Doi: 10.14710/jbes.2022.14226

Journal of Bioresources and Environmental Sciences, 2022, 1(1), 1-7

Research Article

Microplastic Identification in Fisheries Commodities in Sayung Waters, Demak

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Received: 6th Feb 2022

Accepted: 7th April 2022

Published: 15th May 2022

Abstract: Each year plastic production worldwide has increased. Approximately 10% of the production of plastic will lead to the sea. This plastic is degraded to be a small particle size < 5mm called microplastic. The river is the main route of entry of plastic from land to the sea. Sayung River is a river that has the potential to be contaminated with microplastics around which it is used as a location for the cultivation of various fisheries commodities including *Pernaviridis*, Penaeus monodon, and *Lates calcarifer*. The study aims to determine the number and type of microplastic in Penaeus monodon, *Pernaviridis*, and Lates calcarifer. Samples were taken from three different stations in the coverage area. Microplastic abundance analysis by isolating microplastic on each sample. Isolation samples of Pernaviridis, Penaeus monodon, and Lates calcarifer are done by dissolving the sample in a solution of 10% KOH was allowed for 24 hours at a temperature of 60 °C and observed under a binocular microscope. Founded types of microplastic are fiber, fragments, pellets, and films on *Pernaviridis*, Penaeus monodon, and Lates calcarifer. *Pernaviridis* found on many types of films, in *Penaeusmonodon* are the most prevalent types of fragments and the Lates calcarifer most common types of fiber. Pellet type is the least kind found in *Pernaviridis* and Penaeus monodon. Based on the age when taken, Penaeus monodon is the commodity that has the most potential to be contaminated with microplastic while based on the number of particles found in Lates calcarifer is the commodity with the most potential to be contaminated with microplastic.

Keywords: Lates calcarifer, Microplastic, *Penaeusmonodon, Pernaviridis*, Sayung

1. Introduction

In 1964 there were 15 million tons of plastic are produced worldwide and increased up to 20-fold by 2014 as many as 311 million tons of plastic are produced a commodity with the most potential to be contaminated with microplastic. (Plastic Europe, 2015). Ministry of Industry (2013) declares that the plastic consumption in Indonesia reached 1.9 million tons during the first 6 months of the year 2013. It indicates that there are about 1.9 tons of plastic waste the potential to pollute the seas of Indonesia in the period. At least 10% of the total plastic into plastic garbage thrown into the sea (Cauwenberghe *et al*., 2013). Plastic waste carried to the sea consists of various sizes. The waste will run into fragmentation through a variety of physical, chemical, and biological processed (Galgani, 2015) and will be degraded into microplastics, namely plastic waste of less than 5 mm in size (Arthur *et al*., 2008).

Microplastic get into the human body will have a negative impact, which is toxic, causing disruption of the digestive and the endocrine system (Stevenson, 2011). Microplastic marine life can take, directly or through the food chain. Distribution microplastic through the food chain occurs because consuming organisms and other organisms that already contains microplastic (CBD-STAP, 2012). Humans also potentially to consume microplastics because they are consuming marine biota that containing microplastics, such as *Pernaviridis, Penaeusmonodon* and *Lates calcarifer*.

Coastal land of north beach, especially in the area of the mouth of the river, developing settlement center because the area around the mouth of the river is relatively fertile. Activities performed by humans certainly have side effects that would be detrimental to the environment (Rohmat, 2007).

Sayung river estuary is one of the bodies of water that potentially exposed to plastic waste which is located in Demak. Sayung river estuary has the potential to be a place of cultivation, but Sayung river estuary area also has some drawbacks. Some of them are the environmental damage caused by waste from the Semarang area carried by the river flow toward the mouth of the river. Plastic waste accounted for 15:49% of all waste paper bins and beat. (KLHK, 2018).

However, research on the microplastic content of *Pernaviridis, Penaeusmonodon* and *Lates* calcarifer as biota consumption and the cultivation of Sayung region has never been done. Based on this background of this research, the analysis of microplastic content in *Penaeus monodon, Pernaviridis, Lates calcarifer*, in the Sayung river area.

2. Method

2.1. Determination of Research Station

Stations determination based on the coverage area that is in the location of cultivation and catching *Penaeus monodon, Pernaviridis, Lates calcarifer* in Sayung. Each station of research totaling 3 stations around the mouth of the Sayung river. Each station represents the area of mangrove, estuary, tourist attractions, and around ponds marine residents.

2.2. Environmental Parameters Data Taking

Data taken environmental parameters, ie water temperature, pH, salinity, water transparency and dissolved oxygen or dissolved oxygen (DO). Measurement of environmental parameters of data carried by 3 points each station, then take the average value to determine the value of the environmental parameters of each station.

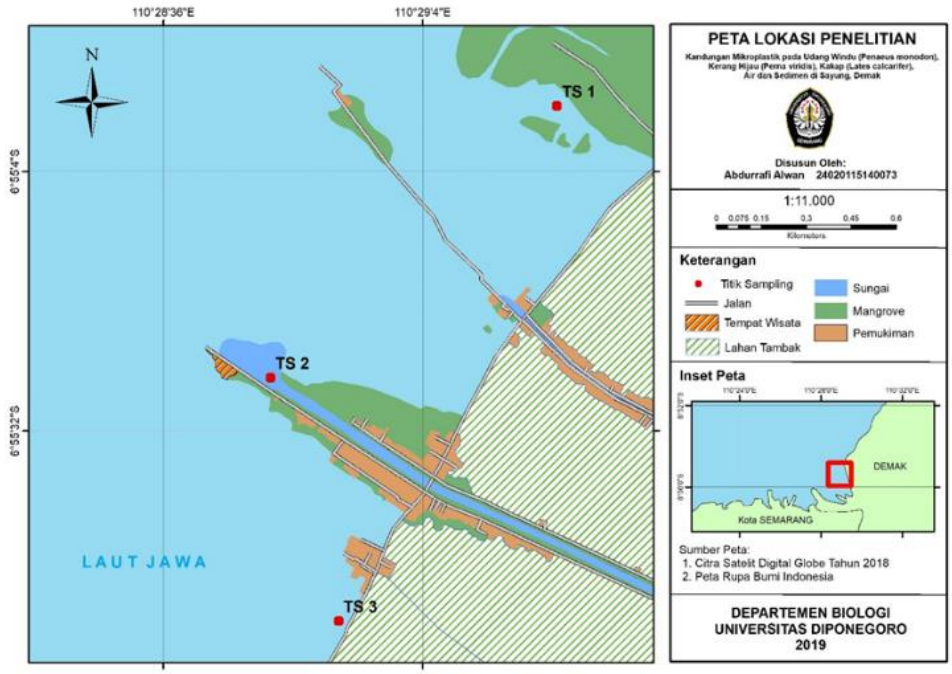

Figure 1. Map location of the research station Sayung

2.3. Sampling shrimp (Penaeus monodon), mussels (Pernaviridis) , and fish (Lates calcarifer)

Shrimp, fish, and mussels are taken from each of these stations for a total of 27 animals in each organism. Furthermore, shrimp, fish, and mussels preserved in the alcohol based on station.

2.4. Micro plastic Analysis on shrimp (Penaeus monodon), mussels (Pernaviridis) , and fish (Lates calcarifer)

The analysis process begins with measuring the length and weight of the Penaeus monodon, *Pernaviridis, Lates calcarifer*. The Penaeus monodon and *Pernaviridis* are separated from the shell (De Witte et al., 2014; Devriese et al., 2015). The soft tissue in Lates calcarifer, *Pernaviridis* and *Penaeus* monodon that had separated then dissolving with 10% KOH solution were allowed to stand for 24 hours at 60 °C, suspense and then filtered with filter paper. Microplastics are on

filter paper and then transferred to a Sedge wick Rafter counting chamber and the observed number of microplastic using a microscope binocular with a magnification of 40X. Furthermore, microplastic obtained to be calculated the number of each type and photographed with Optilab Viewer 2.0. (Rochmanet al., 2015).

3. Result and Discussion

3.1. Environmental Parameters in the Sayung Area, Demak

The range of factors in Table 1. shows that all physical-chemical factors still support the growth of either *Pernaviridis, Penaeusmonodon or Lates calcarifer*. *Pernaviridis* can grow optimally at temperatures of 26-32 ° C, 27-35 ppt salinity, dissolved oxygen is worth 6 mg / L, the brightness of 1-7 m, and a pH of 6 to 8.2; *Penaeus monodon* can grow optimally at temperatures of 26-32 ° C, 19-35 ppt salinity, dissolved oxygen of 5-7 mg / L and a pH of 7 to 8.5 and the Lates calcarifer can grow optimally at salinity 10-35, with temperatures between 27-30 ° C, dissolved oxygen > 4 mg / L and a pH of 7 to 8.5 (Badruddin et al., 2015; Suparjo 2008; Yonvitner & Sukimin, 2004).

Table 1, Environmental parameters at three research stations

Station Research	Coordinate point	Environmental parameters				
		Temp (°C)	Salinity (ppt)	pH	Brightness (m)	DO (mg / L)
1	6 ° 54'46.6 "S 110 ° 29'08.9 "E	30.5	32	7.4	3.28	5.52
2	6 ° 55'25.0 "S 110 ° 28'44.1 "E	31	28	7.4	3.44	5.41
3	6 ° 55'13.6 "S 110 ° 29'01.2 "E	30.6	30	7.8	3.52	5.78

3.2. Microplastic on Pernaviridis

Based on Table 2. the film is the most commonly found on the body of a *Pernaviridis* with 1941 particles, followed by fiber with 1428 particles. All types of microplastics are found in shells of various sizes and shells measuring 9 cm have the most microplastic particles. Fiber and film microplastic groups are most commonly found in many *Pernaviridis.* This is related to how to eat the *Pernaviridis*, are filter feeders. The animals are classified as filter feeders and deposit feeders just take the food around it, they can choose which ones will eat and not be eaten (Rajagopaletal., 2006). *Pernaviridis* will eat small objects in the environment, whether food or microplastic in the waters.

Table 2. the number of particles of each microplastic group in mussels of various sizes.

Mussels (Pernaviridis) Size	Microplastic type				Total
	pellets	*fiber*	*Film*	*Fragment*	
3 cm	16	221	249	50	536
6 cm	78	351	609	177	1215
9 cm	171	856	1083	250	2360
Total	265	1428	1941	477	4111
Average	88.33	476	647	159	1370.33

3.3. Microplastic on Penaeus monodon

Based on Table 3. The fragment is most commonly found on the part of *Penaeus monodon* with 2206 particles, followed by the 1785 fiber particles. All kinds of microplastic can be found in *Penaeusmonodon* of various sizes and at the most containing microplastic particles measuring 21-24 cm.

Table 3. Number of particles of each group microplastic in Penaeus monodon of various sizes

Shrimp (*Penaeus monodon*) size	Microplastic type				Total
	pellets	*fiber*	*Film*	*Fragment*	
11-14 cm	87	222	136	276	721
16-19 cm	206	457	239	627	1529
21-24 cm	535	1106	937	1303	3881
Total	828	1785	1312	2206	6131
Average	276	595	437.33	735.33	2043.67

Groups of fragment and fiber are a type of microplastics that are found in *Penaeusmonodon*. This relates to the nature of *Penaeusmonodon* are omnivorous, able to adjust to the food available in the neighborhood, not selective, and habitat of *Penaeusmonodon* that live in the bottom waters (Ghufran & Kordi, 2015). Microplastic is numerous in sediments namely the fibers and fragments, so the *Penaeusmonodon* may take microplastic of both its groups.

3.4. Microplastic on Lates calcarifer

Based on Table 4. The fiber is most commonly found on the Lates calcarifer with 2034 particles, followed by fragments, pellets, and films with 1570, 1551, and 1441 respectively. All kinds of microplastic can be found on the Lates calcarifer in a various size and *Lates calcarifer* with 24-29 cm long containing particles at most that 3043 microplastic particles.

Microplastic fiber group then followed by fragments, pellets, and films in a row are the group most often found until the least found. Research from Lusheretal. (2013) also revealed that the particles are most commonly found in fish are fiber and according to Hapitasari (2016) on the red snapper and grouper fiber is the most abundant particles. Young Lates calcarifer is Carnivora and natural cannibals have a very broad habitat of marine areas are muddy, sandy, until the mangrove ecosystem (Mayunar & Abdul, 2002; Ridho & Patriono, 2016). It is thus possible contamination of Lates calcarifer against microplastic different types from the impact of eating organism contaminated with microplastics.

Table 4. Number of particles of each group microplastic on Lates calcarifer various sizes

Fish (*Lates calcarifer)* Size	group microplastic				Total
	pellets	*fiber*	*Film*	*Fragment*	
13-16 cm	188	274	320	309	1091
19-22 cm	630	859	597	376	2462
24-29 cm	733	901	524	885	3043
Total	1551	2034	1441	1570	6596
Average	517	678	480.33	523.33	2198.67

3.5. Comparison between Fishery Commodities Microplastic

Data on Tabel 5. shows the average value of the particle microplastic at Lates calcarifer, *Pernaviridis* and *Penaeus monodon* were each taken from 27 sample. Microplastic most commonly found in fish (*Lates calcarifer*) with a value of particle 2198.67, followed by 2043.67 shrimp (Penaeus monodon) with particles and *Pernaviridis* with particle 1370.33. Fragment type most commonly found in *Penaeus monodon* with 735.33 particle, film types most often found in *Pernaviridis* with 647 particles, fibers and pellets kind most commonly found in *Lates calcarifer* with a value of 678 consecutive and 517 particles.

Table 5. The average value of particle microplastic in fishery commodities

Fishery Commodities	Microplastic type				Total
	pellets	*fiber*	*Film*	*Fragment*	
Mussels (Pernaviridis)	88.33	476	647	159	1370.33
Shrimp (Penaeus monodon)	276	595	437.33	735.33	2043.67
Fish (*Lates calcarifer)*	517	678	480.33	523.33	2198.67

The size of *Pernaviridis* taken is 3-9 cm, *Pernaviridis* have a growth rate of 0.7-1 cm every month (Sudrajat, 2015). This shows that *Pernaviridis* measuring 9 cm can be 9 - 12.85 months old. *Penaeus monodon* size taken is 11-24 cm, Penaeus monodon has a growth rate of 0.236-0.288 cm/day (Siboro et al., 2014). *Penaeus monodon* measuring 24 cm means the *Penaeus monodon* is 2.78 - 3.39 months old. While the size of Lates calcarifer taken is 13-29 cm, the *Lates calcarifer* can grow up to 30 cm in 6 months (Anil et al., 2010). Lates calcarifer measuring 29 cm means having age between 5-6 months. Viewing of age at the time taken by the number of particles found in the *Penaeus monodon* commodities are commodities that are most polluted by microplastic.

In a shorter time, Lates calcarifer contains almost the same number of microplastic particles as Penaeus monodon. It caused of Penaeus monodon being detritus eaters of various types of crustaceans, gastropods, bivalves, annelids, nematodes and small fish (Hermansah, 2000). When the food shortage *Penaeusmonodon* also cannibals.

Pernaviridis are also potentially highly polluted commodities, It although have lower microplastic particles than fish and shrimp. *Pernaviridis* are sessile animals that live attached to the substrate, the content of the number of microplastic particles is half of the microplastic content in shrimp and fish. It could be, because *Pernaviridis* are filter feeders, that filtering water and getting food directly from water without being able to choose the food (Suryono, 2013). *Pernaviridis* will accidentally eat microplastics in Sayung waters that containing 213 particles / L.

The way to reduce the microplastic content in fishery commodities is by purification treatment it carried out the transfer of commodities from polluted native habitat to controlled habitats with minimal contamination from microplastics. In the study of Cauwenberghe & Janssen (2014) in purified shells, there was a decrease in the average microplastic content compared to before purification.

4. Conclusion

Type of Microplastic fiber, fragments, pellets, and films on *Pernaviridis, Penaeus monodon, and Lates calcarifer* was found. In the *Pernaviridis* found kinds of films with 1941 the number of particles. Penaeus monodon is the most prevalent types of the fragment with 2206 the number of particles, and the *Lates calcarifer* most common types of fiber with 2034 the number of particles. Pellet type is the least kind found in *Pernaviridis* and *Penaeus monodon* with values particles 265 and 828 respectively. Based on the age at the time taken *Penaeus monodon* is the most potentially contaminated commodities microplastic while based on the number of particles found *Lates calcarifer* is a commodity that most potentially contaminated microplastic.

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