Microplastic Abundance in Telebralia at Mangrove Forest Pulau Panjang, Serang-Banten

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Abstract. This research investigated the abundance and the type of microplastic pollution in Telebralia collected at mangrove forest in Pulau Panjang. In total of 60 Telebralia consist of 30 Telebralia palustris and 30 Telebralia sulcata were collected. The soft tissue was extracted with HNO3 65% for 24 hour and mixed with NaCl solution. Samples were observed under binocular microscope and further microplastic analysis was done. Microplastic pollutions were detected in all of 60 species of Telebralia. Most of the microplastic pollutions were fiber. Overall, the average of microplastic abundance in Telebralia at mangrove forest Pulau Panjang was 2117 particles/individual. The number of suspected microplastics found in Terebralia ranged from 1240 to 3420 particles/individual. Telebralia palustris has more microplastic abundance than Telebralia sulcata. This research confirms that microplastic pollutions have infiltrated the marine ecosystem especially mangrove forest. Thus, microplastic pollutions and its effect needs further research. Keyword: Microplastic, Telebralia, Pulau Panjang

1 Introduction

Plastic debris is one of the enviromental problems which gain a lot of concern [1]. Land gives contributions to 80% sea pollution, which 60%--95% is plastic debris [2]. More than 300 million tons of plastic are produced every year, and 8 million tons minimum of plastic end up in marine ecosystem [3]. At the marine ecosystem, microplastics (1 μm-5 mm) are one of the most ubiquitous pollutants [4-5]. Its small size and light weight make microplastic distributed undoubtedly throughout the marine ecosystem, putting it as one of the vital threat to global marine ecosystem, marine organism, and human [2]. Microplastics have direct impact to marine organism because marine organisms ingest microplastics. Those microplastics eventually have the ability to absorb persistent organic pollutant (POPs) which is toxic chemicals [5-6]

Mangrove forest is one of the marine ecosystem that can be polluted by microplastics. Mangrove ecosystem is an accumulation zones, this cause mangrove forest's flora and fauna to be afflicted by plastic debris especially microplastics [7]. One of the mangrove ecosystems in Indonesia is located at Pulau Panjang, Banten. Panjang island is the largest island in Banten Bay. The increasing development of industrial sector of Banten bay could lead to the increasing marine pollutants at Pulau Panjang which is driven by ocean currents and waves. Microplastics are found contaminating water, sediment, and living organism in mangrove forest. Various research have shown that microplastics also contaminated variety of organism living in mangrove forest, including gastropods [8].

This research focuses on gastropods, the mud-whelk Telebralia spp. Telebralia spp can be the indicator of mangrove forest stability as Telebralia spp feed on leaf litter, propagules, fruit, and detritus. There are two Telebralia snails found in Pulau Panjang, known as Telebralia palustris and Telebralia sulcata. These invertebrates are vulnerable and easily contaminated by the microplastics because microplastics can be found tremendously in mangrove's sediment and water. These mud-whelks are also consumed by local people. These can lead into the biomagnification and bioaccumulation in human body which can be life threatening. Research about microplastic contamination in Telebralia spp are rare and this research of microplastic contamination in Telebralia spp at Pulau Panjang is the first to be done. This study examines the type and the amount of microplastis in the mud-whelk (Telebralia spp.) at Pulau Panjang, Serang, Banten.

2 Method

2.1 Study Area

The study was carried out in mangrove ecosystem of Pulau Panjang, Banten Bay. Pulau Panjang is the largest island in the Banten Bay located at 6o25'18"-6o28'12" south latitude and 106o22'9"-106o25'36" east longitude. There were three sampling stations where Telebralia spp is taken.

Fig. 1. Pulau Panjang, Serang-Banten.

2.2 Procedures

2.2.1 Sample collection

Telebralia palustris and Telebralia sulcata were collected from three sampling stations. Ten samples of each spesies were collected from each stations. There were 60 samples in total which consist of 30 samples Telebralia palustris and 30 samples Telebralia sulcata. Collected samples were placed in cool box then preserved on freezer. The sediment was also taken from each sampling station to be extracted in laboratorium.

2.2.2 Sample extraction

The shell of the sample's then destroyed by hammer. Then, the soft tissue was weighed. The soft tissue was placed in glass jar then soaked in HNO3 65 %. The jars were then placed in fume hood for 24 hours. After 24 hours soaked in HNO3 65 %, the soft tissue was dissolved. The samples were then diluted with saturated NaCl solution for another 24 hours. The 20 ml of diluted solution then pippeted to erlenmeyer flask to be homogenized. 1 ml of homogenized solution then pippeted to the counting chamber to be observed under a microscope[9]. The repetition was done 3 times. The amount of microplastic in each sample is counted and differentiated by its shape. The average total number of microplastic particles found was multiplied by 20 mL to collect the abundance of microplastic/individual

2.2.3 Sediment extraction

The sediment was dried using oven with 60oC temperature for 24 hours. 26% saline solution was added in the extraction process to make microplastic particles float on the solution's surface. The ratio used for dried sediment and saline solution was 1:3. The 10 mL diluted solution pippeted to erlenmeyer flask, then homogenized. 1 ml of homogenized solution then pippeted to the counting chamber to be obeserved under a microscope. The repetition is done 3 times. The amount of microplastic in each sample is counted and differentiated by its shape.

2.3 Data analysis

Data obtained were then analyzed with Microsoft Excel.

3 Result and Discussion

Microplastics were found in all the samples, included the sediment samples from all three sampling stations at Pulau Panjang, Banten. Different shape of microplastics were found in all the samples observed. There were fibers, fragments, films, and granules. The different microplastics type found from the sampling sites were mainly caused by exposure of different pollution sources.

Table 1. Microplastic abundance in Telebralia spp. in each station.

	Average of Microplastics found	
	Telebralia palustris	*Telebralia sulcata*
Station 1	3389.33 particles/ind	2096.67 particles/ind
Station 2	3367.33 particles/ind	864.00 particles/ind
Station 3	1292.00 particles/ind	692.67 particles/ind

The average of microplastics found in Telebralia palustris from the first station were 3389.33 particles/ind. It is the highest average amount of observed microplastics. The average microplastics amount in Telebralia palustris from the second station were 3367.33 particles/ind. The average microplastic amount in Telebralia palustris from the third station were 1292.00 particles/ind. The average of microplastics found in Telebralia sulcata from the first station were 2096.67 particles/ind. It is the highest average amount of observed microplastic in Telebralia sulcata among all the three station. The average microplastic amount in Telebralia sulcata from the second station were 864.00 particles/ind. The average microplastics amount in Telebralia sulcata from the third station were 692.67 particles/ind which is the lowest

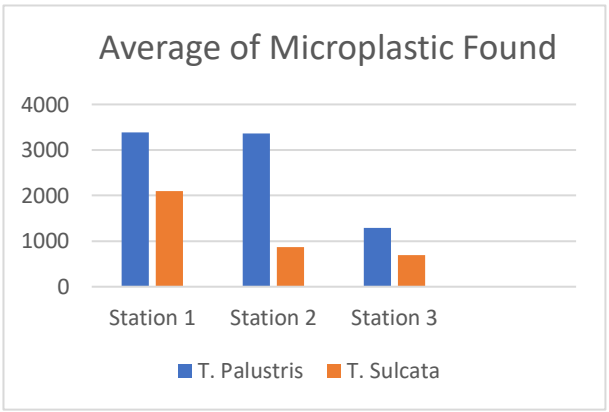

Fig. 2. The Microplastic abundance in Telebralia spp. in each station.

The highest microplastics amount were in the first station. The first station was at Munir beach which is a tourist attraction. Beside being a tourist attraction, munir beach is a place where local fishermen do fisheries.

Then followed by second station. The second station was at sand quarry. Local people also do the fisheries along the coastline of second station. The fewest microplastic particles found were in the third station. The third station was mangrove forest where there is no human activities occured around the coastline. The concentrations of microplastic found were higher in the sampling station where elevated amounts of marine debris were observed during sampling. Those marine debris was higher in place where a lot of human activities occurred.

Detected marine debris including fishing nets, plastic bags, plastic bottles, plastic containers, plastic wraps etc.

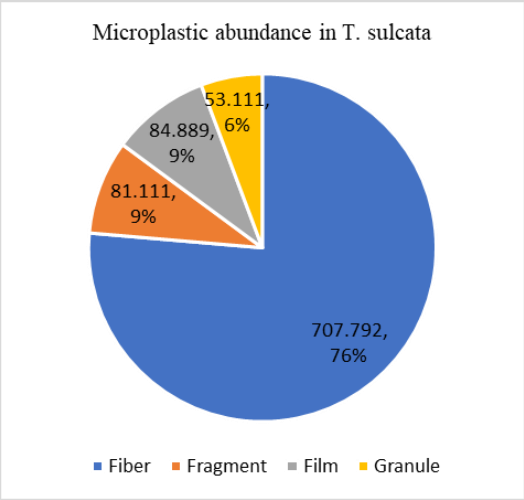

Fig. 3. The average microplastic amount in T. sulcata and T. palustris.

T. palustris has higher level of average microplastic amount than T. sulcata. T. palustris's average microplastics amount were 2682,9 particles/ind. T. sulcata's average microplastic amount were 1217,78 particles/ind. The weight of body mass was related with the amount of microplastic inside the snail body. The samples of T. palustris's soft tissues weighed 2--3 gr and the samples of T. sulcata's soft tissues weighed ±1 gr. It is concluded that T. palustris's body mass was heavier than T.sulcata, so the microplastic abundance inside the T. palustris was higher than T. sulcata. It indicates positive correlation between snail body mass and the amount of microplastic in it[8].

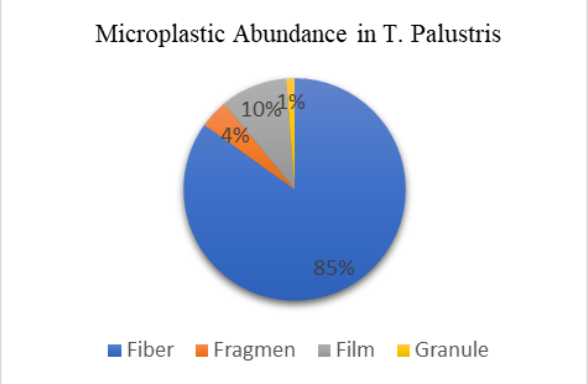

Fig. 4. Percentage of microplastic's type in T. palustris.

The majority shape of microplastic in T. palustris observed is fiber (85%), followed by film (10%), then fragmen (4%). Granule is the type of microplastic with the fewest amount in T. palustris. T. sulcata also has positive correlation with T. palustris. The highest amount of microplastic found in T. sulcata also fibers (76%), followed by films, then fragments. The least microplastic found in T. sulcata is granules. Fibers are the most frequently found microplastic in all the samples observed.

Fibers are also the most frequently found microplastic in all three sampling station. The fiber type of microplastics is widely used in the manufacture for synthetic fabrics in clothes[8]. The fiber type also degraded from fishing nets and ropes. Fragment type of microplastic is degraded from household equipment, which is made from plastic such as plastic bags, plastic wrapper, etc[11]. Those type of microplastics are degraded from plastic debris because of atmospheric chemical reactions, ultraviolet rays, sea water, and physical forces like wave actions [12]. Whereas granule is primary microplastic which material come from cosmetics such as facial wash and toothpaste[13].

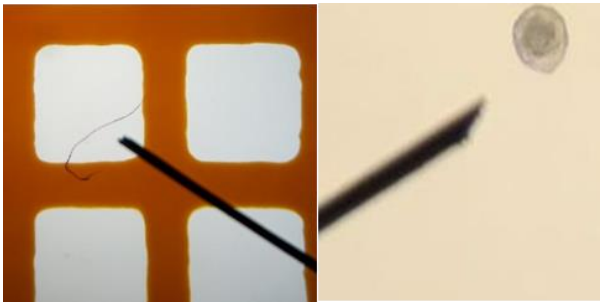

Fig. 5. Photographs of observed microplastic (a) film (b) fragmen.

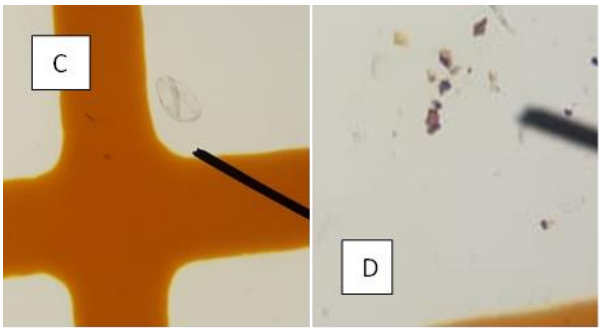

Fig. 6. Photographs of observed microplastic (c) fiber (d) granule

The highest microplastic findings were in the first station, followed by second station, then the third station. The amount of microplastics found in the sediment samples indicate positive correlation with microplastics found in Telebralia spp. The majority shape of microplastic in the sediment samples observed were fibers (64%), followed by films (19%), then fragments (10%). Granules (7%) was the type of microplastics with the fewest amount in the sediment sample. Mangrove ecosystem of Pulau Panjang could be contaminated because of tidal current process and human activities.

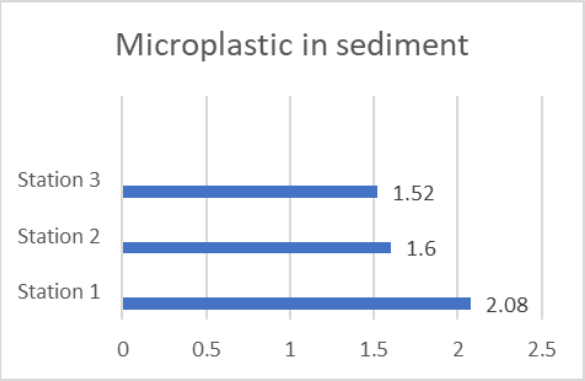

Fig. 7. Microplastic in sediment.

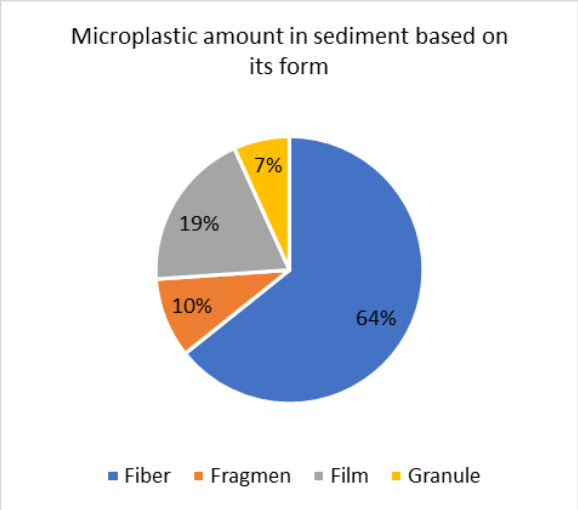

Fig. 8. Microplastic in sediment based on its form.

Microplasctic can be accumulated in organism body through food web. Bioaccumulation in the mud-whelk soft tissue occured mostly because mud-whelk is deposit feeder. These organism ingest these particles deliberately as they take them up by accident along with the ingested sand. Continuous exposure of microplastic can lead to disturbed internal organ fuction.

4 Conclusion

Based on the results of this study, microplastic were found in the samples of Telebralia spp and mangrove sediment in Pulau Panjang, Banten. The types of microplastic found in the sample were fibers, fragments, films, and granules. The average number of microplastic in T. palustris were 2682.9 particles/individuals. Fibers were the most frequent type of microplastic observed. The average number of microplastic in T. sulcata were 1217.78 particles/individuals. Fibers were the most frequent type of microplastics observed. The average microplastics in the sediment were 2.13 particles/g. Fibers were the type of microplastic most commonly found in sediment samples with 1.32 particles/g.

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