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Identification of Microplastics Content in Sediment, Water and Digestive Channel of Milkfish *(Chanos chanos)* in Sidoarjo Pond

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Abstract

Microplastics are a form of new pollution that the Indonesian people are unaware of. The factors for the entry of microplastics into pond waters are water sources, anthropogenic activities, and pond cleanliness. This study aimed to determine the abundance, color and shape, and types of microplastic polymers found in milkfish's sediment, water, and digestive tract *(Chanos chanos)* in Sidoarjo ponds. The average abundance of microplastics in sediment samples obtained from semi-intensive ponds is 300 particles per 50 grams, while the sediment samples from traditional ponds are 613 particles per 50 grams. The average abundance of microplastics in the semi-intensive pond water samples was 2.1 particles per 20 liters and 2.3 particles per 20 liters in traditional ponds. The average abundance of microplastics in the milkfish (*Chanos chanos*) samples from the Semi-Intensive Pond was as many as six particles per tail. In comparison, the Traditional Pond had 9.5 particles per tail. In this study, four colors of microplastics were found, namely blue, black, red, and transparent, while the microplastics obtained were fiber, fragment, and filament. The microplastic polymers encountered in this study were dominated by polyamide or nylon polymers. In sediment samples from both ponds, we found the presence of *Polyamide* or *Nylon* polymers, namely *Polystyrene* and *Polyamide* or *Nylon*, and in the digestive tract of milkfish *(Chanos chanos),* namely *Polyamide* or *Nylon*.

Keywords: Microplastics; Sediment; Water; Milkfish *(Chanos chanos)*

Introduction

One of the never-ending problems in Indonesia is plastic waste. People frequently use it and are attached to its functional existence daily. Plastic base materials have quality, economical prices, are anti-rust, and are lightweight. This of which causes the use of plastic always increases every year. Plastics have incorruptible non-biodegradable properties by biological processes. It triggers plastic as an impactful contributor to waste on the environment and is one of the causes of environmental pollution (Thompson et al., 2009). In addition, several studies, one of which is the study of (Jambeck et al., 2015), reported that Indonesia is the second largest contributor to plastic waste worldwide.

Moreover, this is because Indonesia can contribute 0.48 to 1.9 million tons of plastic waste every year. The published research (Wardhani et al., 2018) supported this clause, reporting that waste production in Sidoarjo Regency also exceeds the limit of the existing population. The population in Sidoarjo Regency ranges from 1,781,405 to 1,791,405 people, while the waste produced reaches 5,344,215 m3/day. The most commonly produced waste is plastic. This considerable amount of waste needs optimal

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Corresponding Author: Annisa Inda Sanabila; email: sanabila02@gmail.com, Sunan Ampel Surabaya, Jl. Ahmad Yani No.117, Jemur Wonosari, Kec. Wonocolo, Kota Surabaya, Jawa Timur 60237 management; hence final disposal solution is the aquatic environment, such as rivers and seas (Joesidawati, 2018).

As plastic waste contaminates the aquatic environment, such as seas and rivers, it will inadvertently undergo a degradation process or decompose into tiny particles. In other words, plastic will become microplastic. According to (Efsa, 2016), the microplastic size is 5m. Several factors cause the shrinkage of large plastics into tiny particles, including the activity of UV rays reacting with plastics and water waves that cause abrasion so that plastic will accumulate in sediments and water (Hidalgo-Ruz et al., 2012). Microplastics accumulated in sediments and water may cause aquatic organisms to contaminate them. Several researchers in Indonesia carried out studies on microplastics in open waters such as seas and rivers in sediments, water, and fish. One was conducted by (Dewi et al*.,* 2015) in their publication, reporting that the microplastic particles have positively contaminated observed sediments. At the same time, research on microplastics in water and fish samples was carried out by (Febriani et al*.,* 2020). His research also stated that particles suspected of being microplastics were positively contaminating the observed water and fish samples.

One of the previous studies (Priscilla & Patria, 2019) claims that microplastics are found not only in open waters such as rivers and seas but also in ponds waters. In his research, samples of water, sediment, and milkfish *(Chanos chanos)* were positive for contamination with microplastic particles. This study's significant differences from previous studies are the type of pond, the research location, and the method used. Contaminated with microplastics will be very dangerous for aquatic organisms such as fish and will also significantly impact humans because they contain several dangerous chemical compounds. In addition to containing microplastic chemicals, other contaminants will also be involved. If fish accidentally ingest microplastics, they will have them infiltrate digestive organs and absorb them into their body (Amelia et al*.,* 2021). Microplastics in aquatic biota will stick to the gills, dissolve in the digestive tract, and end up fused to the meat. This presentation will be problematic for the community around the pond. The reason is that the pond is one of the controlled or kept clean containers. People utilize ponds to raise and harvest fish, which are traded in the community and consumed by humans. The primary purpose of this study was to determine the abundance, shape, and color, as well as the type of polymer that forms microplastics in sediment, water, and the digestive tract of milkfish *(Chanos Chanos)* taken in the Sidoarjo pond.

Research Methods

The Research Design

It is exploratory research; the organization was from September to October 2021. Two different types of ponds, Banjar Kemuning Semi-Intensive Pond and Damarsih Traditional Pond became the sampling locations in Sidoarjo Regency. Further analysis of the samples went to the ECOTON *(Ecological Observation and Wetland Conservation)* Laboratory. It then continued with the FTIR *(Fourier Transform InfraRed)* spectroscopic test conducted at the Sepuluh November Institute of Technology, Surabaya. The tools used in this research include surgical instruments, iron trays, Petri dishes, beakers, vials, glass bottles or jars, hot plates, measuring cups, filter cloth, Erlenmeyer, dropper sparrow, analytical scales, oven, ruler, binocular microscope, and the FTIR (Fourier Transform InfraRed). Whereas the materials used in this research process were distilled water, H_2SO_4 solution, H_2O_2 solution, NaCl solution, 200 m of nylon filter paper measuring 5x5 cm with a square shape, filter paper, water samples, sediment samples, and milkfish samples *(Chanos Chanos)* taken from the two specified locations.

Population and Sample

The samples obtained as much as 1 kg of 10 cm substrate depth sediment and 20 liters of water taken with a *plankton net* type 25 bottle size of 500 ml, with forty 180–295 grams of milkfish *(Chanos Chanos)* aged six months for this study. Three samples were in jars and then distributed to the laboratory. The sediment samples obtained were weighed to 300 grams and dried in an oven at 100°C for 12 hours. With this process, we obtained the dry sediment with a reduced volume of 50 grams, then filtered it using nylon filter paper to obtain finer sediment. The density separation process proceeded using a mixture of saturated NaCl solutions of 150 ml each. It was then manually stirred to have no lumps of sample for 1 minute (Ridlo et al., 2020) and then allowed to stand for 5 minutes to form a precipitate layer. The precipitated layer sediment sample was taken as part of the surfactant, added to 15 ml of H_2O_2 solution, and incubated for 24 hours (Zhao et al., 2018). The obtained water sample was filtered using nylon filter paper and rinsed jar bottle using distilled water to leave no microplastic behind. Next, added 20mL of H_2O_2 and H_2SO_4 solution. It needed 24 hours to incubate the water samples at room temperature. Dissecting the fish was the next step to take part of the intestine. It was a modified method in this study (Yudhantari et al., 2019). The intestines were taken out and washed thoroughly using NaCl solution, then dissected by spray gradually using distilled water before adding a 20mL solution of H_2O_2 and H_2SO_4 and incubated for another 24 hours. We bathed the three samples using an incubated hot plate on the samples to destroy organic matter in the sediment for 2 hours at a temperature of 30°C. Afterward, the microplastic filtering process proceeded using a nylon filter cloth to take the microplastics from the three samples. Microplastic content in this study is the shape, color, and type of its polymer, along with its discovery from the observed samples.

Data Collection Techniques

Upon obtaining the shape and color of the microplastic in the sample, the abundance of the microplastic obtained was calculated using the determined formula as follows:

a. The formula for the abundance of microplastics in sediment (Rahmadhani, 2019)

$$\frac{\Sigma MP}{Sample} \text{X } 1000$$

Description:

$\sum$MP = Amount of microplastic

b. The formula for the abundance of microplastics in water (Masura et al., 2015)

$$\frac{Amount\ of\ Microplastic}{Volume}$$

c. The formula for the abundance of microplastics in fish (Boerger et al., 2010)

$$\frac{Amount\ of\ Microplastics}{Amount\ of\ Fish}$$

Research Result and Discussion

Semi-intensive and traditional ponds are both types of fish ponds that have differences in their characteristics and how they are maintained. Based on the results of surveys and field interviews conducted by pond farmers, semi-intensive ponds have a source of irrigation from casting and channeling through underground pipes. This semi-intensive pond is also capable of cultivating a variety of different fish species with the same feeding habits and different sizes. The structural characteristics of this semi-intensive pond are relatively modern, as the walls of the pond cement-covered. The entrance and exit channels of the semi-intensive pond have one door for water discharge, and its water flows through underground pipes.

In contrast to semi-intensive ponds, water sources from traditional ponds utilize the ebb and flow of the sea and rivers around the location. Traditional ponds only have one door for the water flow. They can only cultivate fish in one type or monoculture. In terms of the pond area, they are also wider than semi-intensive ponds. The structure of traditional pond ponds uses natural materials of compacted soil with no cement.

We found microplastic particles in sediment, water, and milkfish *(Chanos Chanos)* samples in the form of fiber, fragment, and filament. We also found fiber in milkfish *(Chanos Chanos)* samples. The acquisition of the number of microplastic particles and the average abundance in samples of sediment, water, and milkfish *(Chanos Chanos)* is in Table 1. Microplastics in fiber dominate the samples of sediment, water, and milkfish *(Chanos chanos)*. Figure 1 presents the shape of the microplastics obtained in this study. We found microplastics in the sediment, water, and milkfish *(Chanos Chanos)* samples in four colors; blue, red, black, and transparent. However, the color of the microplastic that dominated the three samples in this study was blue. The following Table 2 presents the number of microplastic colors in the three samples in this study.

Furthermore, this study found two types of polymers; Polyamide and Polystyrene. Table 3 will present the interpretation of the FTIR test results for the samples. In contrast, the microplastic polymers' results in this study's three samples are in Figure 2.

Table 1 shows the highest average abundance of microplastics in the three samples obtained in traditional ponds. Based on (Watters et al., 2010), sediment texture can influence the abundance of microplastics in sediment samples since the two sediment textures taken from the two locations are different. The texture of the sediment taken from semi-intensive ponds tends to be sandy loam, while the sediment in traditional ponds has a soft loamy texture. The statement in the study (Watters et al., 2010) supports that soft texture sediments can trap debris compared to rocky, sandy, and gravel sediments. The data in this study follow the research conducted by (Li et al., 2021). In his research, he investigated the abundance of microplastics in sediments carried out in six ponds, where the first to fourth stations were aquaculture ponds of tilapia fish. In contrast, stations five and six were shrimp culture ponds. The two aquaculture ponds have different characteristics: tilapia fish ponds have sandy and rocky sediment characteristics, while shrimp ponds have soft loamy sediment characteristics.

Table 1

Number of Microplastic Particles in Sediment, Water and Milkfish (Chanos Chanos) Samples

	Fiber (particle)	Fragment (particle)	Filament (particle)	Total (particle)	Abudance Value
Semi-Intensive Ponds					
Sediment	33 particles	10 particles	2 particles	45 particles	300 particles / 50 gram
Water	126 particles	3 particles	2 particles	131 particles	2,1 particles / 20 liter
Milkfish *(Chanos chanos)*	113 particles	-	-	113 particles	6 particles / 20 tail
Traditional Ponds					
Sediment	72 particles	13 particles	7 particles	92 particles	613 particles / 50 gram
Water	103 particles	30 particles	8 particles	141 particles	2,3 particles / 20 liter
Milkfish *(Chanos chanos)*	190 particles	-	-	190 particles	9,5 particle s/ 20 fish

Meanwhile, the population density of the research location influences the water sample's high contamination, influenced by the source of the pond's irrigation and cleanliness. Based on the results of surveys and interviews, both ponds have different sources of irrigation. Semi-intensive ponds' irrigation source comes from castings channeled into underground pipes, while traditional ponds have their irrigation source from tidal rivers surrounding the pond. Suppose an individual looks at the river's condition, which is the irrigation source for traditional ponds. In that case, one will find many single-use plastic piles as there are household channels whose houses are on the riverbank. It is indeed polluting the river water used to irrigate traditional ponds. Usually, the hazardous pollutants carried into pond water are either organic or inorganic materials such as detergents, diesel fuel spills, heavy metals, and others in part. Microplastic pollutants will enter the pond water from the river mouth and seawater simultaneously without filtering. While maintaining the two ponds, the semi-intensives are better than traditional ponds. Andrady (2011) explained that carrying household, industrial and aquatic waste from land to the river causes the accumulation of microplastics in water. Facts relating to the location of traditional ponds close to industrial areas that are densely populat.

Table 2

Number of Microplastic Clors in Sediment, Water and Milkfish (Chanos chanos)

Location	Sample	Red	Blue	Blue	Transparent
Semi-Intensive Ponds	Sediment	Fiber : 1 Fragment : - Filament : -	Fiber : 25 Fragment : - Filament : -	Fiber : 5 Fragment : 4 Filament : -	Fiber : 2 Fragment : 6 Filament : 2
	Water	Fiber : 36 Fragment : - Filament : -	Fiber : 41 Fragment : - Filament : -	Fiber : 14 Fragment : 3 Filament : -	Fiber : 23 Fragment : 1 Filament : 2
	Milkfish *(Chanos chanos)*	Fiber : 16	Fiber : 68	Fiber : 23	Fiber : 6
Tradisional Ponds	Sediment	Fiber : 13 Fragment : - Filament : -	Fiber : 30 Fragment : 11 Filament : -	Fiber : 27 Fragment : - Filament : 5	Fiber : 2 Fragment : 2 Filament : 2
	Water	Fiber : 29 Fragment : - Filament : -	Fiber : 40 Fragment : 14 Filament : -	Fiber : 33 Fragment : - Filament : 6	Fiber : 1 Fragment : 16 Filament : 2
	Milkfis *(Chanos chanos)*	Fiber : 19	Fiber : 103	Fiber : 54	Fiber : 14

Table 3

Interpretation of FTIR Test Result for Microplastic Polymers in this Research

Sample	Wavenumber (cm^{-1})	Interpretation Peak
Semi-intensive pond sediment	3336.53 cm^{-1}	N-H *stretch*
	2917.34 cm^{-1}	CH_2 asym dan sym *stretch*
	2847.49 cm^{-1}	C=O *stretch*
	1636.64 cm^{-1}	N-H *bend* C-N *stretch*
	1509.11 cm^{-1}	CH_2 *bend*
	1454.35 cm^{-1}	CH_2 *bend*
	1422.69 cm^{-1}	CH_2 *bend*
	1365.70 cm^{-1}	N-H *bend*
	1319.15 cm^{-1}	NH *rocking*
	1260.15 cm^{-1}	NH *rocking*
	1023.97 cm^{-1}	
	897.10 cm^{-1}	
Semi-intensive pond water	3281.38 cm^{-1}	*CH aromatic* stretch

	1636.60 cm^{-1}	*C-C aromatic* stretch
	500.60 cm^{-1}	*C-C* rocking
Semi-intensive pond milkfish *(Chanos chanos)*	3280.57 cm^{-1}	N-H *stretch*
	2916.84 cm^{-1}	CH *stretch*
	2849.56 cm^{-1}	CH *stretch*
	1625.75 cm^{-1}	C=O *stretch*
	1460.69 cm^{-1}	N-H *bend*, C-N *stretch*
	436.71 cm^{-1}	N-H *rocking*
Traditional pond sediment	3343.92 cm^{-1}	N-H *stretch*
	2918.95 cm^{-1}	CH$_2$ asym dan sym *stretch*
	2844.33 cm^{-1}	C=O *stretch*
	1636.55 cm^{-1}	N-H *bend* C-N *stretch*
	1511.35 cm^{-1}	N-H *bend*
	1258.05 cm^{-1}	NH *rocking*
	1017.27 cm^{-1}	NH *rocking*
	909.76 cm^{-1}	
Traditional pond water	3288.41cm^{-1}	N-H *stretch*
	2919.12 cm^{-1}	CH *alifatik*
	2847.48 cm^{-1}	CH *alifatik*
	1631.83 cm^{-1}	N-H *stretch*
	1030.47 cm^{-1}	CH$_2$ *stretch*
	909.76 cm^{-1}	C-N *rocking*
	526.65 cm^{-1}	C-N *rocking*
Tradisional pond milkfish *(Chanos chanos)*	3286.09 cm^{-1}	NH *stretch*
	2919.13 cm^{-1}	CH *stretch*
	2850.36 cm^{-1}	CH *stretch*
	1708.60 cm^{-1}	C=O *strech*
	1625.88 cm^{-1}	C=O *strech*
	1542.18 cm^{-1}	NH *bend*, C-N *stretch*
	1464.74 cm^{-1}	NH *bend*
	1376.76 cm^{-1}	NH *bend*
	1158.68 cm^{-1}	NH *bend*
	1049.32 cm^{-1}	NH *bend*
	404.95 cm^{-1}	C-N *rocking*

Figure 1

Shape of microplastics found in this research: (a) Fiber, (b) Fragment and (c) Filament

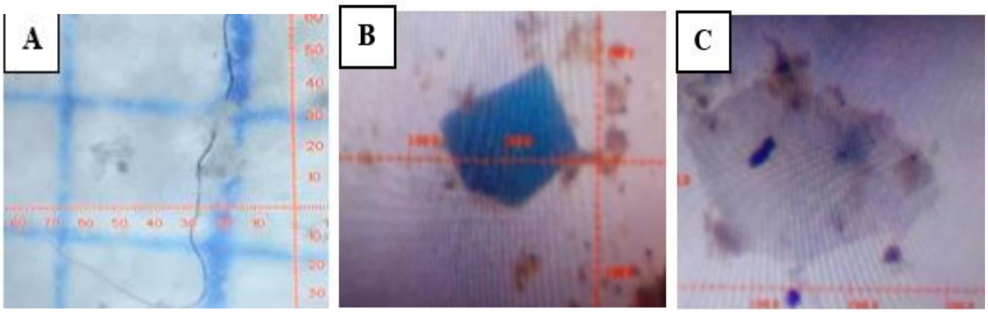
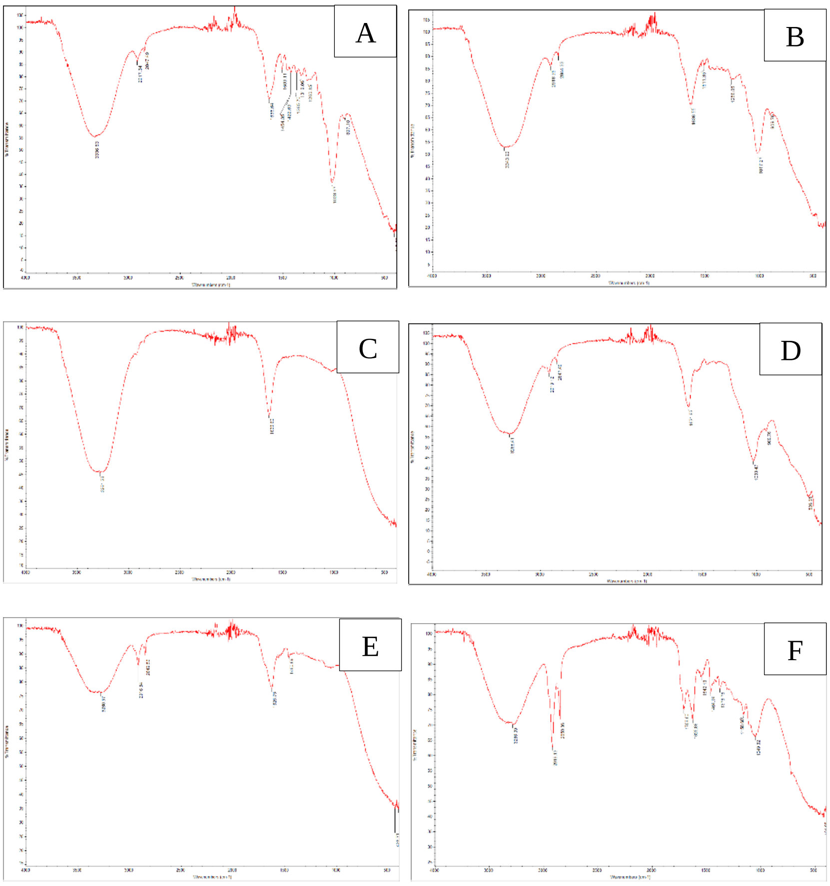


Figure 2

Microplastoic polymer FTIR test result in this research: (a) Semi-inetnsive pond sediment, (b) Traditional pond sediment, (c) Semi-intensive pond water, (d) Traditional pond water, (e) Semi-intensive pond milkfish (Chanos chanos), and (f) Traditional pond milkfish (Chanos chanos)



Milkfish (*Chanos Chanos*) as the main object in this study (Bagarinao, 1991) is a type of filter feeder, and they take food in the substrate (deposit feeder) so that water and sediment influence the infiltration of microplastics to their digestive system. Milkfish *(Chanos Chanos)* aquaculture is also fed in the form of pellets to allow the entry of microplastics from the surface of the water in the process of consuming pellets (Priscilla & Patria, 2019). The highest number of microplastics obtained in water and sediment caused a high abundance found in milkfish intestines. In this study, Milkfish *(Chanos Chanos)* traditional pond samples acquire the highest abundance of microplastics. Based on (Neves et al., 2015) claims that the digestive tract of fish is the final place for accumulating microplastics, including large ones. Usually, fish feces are unable to excrete these large microplastics. The impact of microplastic infiltration in the digestive tract of fish will harm fish, one of which is blockage of the digestive tract of fish and growth abnormalities in fish. It happens due to the long-term consumption of microplastics. The abundance and harmful effects of microplastics in the digestive tract of Milkfish *(Chanos Chanos)* certainly raise concerns about what will happen to humans when consuming them. Even with the mostly removed intestines, the smaller microplastic particles would transport to other body parts of the consumable fish (Smith et al., 2018).

Based on (Carbery et al., 2018; Wang et al., 2019) claim the danger of microplastic infiltration in Milkfish *(Chanos Chanos)* as toxic substances carried into milkfish. These harmful substances are more likely to be ingested and transferred to humans (Carbery et al., 2018). The long-term effects of the accumulation and transfer of microplastics will continue to occur along the food chain; of course, this is of great concern (Smith et al., 2018).

Chemical exposure to ingested microplastics can cause oxidative lipids in fish gills and muscles and neurotoxicity (Barboza et al., 2020). De Sales-Ribeiro et al. (2020) claimed that fish might suffer from anorexia and false satiety when ingesting microplastic, although it does not cause histopathological changes. Microplastic sticks to the gills dissolve in the digestive tract and blends in the meat; thus, plastic with harmful chemicals accumulates in fish and can cause harm to public health. Based on (Wardrop et al., 2016), it is said that when fish ingest microplastics, harmful pollutants such as heavy metals are also transported to fish along with microplastics.

Based on the results from table 2, microplastic fibers dominate the observed three samples. The colors of the microplastics found in this study were red, blue, black, and transparent. Blue and black are the often-seen colors of microplastics. The discovery of fiber microplastics from the two ponds was due to the large number of fishing nets found at the research site. A study supports that fiber-type microplastics could also come from textile fibers and fishing nets (Amelinda et al., 2021), also based on (Lie et al., 2018). This fiber-type microplastic can last longer on the surface of the water because of its relatively lower density. Microplastics with the type of fragments found in the sediment samples from semi-intensive ponds were confirmed because of the discovery of degraded fish storage or cool boxes or styrofoam and floating beverage packaging bottles into tiny particles.

Microplastics with fragments generally tend to have irregular edges (Amelinda et al., 2021). The discovery of microplastic fragments from traditional pond sediment samples was due to broken plastic bottles at one point, allowing the fragments to come from the broken plastic bottles. Moreover, after conducting a field survey of the irrigating river to the traditional ponds, it can be seen that there are some fragments of the channel pipe. Based on (Hasibuan et al., 2021) stated that filament-type microplastics came from broken plastic bags. Based on the field survey results, single-use plastic bags were found in research locations in semi-intensive ponds. The water flow carries out filament-type microplastics in traditional pond sediment samples. In addition, several single-use plastic bags were also seen in the river, which is the source of irrigation for traditional ponds. Water sources from traditional ponds utilize the ebb and flow of sea and river water. The river that is the irrigation source for the ponds is also likely to contain plastic bags, which will eventually degrade and slowly released into the environment as microplastics (Kataoka et al., 2019).

The red and blue microplastic colors most likely came from household waste, such as laundering drains, clothes threads' color, and fishing nets. This explanation is also supported by (Dekiff et al., 2014), which state that red and blue microplastics come from degradation processes with light (UV) or anthropogenic human products. Kapo et al. (2020) stated that if a black color is found on a concentrated microplastic, it has not yet undergone discoloration. Black pigmentated microplastics are believed to have many contaminants absorbed in microplastics and other organics (GESAMP, 2016). Hiwari et al. (2019) asserted that black microplastics tend to have the advantage of absorbing high pollutants and will affect the texture. Usually, microplastics found with dense colors are thought to be used as the base material for polyethylene polymers with low density, so they are often found on the surface of the water. Polyethylene polymers are categorized as the main ingredients in making plastic bags or crackles (GESAMP, 2016).

Transparent-colored microplastics indicate the time length they have been photodegraded by UV light. Transparent microplastics are filamentous; the white color is believed to come from carelessly disposed of plastic bags, cool boxes, or fish storage (Kapo et al., 2020). Hiwari et al. (2019) added that transparent-colored microplastics are the essential ingredients of polypropylene (PP) polymers, as well as polyethylene (PE) polymers which are also commonly found in water.

Based on the interpretation of the FTIR test results from the six samples, it was found that there were two polymers, namely Polyamide and Polystyrene. Polyamides were found in sediment samples from semi-intensive and traditional ponds, water from traditional ponds, and milkfish *(Chanos chanos)* in semi-intensive and traditional ponds. Meanwhile, polystyrene polymer was only found in semi-intensive pond water samples.

Polyamide polymers are identical in the presence of a vibrational region of the N-H bond. This polymer originates from anthropogenic activities such as fishing (Singh et al., 2021). These polyamide polymers are often found in microplastic studies such as research conducted by (Singh et al., 2021); they found polyamide polymers in the observed sediment samples. Studies conducted by (Zaki et al., 2021) also found the presence of polymers. Polyamide in fish was also found in research conducted by (Salazar-Pérez et al., 2021), (Bessa et al., 2018), and (Karuppasamy et al., 2020).

The discovery of Polystyrene polymer in the semi-intensive pond water samples came from styrofoam found at the end point of the semi-intensive pond; the styrofoam came from the form of microplastic fragments. It is supported by a statement (Harsojuwono & Arnata, 2015) stating that Polystyrene polymer is a type of synthetic polymer often used as an electrical insulator, food wrapper, and Styrofoam. Several other references state that polystyrene polymers can also come from clothing fibers released due to the laundering process. It can be ascertained that the polystyrene fibers found in a sample are sourced from microplastic fiber types, which are also abundant in a sample (De Falco et al., 2019). Hence, in this case, the polystyrene polymer can be said to come from two sources, namely from styrofoam fragments and also clothing fibers that are released due to the laundering process. Even though the semi-intensive pond water source comes from foundries, the semi-intensive pond is less feasible because, in the pond, one of the two pipes was used for irrigation while the other one was used as a drain from the toilets around the pond. It is very likely that some pond farmers who live around the pond then wash their clothes. The clothing fibers are released so that the polystyrene fiber polymer accumulates in semi-intensive ponds. This polystyrene polymer is a polymer that is also often found in microplastic identification research.

Conclusion

The highest average abundance of microplastics in the three samples observed was obtained from traditional pond samples. Sediment samples had the highest average abundance of 613 particles/ 50 grams, water samples 2.3 particles/ 20 liters, and Milkfish *(Chanos Chanos)* 9.5 particles/ 20 individuals. In this study, three forms of microplastic were found: fiber, fragment, and filament. The colors of the microplastics found in this study were red, blue, black, and transparent. The blue color is a microplastic color that often appears in the three samples observed. The microplastic polymers found in this study were Polyamide and Polystyrene polymers.

Suggestion

Much research on the identification of microplastics has been carried out in open waters. However, more research on the identification of microplastics has yet to be carried out in pond waters. Researchers hope that with this research, further researchers need to follow up on the maximum levels of microplastics in humans in the future.

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