



Fourier Transform Infrared (FTIR) for Analysis of Microplastic Content in Sediment and Seawater in Pancer Beach Area, Jember Regency

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KEYWORDS

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ABSTRACT:

Introduction: Plastic pollution in the world's oceans is an internationally recognized environmental issue. Mismanagement of plastic waste in coastal communities, resulting in an estimated annual input of 4.8 to 12.7 million metric tons of plastic into the world's oceans. Plastic is not easily degraded so it can have an impact on microplastic contamination. Pancer Beach is one of the tourist attractions in Jember Regency which is directly adjacent to the Indian Ocean. Dense population activities can potentially pollute microplastics to the environment. In addition, the tourist attraction of Pancer beach as a tourist destination from various parts of the region causes environmental pollution. This study was conducted to determine the characteristics, abundance, and polymers of seawater microplastics and sediments in Pancer Beach

Objectives: This study was conducted to determine the characteristics, abundance, and polymers of seawater microplastics and sediments in Pancer Beach

Methods: The method used is laboratory testing using stereo and FTIR microscopes with three samples each at three location points.

Results: Microplastic particles obtained consist of 3 forms including fibers, filaments, and fragments found in all locations and sediment samples. Seawater samples were found only 2 types, such as fiber and filaments. The color of each particle consists of black, purple, green, blue, clear, and brown in seawater and sediment samples.

Conclusions: The highest abundance of seawater microplastics reached 0.23 particles/ml and sediment 0.41 particles/gr. FTIR analysis revealed that polymers indicated in seawater and sediments were nylon, High density polyethylene (HDPE), and polyvinyl chloride (PVC).



1. Introduction

Plastic pollution in the world's oceans is an internationally recognized environmental problem [1]. The extent of this pollution, as well as the increasing understanding of its potential impacts further create this problem as a public concern [2]. Millions of tons of plastic enter the marine environment annually, and the amount is expected to increase in the coming years [1]. It is known that the amount of plastic waste entering the ocean is increasing, causing plastic as a pollutant recognized worldwide that is of economic, social and political concern, because it poses a threat to marine wildlife and ecological systems, industry, to food security [2]. The threat of danger does not stop there, over time plastic waste in the marine environment can also be degraded or decomposed into small pieces, especially through weathering and mechanical forces such as wave action and abrasion with sand [1]. The degradation process produces plastic objects measuring between 5 mm and 1 μ m, or commonly referred to as microplastics [1]. Microplastic pollution creates widespread environment-related problems and poses a major threat to marine life and ecosystems.

Microplastics in the marine environment have become a hot topic in marine science because their size is easily swallowed by biota and transmitted and accumulated through the food chain [3]. As a result of contamination caused after ingesting microplastics, marine organisms can be exposed to additives, which can alter some biological processes (e.g. endocrine disruption) with consequences (e.g. reproduction, growth rate, and mobility) [2]. In addition, the side effects of microplastics on marine organisms can be both physical and chemical, where the physical effects are most often attributed to the size and shape of microplastics, whereas chemical effects are related to the fact that plastics carry a "cocktail of chemicals" with them [4]. Among the chemicals present in microplastics are materials present in plastic polymers during their production (various additives) and those present in water adsorbed on the surface of microplastics, such as various organic and inorganic pollutants [5]. Based on laboratory and field studies show adverse effects caused by exposure to microplastics in marine organisms [6]. Based on the results, it is stated that there are effects from microplastic contamination at the molecular level to organisms, including ingestion of microplastics can cause

obstruction and failure of the digestive tract in corals, oxidative stress in fish, changes in gill structure and digestive glands in shellfish contaminated with microplastics in harbors, decreased energy reserves of worms exposed to sediments spiked with microplastics, alterations in predatory behavior and reproduction of fish that exposure to microplastic-enriched foods [6].

High concentrations of microplastics are commonly found in areas with high population densities, near industrial sites or ports, especially on coasts, in coastal surface waters, and in sediments [3]. The distribution of microplastics on the surface of the sea can be influenced by currents, winds, and waves [3]. Based on a number of studies, it has shown the capacity of microplastics to absorb chemicals often found in seawater or wastewater from treatment plants [5]. While the distribution of microplastics in sediments was reported back in the late 1970s, initial observations were made in countries such as Spain, New Zealand, Canada, Bermuda, and Lebanon [7]. Sediments have been considered major absorbers of microplastics, through the ability of microplastics to concentrate organic pollutants or other heavy metals as well as their durability and resistance to degradation, the accumulation of microplastics in sediments can harm marine life and humans [8].

In coastal communities, mismanagement of plastic waste results in an estimated annual input of 4.8 to 12.7 million metric tons of plastic into the world's oceans [9]. Pancer Beach is one of the tourist attractions in Jember Regency which is directly adjacent to the Indian Ocean. Pancer Beach is classified as an open sea and a meeting place between river currents (Bedadung river, Kendas river, and Kapuran river) and the sea [10]. Puger Kulon Village is included in the coastal zone of Pancer Beach which has 15,000 residents [11]. Dense population activities can potentially pollute microplastics to the environment. In addition, the tourist attraction of Pancer beach as a tourist destination from various parts of the region causes environmental pollution. The behavior of tourists who litter causes a lot of garbage scattered around the beach. Pancer Beach which is home to the estuary of Bedadung river, Kendas river, and Kapuran river can also aggravate pollution. Garbage from rivers will usually accumulate on the edge of the beach [12].

The estuary of the bedadung river located around Pancer beach has brownish water and many house hold garbage



is found [13]. Research conducted by Ariyunita et al. shows that the waters in the Bedadung river have been contaminated with microplastics [14]. The abundance of microplastics in Bedadung river water samples was 1.87 particles/liter. This microplastic contamination comes from people's domestic activities in the form of household products. Another study was also conducted by Ariyunita et al. in estuaries along the Puger coast [15]. The results showed the highest abundance of microplastics near the fishery market at 0.19 particles/liter, followed by Getem Muara (0.05 particles/liter), near ponds (0.04 particles/liter), and Muara Bedadung (0.03 particles/liter). The presence of microplastics in the Puger coastal estuary can cause disruption to aquatic ecosystems and pollute the Indian Ocean. Based on the facts of previous data and research, this study aims to analyze the content of microplastics and their polymers in seawater and sediments in the Pancer Beach area..

2. Objectives

to analyze the types, forms, abundance and polymers of microplastics, on the exposure pathways that accumulate microplastic pollutants in marine ecosystems.

3. Methods

3.1 Sampling

The samples in this study are sediment and seawater samples taken from Pancer Beach on April 30, 2021 at 3 different stations. The determination of the station was carried out by purposive sampling method, which is in line with the direction of the river mouth and more or less community activities or visitors. The pick-up location points are 8°22'57"S 113°28'17"E (near visitor/community activities), 8°22'58"S 113°28'22"E (mangrove area), and 8°22'42"S 113°28'36"E (fish auction area) as in (Figure 1).



Figure 1. Sampling Location Point

Based on Ecoton Laboratory sampling guidelines, seawater samples are collected using *MiscoticsCan* tools and 2-liter stainless buckets. The seawater obtained is filtered as much as 100 liters at each location point. Seawater samples that have been obtained are placed in glass sample bottles and labeled. Sediment samples are taken using a shovel and placed on a full 800 ml glass jar.

3.2 Sample Testing

3.2.1 Seawater samples

The water sample that had been obtained was added with a solution of digestion, 30% H₂O₂ and 5 drops of Fe₂SO₄ in each sample. The sample was incubated at room temperature for 24 hours to degrade the organic matter. The sample was water bathed with a temperature of 70 degrees Celsius for 30 minutes, then allowed to cool before filtering. The cooled sample was filtered using a 300 mesh monyl filter. After the preparation process was complete, the filter results were lowered into a petri dish using NaCl and the sample was ready to be identified using a stereo microscope.

3.2.2 Sediment samples

The sediment obtained was placed in a stainless tray and dried in the oven at 90 degrees Celsius for 24 hours or to dry. The dry sediment was sifted, and the sieve results were transferred to a glass sample bottle. The transfer was to add NaCl and incubate at room temperature for 24 hours. The top layer of incubation results was taken and transferred to another glass sample bottle to which a 30% H₂O₂ solution of 20 ml and Fe₂So₄ 5 drops was added, then re-incubated for 24 hours at room temperature. The incubation sample was water bath at a temperature of 70 degrees Celsius for 30 minutes, then allowed to cool. The cold sample was screened and lowered using NaCL and identified using a stereo microscope.



3.2.3 Sample testing on FTIR

FTIR is a tool used to determine functional groups, compounds, and analysis on a sample or material. The FTIR testing process is based on the provisions of the ITS Metallurgical Laboratory Surabaya, using FTIR Spectrophotometry connected to OMNIC software. The sample was placed on a plate holder available at FTIR with an analysis frequency of 000-400 cm^{-1} for data collection. The sample that had appeared data was cleaned from the plate holder and the data stored on a personal computer (The data that comes out will be in the form of waves that have certain peaks with wavenumbers as the X axis, transmittance as the Y axis and include the results of the compounds contained in the sample).

4. Results

4.1 Characteristic of Microplastics

a. Forms of Microplastics

Table 1 microplastic particles obtained consist of 3 forms including fibers, filaments, and fragments found in all locations and sediment samples. Seawater samples were found only 2 types, such as fiber and filaments. Figure 2, shows that fiber is the dominant form of microplastic found in seawater and sediment samples across samples and sites. The total number of fiber-shaped microplastic particles in seawater samples found at the entire site was

56 particles and 73 particles of sediment. Filaments in seawater amounted to 3 particles at point 8°22'58"S 113°28'22"E (mangrove area) and sediment 8 particles at the entire site. Fragments were only found in sediments with a total of 2 particles at point 8°22'57"S 113°28'17"E (near community activities). The image of the shape of microplastic particles in seawater and sediment at 3 sampling sites Table 2.

Table 1. Microplastic Forms of Seawater and Sediment

No	Sample Code	Forms of Microplastics			Sum
		Fiber	Filament	Fragment	
1	A1	20	0	0	20
2	A2	20	3	0	23
3	A3	16	0	0	16
4	S1	29	2	2	33
5	S2	18	5	0	23
6	S3	26	1	0	27
Total		129	11	2	142

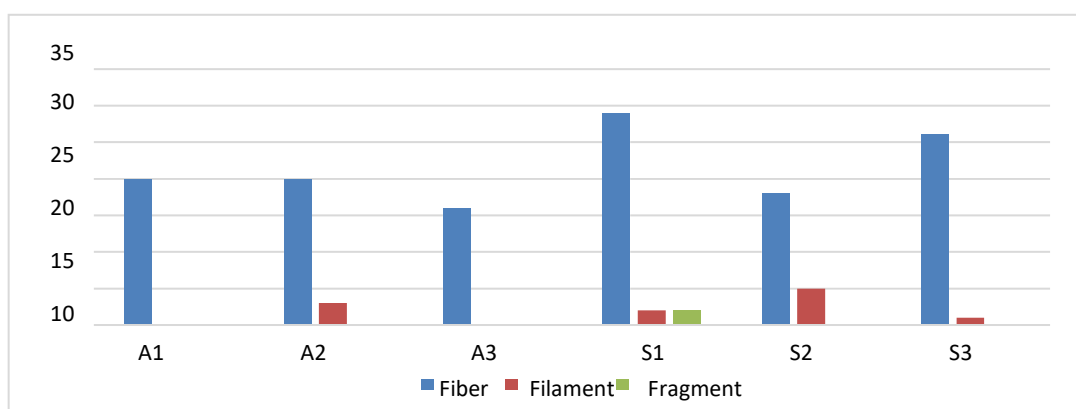
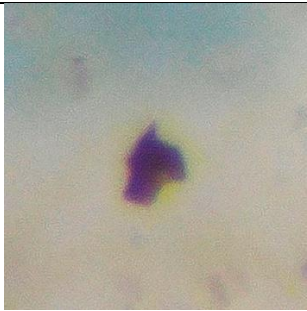


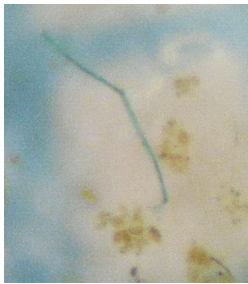
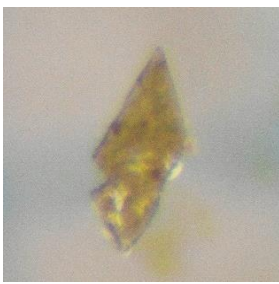
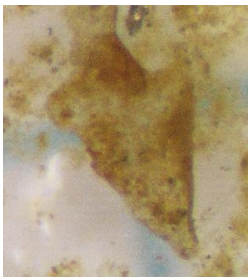
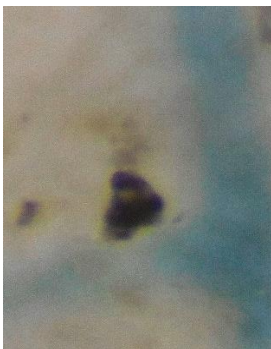
Figure 2. Diagram of the Shape and Number of Microplastic Particles in Seawater and Sediments



Table 2. Visual Forms of Microplastics

No	Sample Code	Forms of Microplastics		
		Fiber	Filament	Fragment
1	A1		-	-
2	A2			-
3	A3		-	-



No	Sample Code	Forms of Microplastics		
		Fiber	Filament	Fragment
4	S1			
5	S2			-
6	S3			-

b. Microplastic Color

Table 3 results of observations on each microplastic particle in seawater and sediment at 3 different location points found the presence of microplastic particles with different colors. The color of each particle consists of black, purple, green, blue, clear, and brown. Blue is the dominant color found in seawater and sediment samples.

Table 3. Color and Number of Microplastic Particles

Sample Code	Forms of Microplastics	Amount of Microplastics in different colors (particles)							Sum
		Black	Purple	Green	Blue	Clear	Chocolate		
A1	Fiber	20	-	-	-	-	-	20	
A2	Fiber	-	20	-	-	-	-	20	



Sample Code	Forms of Microplastics	Amount of Microplastics in different colors (particles)						Sum
		Black	Purple	Green	Blue	Clay	Chocolate	
A3	Filament	-	-	3	-	-	-	23
	Fiber	-	-	-	16	-	-	16
	Fiber	-	-	-	29	-	-	29
S1	Filament	-	-	-	-	2	-	33
	Fragment	-	-	-	-	-	2	2
S2	Fiber	18	-	-	-	-	-	2
	Filament	-	-	-	-	5	-	3
S3	Fiber	-	-	-	26	-	-	26
	Filament	1	-	-	-	-	-	7

c. Abundance of Microplastic

The abundance of microplastics in seawater and sediment is obtained by calculating using the following formula:

abundance of microplastics =

$$\frac{\text{Total of microplastic (particle)}}{\text{Seawater or sediment weight (ml or gr)}}$$

Table 4. Abundance of microplastics in seawater

Sample Code	Coordinate Point	Abundance of Microplastics (Particulate Matter/ml)
A1	8°22'57"S 113°28'17"E	0.2
A2	8°22'58"S 113°28'22"E	0.23
A3	8°22'42"S 113°28'36"E	0.16

Table 4 microplastic abundance in seawater was highest in sample A2 with coordinate point 8°22'58"S 113°28'22"E, which is located in mangrove area. The high and low abundance of microplastics in seawater was influenced by differences in location point taking.

Table 5. Abundance of microplastics in sediments

Sample Code	Coordinate Point	Abundance of Microplastics (Particulate Matter/gr)
S1	8°22'57"S 113°28'17"E	0.041
S2	8°22'58"S 113°28'22"E	0.028
S3	8°22'42"S 113°28'36"E	0.033

Table 5 microplastic abundance in sediment was highest in sample S1 with coordinate point 8°22'57"S 113°28'17"E, which is located in areas near resident/visitor activity. The high and low abundance of microplastics in sediments was influenced by differences in location point taking.

4.2 Seawater Microplastic Polymers

FTIR test results on seawater at 8°22'57"S 113°28'17"E showed 3 wave peaks including 3316.34 cm⁻¹, 1636.19 cm⁻¹, and 567.74 cm⁻¹. FTIR test on seawater at point 8°22'58"S 113°28'22"E had 2 types with 2 peaks and 3 peaks respectively. The first type (fiber) has 2 peaks, such as 1636.11 and 548.86, while the second type (filament) had 3 peaks, such as 3316.06, 1636.20, and 563.86. The FTIR test results of seawater at point 8°22'42"S 113°28'36"E had 3 peaks, such as 3320.14, 1636.12, and 567.61

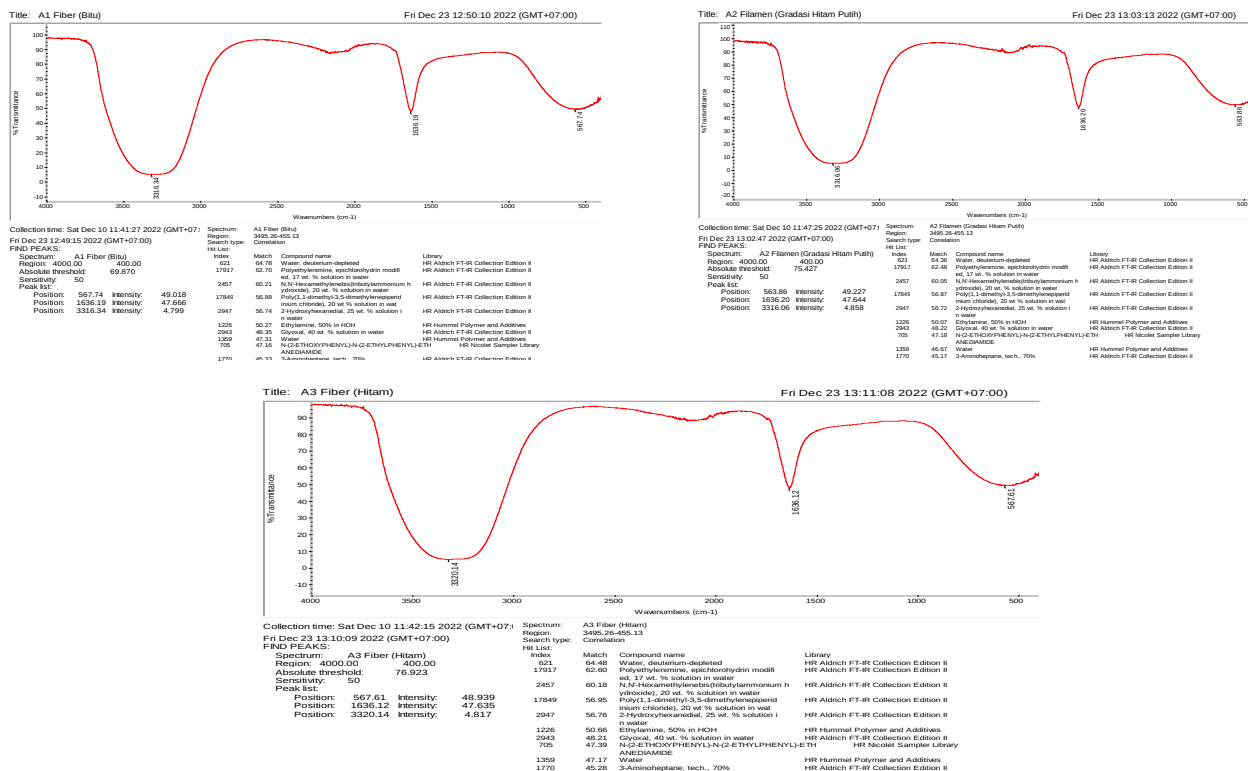
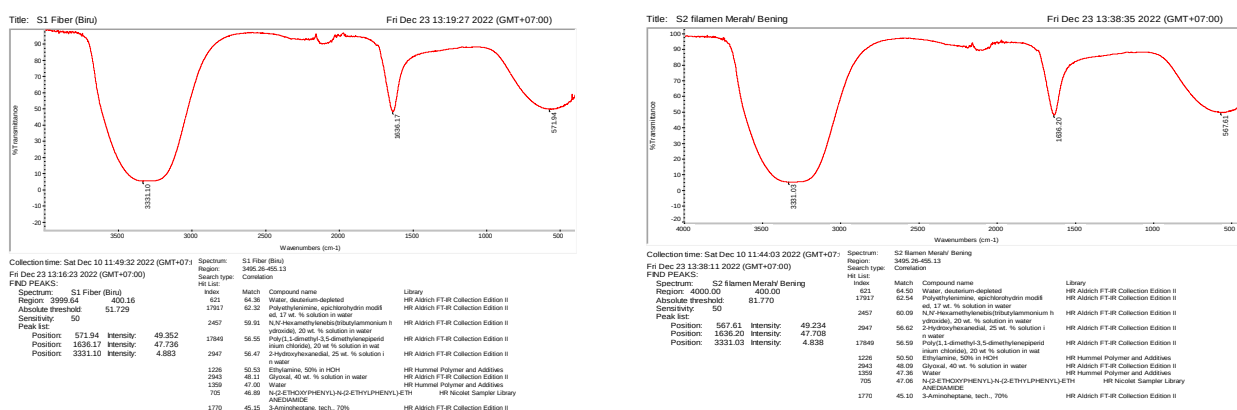


Figure 3. FTIR test results at 3 sea water points (A1 fiber, A2 filament, A3 fiber)

4.3 Polymers Microplastic Sediments

FTIR test results on sediments at point 8°22'57"S 113°28'17"E had 2 types with 3 peaks each. The first type (Fiber) was 3331.10 cm⁻¹, 1638.17 cm⁻¹, and 571.94 cm⁻¹, while the second type (Filament) was 3323.58 cm⁻¹,

1, 1636.23 cm⁻¹, and 567.85 cm⁻¹. The FTIR test on seawater at 8°22'58"S 113°28'22"E had 3 peaks including 3331.03 cm⁻¹, 1636.20 cm⁻¹, and 567.61 cm⁻¹. The results of the seawater FTIR test at point 8°22'42"S 113°28'36"E had 3 peaks, such as 3330.86 cm⁻¹, 1636.22 cm⁻¹, and 548.59 cm⁻¹



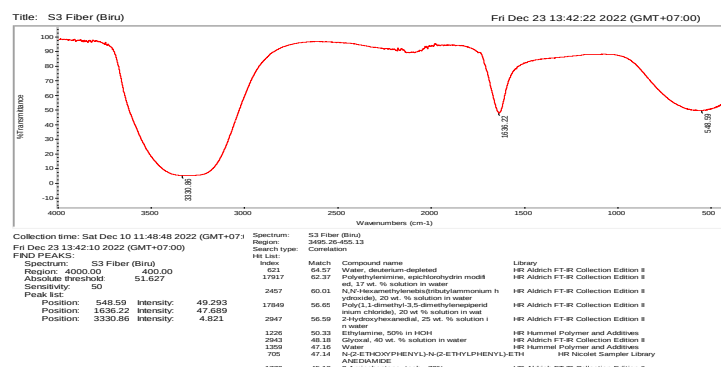


Figure 4. FTIR Test Results at 3 Sediment point (S1 Fiber, S2 Filament, S3 Fiber)

5. Discussion

5.1 Characteristics of Microplastics

a. Forms of Microplastics

The results of observations on seawater and sediment samples was taken from Pancer Beach obtained three forms of microplastics, such as, fibers, filaments, and fragments. Microplastics form fiber most commonly found in all sampling sites both in seawater and in sediments. The total amount of fiber-shaped microplastics in the seawater samples was 56 particles and 73 particles of sediment. The discovery of microplastics in the dominating form of fiber was also found in several studies, including in the waters of Jakarta Bay [16], the coastal waters of Bengkalis Island [17], and Doublesix Beach, Kuta, Melasti, Mengiat, and Tanjung Benoa [18]. The results of research conducted by Ningrum, et al regarding microplastics in fish and sea shell samples have different types. Laboratory test results show the type of microplastic found are types of microplastic fibers, fragments, granules, filaments, and granules. The samples taken were the digestive tracts of fish and shellfish on the coasts of Payangan and Puger [19]. Based on these studies, fiber-type microplastics are most commonly found due to the high activity of fisheries and settlements around the water and the large number of thread remains. According to Octarianita et al., the dominance of fiber form microplastics is caused by human activities such as fishing nets or clothes that are no longer used [20]. Unused clothes will experience friction and decompose into very small plastic particles that are carried away by the current into the waters. Erlangga et al. also mentioned that fiber microplastics

usually come from laundry waste, synthetic fabrics, fishing nets, ropes, plastic bags, and plastic containers [21]. Long fiber forms can be obtained from *monofilament* pieces of fish nets/hooks, ropes and fabrics by synthesis [22]. The highest percentage of fiber-shaped microplastics is also found in coastal areas of Singapore at 72% [23].

The filament-type microplastics identified in this study were found at the location of the mangrove area as many as 3 particles. While in sediments, filaments were found in all locations with a number of 8 particles. Filament-type microplastics have a shape like thin sheets and come from single-use plastic waste contamination [24]. The filament is transparent and has a flexible texture [25]. Filaments are often found from pieces of packaging and plastic bags. Filaments are found on the surface of the water because the density is lower than other forms and makes filaments can be easily transported through water media [26].

Fragment-type microplastics were found only in sediment samples with a total of 8 particles. The location of the sample was near community activities or visitors. Fragment-type microplastics are rarely found in waters because they have a greater density. Microplastics with fragment types come from packaging of drinking water bottles, plastic containers, and other pieces of plastic. The fragments are stronger synthetic polymer plastic flakes. Fragments are a form of microplastic derived from hard plastic waste such as household appliances. The difference with filaments is their transparency, for filaments tend to look transparent compared to fragment forms [27]. Microplastic fragment types that have a



density greater than seawater will sink so that they accumulate in sediments [28]. Thick plastic waste such as plastic bottles and plastic waste from household activities has the potential to cause fragment-type microplastics [29]. Fragments are formed from macroplastic fragmentation affected by weather, mechanical processes, and the disposal of domestic waste coming from nearby settlements. If the amount of fragment-type microplastics is higher in sediments than in the water, it indicates that fragments have less buoyancy and sink to the seafloor [16]. Likewise in this study, fragment-type microplastics were only found in sediment samples with location points near community activities or visitors. Researchers when taking data, found some wasted garbage scattered on the coast to the roots of the mangrove. Plastic bottles or waste were also found floating in the sea area and also settling in sediments. Plastic that deposits in sediments was estimated in the long term because it was in the form of old school food product packaging.

b. Microplastic Color

The color of microplastic particles is influenced by the color of origin and age of the plastic. For example, transparent fibers may come from the fragmentation of fishing rods or nets. As for colored particles, they may come from plastic commodities such as testicle and feeding products. The color possessed by microplastics can change due to the effects of degradation. Identification of microplastic color is carried out to determine the composition of waste and the duration of the degradation process [30]. In this study, microplastic particles with different colors were found, there were black, purple, green, blue, clear, and brown. The most dominating microplastic color was blue with 71 particles. The dominance of blue microplastics was also found in several studies, including in the waters around Barranglompo Island Makassar [31], in sediments of artificial reef areas around the Ma'an Islands [32], and in mangrove sediments of Butuan Bay, Philippines [33]. Blue microplastic particles may come from the use of fishing gear in fisheries such as fishing nets [34]. Blue microplastics in the form of fibers and fragments are believed to come from disposable masks [35]. Blue microplastics also come from synthetic dyes for the manufacture of plastics such as copper *phthalocyanines* [36]. Black color was also found quite a lot in this study both in seawater and sediment. Black color can indicate

microplastics and other organic particles absorb high contaminants and impact on pollutants [37]. Hidalgo (2012) in his research found the presence of types of *Polymerized Styrene* (PS) and *Polypropylene* (PP) which allegedly contain *Polycyclic Aromatic Hydrocarbons* (PAHs) and *Polychlorinated Biphenyls* (PCBs) pollutants absorbed in black microplastic particles.

c. Abundance of Microplastics

Microplastics are widely detected in fresh water, sediments, soil, atmosphere, seawater, beach sand, even scattered in remote areas such as polar regions and the Tibetan plateau [38]. The abundance of microplastic particles in seawater was most commonly found in A2 samples with locations in mangrove areas of 0.23 particles/ml. The high microplastics in mangrove areas are caused by tourist garbage trapped in the roots. Garbage carried from the waves to the land will be trapped and fragmented [39]. Plastic waste is found in many mangrove areas including woven bags, plastic bags, packaging bags, drinking bottles, and others. These plastic products are made of polyethylene (PE) and *polypropylene* (PP) which will eventually fragment [40]. While in sediments, the abundance of microplastics was most found in S1 samples of 0.041 particles / gr. The location is located near the activities of residents or visitors. As much as 70% of microplastics settle in sediments and the remaining 30% are in surface water or water columns [41]. Beaches that have many visitors, high fishing activities, near residential areas, small rivers, and many stalls will be the main factors contributing to plastic. Many polluting sources will be carried away by wind and ocean currents, increasing the potential for microplastic pollution in sediments [42].

5.2 Seawater Microplastic Polymers

FTIR test results for seawater samples at three locations contained wave bonds as follows, such as 3316.34 cm⁻¹, 1636.19 cm⁻¹, 567.74 cm⁻¹, 1636.11 cm⁻¹, 548.86 cm⁻¹, 3316.06 cm⁻¹, 1636.20 cm⁻¹, 563.86 cm⁻¹, 3320.14 cm⁻¹, 1636.12 cm⁻¹, and 567.61. FTIR test results for sediment samples at three location points contained wave bonds as follows, 3331.10 cm⁻¹, 1638.17 cm⁻¹, 571.94 cm⁻¹, 3323.58 cm⁻¹, 1636.23 cm⁻¹, 567.85 cm⁻¹, 3331.03 cm⁻¹, 1636.20 cm⁻¹, 567.61 cm⁻¹, 3330.86 cm⁻¹, 1636.22 cm⁻¹, and 548.59 cm⁻¹. The wave results were almost as close as those of seawater samples. This was affected because the location was taken at the same point.



The waves produced in this study were close to standard waves for nylon, *high density polyethylene* (HDPE), and *polyvinyl chloride* (PVC).

Research conducted in mangrove and coastal waters of Singapore also found as many as four types of polymers including polyethylene, polypropylene, nylon and polyvinyl chloride, whose wavelength is almost close to the results of FTIR testing this study [23]. Nylon in everyday life is widely used for the manufacture of fishing rods, ropes, fishing nets, food packaging, clothing, and textiles [23]. Nylon is carcinogenic, toxic, and mutagenic in biota, causing skin allergies (irritation), dizziness, headaches, back pain, and system dysfunction in humans [43]. HDPE is widely used as the main material for making films, pipes, and household appliances because it is easy to form. HDPE is one of the most consumed commodity polymers due to its low cost of production and versatility in its mechanical properties [44]. HDPE at Pancer Beach was thought to have come from several broken bottles found in the sand area of the beach. In addition, at Pancer Beach there had also been found traces of floating plastic pipes. PVC is one type of plastic polymer that is used in various aspects in society. PVC is manufactured and used in plumbing, door, window, and roofing sheet products. The massive use of PVC produces large amounts of waste as it nears the end of its economic life [45]. PVC in Pancer Beach was thought to come from degradation of residents' sewerage pipes channeled from the surrounding river estuaries. If ingested and enter the human body, this polymer will inhibit the liver from producing albumin. Furthermore, if there is a lack of albumin, muscle wasting (atrophy) will occur, and the body will have difficulty closing the wound and blood clotting process [46].

6. Conclusion

Microplastic particles was obtained consist of 3 forms including fibers, filaments, and fragments found in all locations and sediment samples. Seawater samples were found only 2 types, such as fiber and filaments. Fiber was the dominant form of microplastic found in seawater and sediment samples across samples and sites. The total number of fiber-shaped microplastic particles in seawater samples found at the entire site was 56 particles and 73 particles of sediment. The color of each particle consisted of black, purple, green, blue, clear, and brown. Blue was the dominant color found in seawater and

sediment samples. The highest abundance of microplastics in seawater in sample A2 was located in mangrove areas (0.23 particles/ml) and in the highest sediments in sample S1 near population/visitor activity (0.041 particles/gr). FTIR test results for seawater and sediment samples indicated the presence of polymers derived from nylon, *High density polyethylene* (HDPE), and *polyvinyl chloride* (PVC).

7. Acknowledgement

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8. Authors' Contributions

All authors have contributed to the final manuscript. The contribution of each author as follow,

PTN; conceptualized and designed the study, collected data, drafted the manuscript

DEI, AM; reviewed empirical studies and critical revision of the ar ticle

WS, AHS; collected data and analyset the data

Kus, YN, LDP; collected data and analyset the data

HIP, RD; designed the figures, edited the paper

All authors discussed the results and contributed to the final manuscript

9. Conflict of Interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

10. Funding Information

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11. Highlight Research

Highlight research consist of minimum 4 points of the study.

1. Microplastic was identified and analysed.
2. Microplastic content in sediment and Seawater
3. FTIR analysis
4. Research Location in Jember



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