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PRELIMINARY STUDY OF MICRODEBRIS CONTAMINATION IN SEDIMENT FROM THREE ESTUARIES ON THE PANGKAJENE RIVER

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ABSTRACT

Studies on microdebris contamination in sediments at the estuary of the Pangkajene River were carried out at three stations. This study aims to observe the abundance and characteristics of microdebris in the estuary sediments of the Pangkajene River. The samples of sediment were collected using a core sampler with a diameter of 8 cm. Microdebris was extracted using the flotation method and vacuum filtration system. The particles were observed with a stereomicroscope then classified based on shape (form), size, and color. The number of particles found ranged from 2.83±2.04-4.00±1.87 item/100gr. The analysis of variance (ANOVA) showed $p>0.05$, therefore the abundance of microdebris between the three stations did not show a significant difference. Microdebris in Fragment form had the highest percentage compared to fibers and granules. Blue and black particles of microdebris were the most common colors. The dominant size of particles was found in the size class <100µm and 100µm-500µm. This preliminary study revealed that the microdebris occurs in the Pangkajene estuary sediments. Currently, we have not classified the types of microdebris found as microplastic, semi-synthetic debris, or natural origin. Therefore, further research is needed to verify particles using an FT-IR Microscope to determine the type of microdebris polymer.

Keywords: Estuary, Pangkep District, Pollution, Microplastic

INTRODUCTION

The garbage problem doesn't seem to have a solution yet. It's about 80% of waste which mostly comes from human activities on land and is not properly recycled then thrown into the aquatic environment and spread to the marine ecosystems (Andrady et al., 2011). Those materials such as plastic that enter ecosystems will not decompose in a short time but will be fragmented (Barnes et al., 2009) and become smaller than before, either by biodegradation, thermocidative, or hydrolysis (Andrady, 2011). Particles with a size of <5 mm formed from this process are called microdebris.

In addition, microdebris can also come from fishing activities using plastic-based equipment. These particles are classified as microplastic or synthetic debris (Kroon et al., 2019). Microdebris can also come from ship paint which may come off due to friction. Daily activities such as washing clothes are also a source of release of microdebris, which is generally in the form of fibers called microfibers (Belzagui et al., 2019) which are generally made from cotton, wool, and nylon. All these particles are classified according to their polymer composing, including synthetic, semi-synthetic, and naturally-derived microdebris (Kroon et al., 2019).

The impact of microdebris on the environment is still uncertain. Reports on the impact of microplastics on organisms are also limited. Several studies have suggested that the distribution of microdebris into the food chain begins with the misinterpretation of organisms that perceive microdebris as prey (Boerger et al., 2010). Ingested microdebris have been reported in several studies from zooplankton (Cole et al., 2013) to species for human consumption such as muscle (Mawaddha et al., 2020), echinoderms (Tanjung et al., 2021), cephalopods (Ilham et al., 2021), and bivalves (Li et al., 2015).

The data on the distribution of microdebris in Indonesia is also still very limited. Although previous research has been carried out in various ecosystems including seagrass (Tahir et al., 2019), coastal water (Cordova et al., 2019), coral reef sediments (Cordova et al., 2018), and deep-sea (Cordova et al., 2016). However, to represent the distribution of microdebris in Indonesia, more records are still needed. There are no studies that report the presence of microdebris in the sediments of the Pangkep river estuary. Therefore, this study aims

to observe the abundance and characteristics of microdebris in the estuary sediments of the Pangkajene River.

MATERIALS AND METHODS

Sampling was carried out at three river estuaries which are channels of the Pangkajene River (Figure 1) in 2018. The samples of sediment were collected using a core sampler with a diameter of 8 cm. Sediment samples were collected using a core sampler with a diameter of 8 cm with three different depths as a replicate including 0-15 cm; 15-30 cm; and 30-45 cm. The Sediments were dried in the oven at a temperature of 60 °C for 24 hours.

Figure 1. Sampling location at the estuaries of the Pangkajene River

The sample was weighed to obtain n 100 gr of dry sediment. The sediment was placed in a beaker to dissolve processed by the addition of 30% H_2O_2 and homogenized with a stirrer at 300 rpm for 30 minutes at room temperature. Three hundred milliliters of NaCl were added for the flotation method. After 24 hours, the supernatant was extracted by Whatman filter paper (0.45 µm pore size) using a vacuum system. To avoid contamination, the filter paper was placed on a petri dish. The particles were observed with a stereomicroscope and then classified based on shape (form), size, and color following the criteria for identifying microdebris by (Nor and Obbard, 2014).

RESULTS AND DISCUSSION

The data shows that the sediment at the mouth of the Pangkajene River is contaminated with microdebris. The number of particles found at each station was 4.00±1.87 at station 1, 2.83±2.04 at station 2, and 3.66±3.23 at station 3 (Figure 2) with the percentage of fragments being more dominant in all stations than fiber and granule forms (Figure 3. Statistical test Analysis of variance (ANOVA) showed $p > 0.05$, which means that there is no significant difference between the abundance of each station.

The sediment from the Pangkajene River estuary contains microdebris. Each station has the same characteristics. It is surrounded by ponds, so the activities around the study site are relatively uniform. The source of microdebris is thought to come from the main river which is the result of domestic activities around it until it spreads to the three estuaries. This condition is thought to be the main factor that causes the abundance of microdebris at each station to be not significantly different.

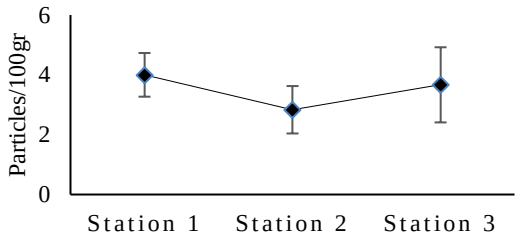

Figure 2. Abundance of microdebris from sediment of the estuary of Pangkajene River.

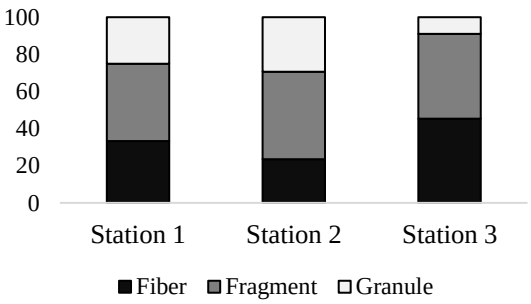

Figure 3. The form percentage of microdebris from sediment of the estuary of Pangkajene River.

The types of microdebris that we found could not be justified as synthetic (microplastic), semi-synthetic debris, or natural particles, because were not clarified using FTIR microscopy. Generally, the particle fragments could be formed of flakes of ship paint which are commonly used as coatings for boat hulls (Hall et al., 2015), or even primary microplastics from several types of cosmetics (Napper et al., 2015) that function as scrubbing agents. Meanwhile, fiber is an emission from washing clothes (Belzagui et al., 2019), so that the type of polymer of the released fibers, depending on the material of the clothes which are generally made of cotton, wool, polyester, and so on. Additionally, the activities of fishermen or the community around the river using nylon-based ropes also have the potential to release microdebris

The abundance of microdebris found in this study was higher (range of 28.3±20.4 – 40.0±18.7 items/kg) than the study of microdebris (microplastics) conducted in seagrass ecosystems at several small islands (ranged from 2.96 – 28.29 items/Kg) (Tahir et al., 2019). Cordova et al. (2019), stated that the highest concentrations of microdebris (microplastics) were found at the closest stations to the mainland. Based on these data, it could be seen that the influence of anthropogenic activities plays a role when viewed from the number of residents in Pangkep Regency compared

to the population on small islands. The characteristics of the microdebris found were very varied, consisting of eight colors. The most common colors were black and blue (Figure 3a). The particle sizes found are relatively small, where the percentage of size class <100 µm and 100-500 µm were higher than other size classes (Figure 3b).

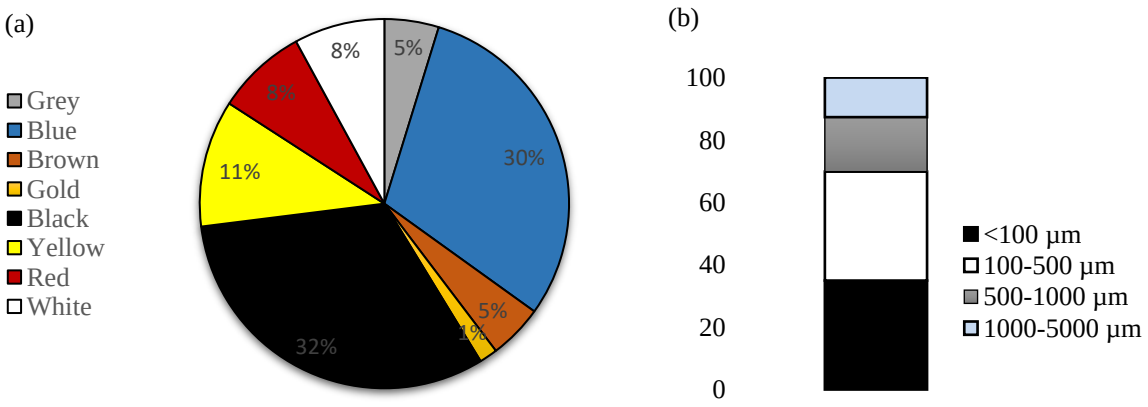

Figure 3. Characteristic of microdebris sediment in Pangkajene River estuary (a) color (b) size class.

The shape and color of microdebris is considered necessary to be monitored because it is one of the factors in the misperception of certain organisms that consider microdebris to be food. This refers to the microdebris that was found in the gut of common planktivorous fish in the study of (Boerger et al., 2010). A more serious threat is that ingested microdebris may have the potential to injure or even clog the digestive system. The presence of microdebris in the estuary environment of the Pangkep river indirectly has the potential to contaminate organisms that inhabit the ecosystem

Information on increasing the concentration of microdebris particles in the sediment is still unclear. Jamberk et al. (2015), reported that Indonesia is the second-largest producer of plastic waste in the world. This indicates that the concentration of microplastics in the sediment may be related to these factors. The concentration of microdebris in sediments may increase with the production of plastic waste and other anthropogenic activities. Therefore, sampling with a depth level that is able to predict certain years in the past is very important for future research.

CONCLUSION

This preliminary study revealed that the microdebris occurs in the Pangkajene River estuary sediments with the number of particles found ranging from 2.83±2.04 – 4.00±1.87 item/100gr. There was no significant difference between the three study sites due to the conditions surrounding the same sampling area. Therefore, anthropogenic activities from around the Pangkajene River are predicted to be a source of contaminants.

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