, followed by 24-hour incubation at 60°C. The purpose of this step was to remove other materials from the digestive organs. Then, 50 ml of NaCl was added to obtain floating microplastic particles. The microplastic filtration process was carried out using Whatman GF filter paper. Microplastic observation was conducted at the Biology Laboratory of the Faculty of Teacher Training and Education, Sriwijaya University, using a trinocular microscope at 100x magnification. The goal was to observe the shape, size, and color of the microplastics found.

RESULT

In microplastic research, it is crucial to identify the type, size, and color of the microplastics. The color of the microplastics can provide clues about the type of polymer used in their production. Knowing the color of microplastics also helps make the identification process more accurate. Identifying the shape of microplastics is important because their shape can provide information about the source and degradation process of the microplastics. The shape of microplastics also affects their environmental impact (Seftianingrum et al., 2023). Microplastics are classified into two types: primary microplastics and secondary microplastics. Primary microplastics are micro-polymers from products like cosmetics or synthetic clothing fibers, while secondary microplastics result from fragmentation processes that break down larger plastic materials into smaller physical particles (Hapsari Ekosafitri et al., n.d.).

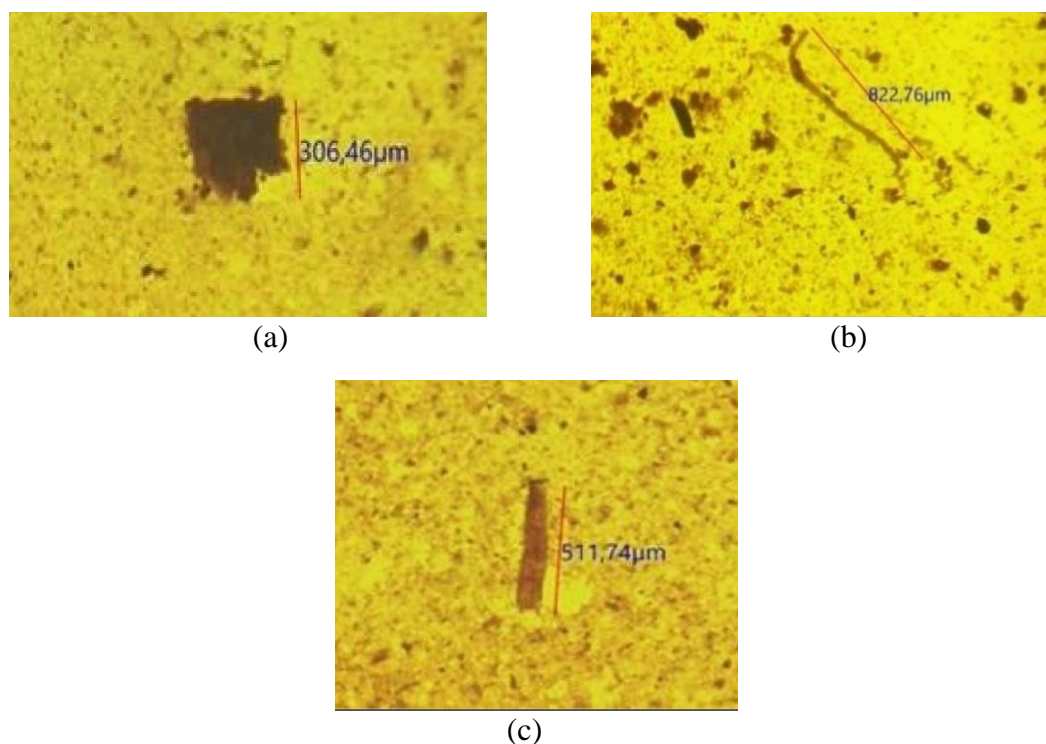


Figure 2. The shapes of microplastics obtained with 100x magnification are (a) foam, (b) fiber and (d) fragments

DISCUSSION

From the fish samples examined, it was found that all biota samples contained microplastics. The types of microplastics found in the samples were fibers, foam, and fragments. The most common microplastic type found in the biota (fish) samples was fiber, with an average of 4 particles per fish sample. Fibers have a long and slender shape (Ayuingtonyas et al., 2019). The fiber-shaped microplastics may have originated from synthetic fabrics, fishing equipment like fishing lines and nets (Ayuingtonyas et al., 2019). Letak sungai yang berdekatan dengan penduduk yang masih banyak melakukan aktivitas memancing ikan menjadi salah satu penyebab mikroplastik fiber mudah ditemukan pada wilayah tersebut (Kurniawan et al., 2023). The source of fragment microplastics is believed to come from plastic and synthetic polymer waste produced by local residents, which undergoes degradation (Wright et al., 2013). Umumnya mikroplastik fragmen bersumber dari botol, toples, potongan pipa (Kurniawan et al., 2023). Film-shaped microplastics are secondary plastic polymers resulting from the fragmentation of plastic packaging or plastic bags with low density (Kingfisher, 2011).

The colors of microplastics found were green and brown. Brown was the most common, with 6 particles detected. Differences in the color of microplastics may indicate how long the microplastic has been in the environment (Laksono et al., 2021). Lama waktu mikroplastik mengalami fragmentasi juga mempengaruhi jenis mikroplastik (Laksono et al., 2021). The color of microplastics can come from colored plastic products, but the color may change due to weather conditions (Lestari et al., 2020). The accumulation of heavy metals on plastic can also affect the color of microplastics during degradation (Massos & Turner, 2017).

The largest microplastic particle identified was a fiber measuring 1068.92 μm , while the smallest was foam measuring 306.46 μm . The differences in microplastic size can be influenced by the length of time the microplastic has undergone fragmentation, the strength of water currents, and wave activity. Microplastics that have undergone longer degradation processes tend to be smaller (Wright et al., 2013). Small microplastics with low density usually float in water (Alam et al., 2019). A high number of small microplastic particles may be due to larger plastic debris breaking down into smaller particles (Ding et al., 2019).

The abundance of microplastics in biota varies, which may be influenced by the level of microplastic pollution in the biota's habitat (Yumni et al., n.d.). The water's edge is the point where microplastics are most commonly found due to its proximity to densely populated settlements that carry out various activities that have the potential to pollute the environment (Laksono et al., 2021). The increasing amount of plastic waste in the environment poses a potential threat to natural ecosystems, affecting both biota and humans (Kara Lavender Law & Richard C. Thompson, 2014).

CONCLUSION

The types of microplastics found in the biota of the Musi River (downstream) in Upang Marga Village, Banyuasin Regency, were fibers, foam, and fragments, with fibers being the dominant type. The colors of the microplastics identified were green and brown, with brown being the most prevalent. The largest microplastic measured 1068.92 μm , while the smallest measured 306.46 μm .

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