Genbinesia 2 (1): 35-42 (2022)
doi: https://doi.org/10.55655/genbinesia.v2i1.23
http://journal.genbinesia.or.id/

RESEARCH ARTICLE

GENBINESIA Journal of Biology

Identification of microplastic content in several types of shellfish in Tanjung Batu Waters, Berau Regency

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Received:
05 November 2022
Accepted:
15 November 2022
Published:
24 November 2022

Abstract

This study aims to determine the microplastic content in several types of shellfish in Tanjung Batu waters, Berau Regency. The type of research used is qualitative research, with descriptive analysis methods. The samples used in this study were blood clams (*Anadara granosa*) and cockles (*Polymesoda erosa*) taken from the sea waters of Tanjung Batu, Berau Regency, East Kalimantan. Observations were made at the Biology Education Laboratory, Teaching and Education Faculty, Mulawarman University. The results showed that blood clams (*Anadara granosa*) and cockles (*Polymesoda erosa*) contained microplastics. The types of microplastics found included fibers, fragments, and films. The type of microplastic that is found the most is fiber and the least is film.

Keywords: Microplastic, Blood clam (*Anadara granosa*), Cockle (*Polymesoda erosa*)

Introduction

Indonesia is a country with abundant natural resources, both from land and water. Indonesian waters are vast, so there are so many marine biota in them, which are of great benefit to human life, one of which is food. However, currently a lot of waters, especially beaches, are polluted by plastic waste from human activities. Garbage is generated every day by humans and will continue to increase every day. The threat of waste will have an impact on humans themselves, especially in the sea area because of the linkages between living things in the sea, humans and the sea. According to the Ministry of Industry[1], it was stated that around 1.9 million tons of plastic were produced during 2013 in Indonesia, with an average production of 1.65 million tons/year. The most important plastic constituents of microplastics in seawater are polypropylene (PP), polyethylene (PE), polyvinyl chloride (PVC), polystyrene (PS), and polyethylene terephthalate (PET). According to Andrady[2], PET is the most commonly used plastic, accounting for about 90% of the world's plastic products[3]. Plastic waste pollution is a very serious problem. The persistent nature of plastic makes it difficult to decompose plastic, although over time it will be degraded into smaller particles or what are called microplastics. The very small size of microplastics and their large number in the oceans make them ubiquitous and have high bioavailability for aquatic organisms. As a result, microplastics can be eaten by marine biota[4]. As in Adisaputra's research[5], namely in analyzing the content of a microplastic in Bawis and Mackerel fish in Bontang waters, East Kalimantan, it can be concluded that these waters have been polluted by the discovery of microplastic content fragments, films, monofilament, and fiber[6] in the fish's body. The garbage is a problem that is not only experienced by our country Indonesia, but is a problem in all countries in the world. On land and in the sea, garbage is very familiar to be found, which of course pollutes the human environment. Garbage produces air pollution and flows into rivers or seas[7], which will disrupt activities in the rivers or seas. Garbage that enters the sea is known as marine debris[8].

The benefits of the sea are enormous for human life, such as the use of marine life as a food ingredient, which will affect the health of the body that consumes it. From an aesthetic point of view, it will disturb the beauty of the eye and can cause a bad smell. The presence of microplastics and zooplankton is difficult for marine biota to distinguish because of their size which is less than 5 mm, this can cause biomagnification in larger marine biota. Microplastic biomagnification is caused by zooplankton that eat microplastic particles and then zooplankton are eaten by other, larger biota so that the microplastic will enter the bodies of marine biota[9]. With the existence of plastic waste that can become dangerous microplastics, and the data and information on microplastic pollution in the Tanjung Batu village are inadequate, it is necessary to study the identification of microplastics in marine biota, especially shellfish in that area. Shellfish play an important role for ecology and economy as a source of protein[10]. Because they contain high protein, shellfish are a side dish that is beneficial for the human body, and it turns out that people from all walks of life like it.

Indonesia with a high level of waste production causes a lot of waste pollution, especially plastic waste in the sea, where in the Tanjung Batu waters, Berau Regency is one of the polluted waters in Berau and there is no prevention and public awareness of the dangers of plastic waste when disposed of into the sea either intentionally or unintentionally and the lack of management of the process of capturing marine biota and other marine potential based on environmentally friendly technology. Thus encouraging research on marine pollution by identifying microplastics in marine biota consumed by the public, namely shellfish, and with this research it is hoped that we can find out information on the level of microplastic pollution in that area.

Materials and methods

This research was conducted at the Biology Education Laboratory, Faculty of Teaching and Education, Mulawarman University, this research was conducted for 3 months starting from April-June 2022. The materials used in the research included blood clams (*Anadara granosa*), cockles (*Polymesoda erosa*), distilled water, KOH, and 0.9% NaCl. The tools used in this research includeBeaker glass, Spatula, Microscope, Digital scale, Erlenmeyer flask, Dropper pipette, Aluminum foil, Glass slide, Object glass, Oven, Hotplate, Filter paper, Basin/container, Latex, Petri dish and lid, Measuring cup, and Funnel.

The type of research used was qualitative research, with a descriptive analysis method to identify and describe microplastic particles found in blood clams (*Anadara granosa*) and seashells (*Polymesoda erosa*) in the waters of Tanjung Batu, Berau Regency. In the process of data collection is done by purposive sampling. According to Sugiyono[11] stated purposive sampling, namely sampling data sources with certain considerations.

The working procedures in this research are first blood clams (*Anadara granosa*) and kepah clams (*Polymesoda erosa*) taken in the waters of Tanjung Batu. Then samples of blood clams and shellfish were weighed and their body length, width and height were measured. Then the clams were separated from their shells and the contents of the meat, after which they were weighed again. The measurement results were recorded and from the measurement results each sample was grouped into 3 repetition groups. Furthermore, the sample is mixed with 10% KOH solution until all the meat is submerged, then baked in the oven at 40º for 24-48 hours. Then the crushed samples were removed from the oven and filtered using filter paper. The filtered precipitate is placed in a petri dish and put back in the oven to dry. After the sample is dry, Samples were taken with a spatula and dissolved in 0.9% NaCl solution. Stir for 5-10 seconds then wait for 20 minutes. This aims to maximize the separation of organic and non-organic compounds so that microplastic particles can float. Then samples were taken using a dropper pipette and microplastics were identified by microscopic observation.

Results

The following are the results of measurements (length, width and height) and weighing of shells.

Table 1. Observation results of blood clams (*Anadara granosa*) samples

Sample	Body weight (g)	Meat weight (g)	Body Length (cm)	Body Width (cm)	Body Height (cm)	Sample group	Types of microplastics found
Blood clams 1	44.8	8,6	5,2	4.0	3,6	A	Fibers, fragments and films
Blood clams 2	47,1	8,8	5,1	3,9	3,6		
Blood clams 3	56,8	10,4	6,6	4,5	3,8		
Blood clams 4	27,9	5,1	4,3	3,4	3.0		
Blood clams 5	29,9	6.0	4,4	3,6	3,3		
Blood clams 6	23,4	5,2	4,3	3,1	2,8	B	Fiber
Blood clams 7	26,9	7.0	4,4	3,3	3,1		
Blood clams 8	29.0	7,2	4,3	3,4	3.0		
Blood clams 9	26.5	6,2	4,4	3,5	3,7		
Blood clams 10	24.0	5,8	4,2	3,3	3.0		
Blood clams 11	25,3	6,2	4.0	3,2	3.0	C	Fibers and fragments
Blood clams 12	22.0	5,4	3,9	3,2	3.0		
Blood clams 13	29,1	5,4	4,3	3,3	3,2		
Blood clams 14	22,8	4,7	4,1	3,3	3.0		
Blood clams 15	23.5	4,8	4,1	3,3	2,9		

Based on the data in **Table 1**, the results of observations of the blood clam (*Anadara granosa*) sample showed that the size of this sample was only 1 adult-sized clam, where this clam was categorized as an adult if it reached a size of 6-9 cm, while the types of microplastics found were fiber, fragments, and film.

Based on the data in **Table 2**, the results of observations of the cockle shell (Polymesoda erosa) sample indicated that all of these samples were of adult size, where these shells were categorized as mature if they reached a size of 57-78 mm, while the types of microplastics found were fibers, fragments, and films.

Table 2. Observation results of clams (*Polymesoda erosa*) samples

Sample	Body weight (g)	Meat weight (g)	Body Length (cm)	Body Width (cm)	Body Height (cm)	sample group	Types of microplastics found
Scallops 1	103,2	13.5	7,8	6,7	4,2	D	Fibers and fragments
Scallops 2	78.1	8,4	7,1	6,5	4,1		
Scallops 3	70.5	13,8	7,3	6,2	3,7		
Scallops 4	60,2	10.0	7,1	6.0	3,8		
Scallops 5	66,8	11,8	7,1	6,4	3,6	E	Fibers, fragments and films
Scallops 6	69.0	14,8	7,1	6,3	3,6		
Scallops 7	55,2	11,7	6,9	6,5	3,4		
Scallops 8	70,1	11,3	6,7	6,2	3,7		
Scallops 9	49,6	11.5	6,4	6.0	3,2	F	Fiber
Scallops 10	41.0	9.0	6,5	5,9	3.0		
Scallops 11	47,8	8,8	6,5	5,8	3,2		
Scallops 12	66,3	10,2	6,8	6.0	3,6		

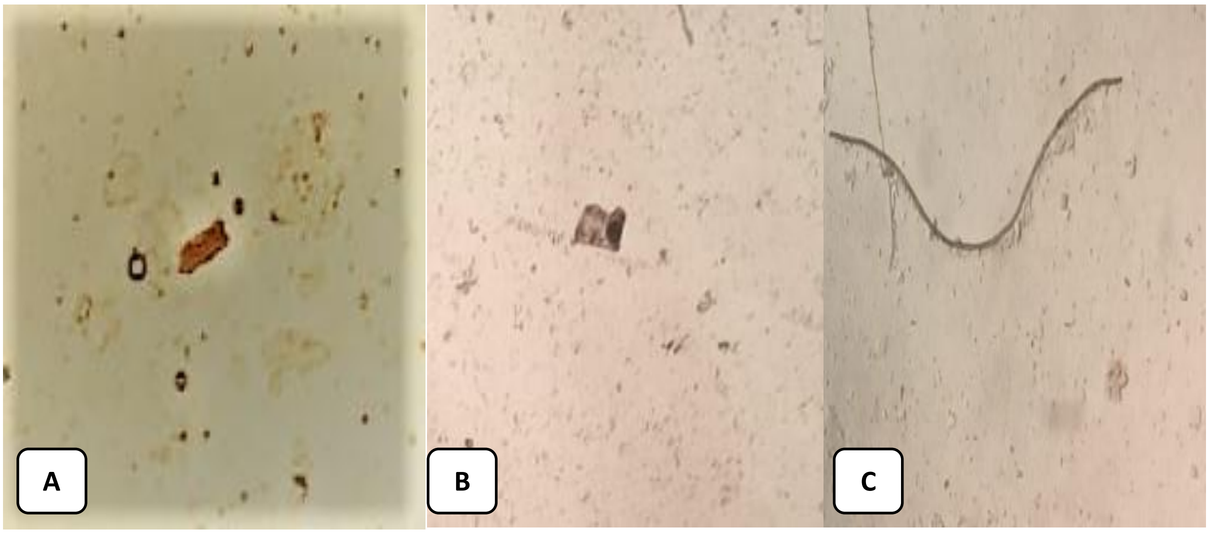

Figure 1. Results of microplastics in blood clams (*Anadara granosa*), (A) fragments, (B) films, and (C) fibers

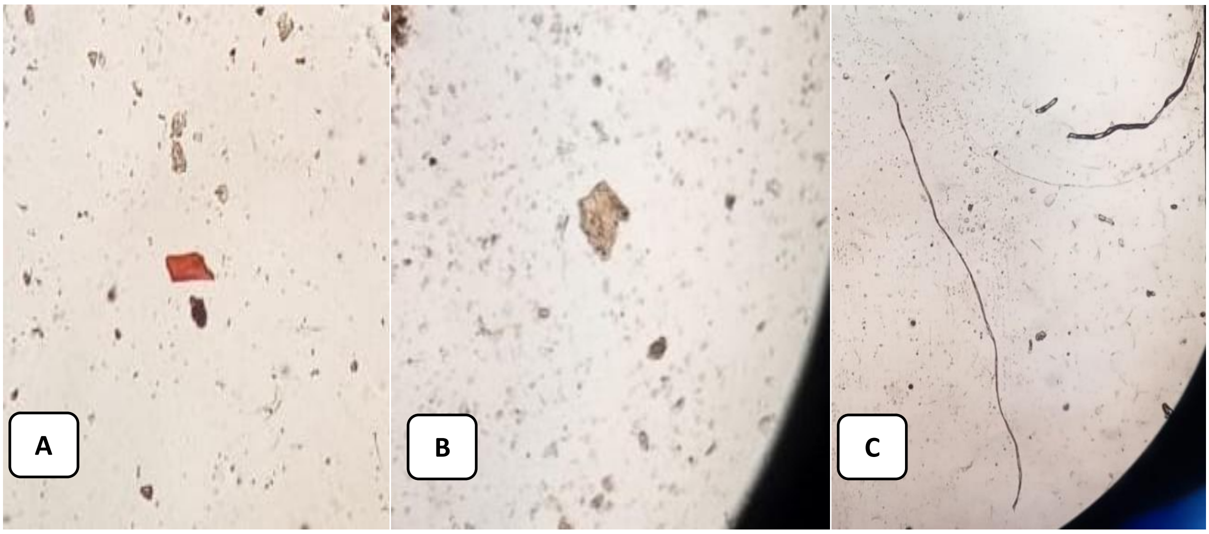

Figure 2. Results of microplastics in clams (*Polymesoda erosa*), (A) fragments, (B) films, and (C) fibers

Discussion

Based on the results of research conducted using a microscope on the body flesh of blood clams (*Anadara granosa*) and cockles (*Polymesoda erosa*), the type of microplastic that is often found and also the most dominant of each shell sample is microplastic fiber. Layn et al.[12] stated that one of the common types of microplastics that enter the aquatic environment is the types of debris, fiber, and film microplastics. This is in accordance with the statement of Crawford and Quinn[13], that fiber is microplastic originating from fishing nets, shaped like strands or plastic filaments. In accordance with the habits of fishermen who catch fish using nets, around the waters found trash fishing nets that have been damaged and several pieces of rope that are usually used by fishermen as fishing gear that are thrown carelessly.

The next type of microplastic is fragment, which according to Virsek et al.[14], that microplastic type of fragment is stiff, thick, has sharp curved edges and has an irregular shape and varies in color. Fragments are the result of degradation of macro debris caused by UV radiation, sea waves, oxidative properties of plastics, and hydrolytic properties of sea water. Evidence is by the presence of disposable plastic drink bottles, gallons of water, and PS sticks. The plastic waste decomposes into small pieces to form fragments.

The least common type of microplastic is film. This type of microplastic film is in the form of sheets or plastic fragments, because it comes from plastic bags and other food packaging which tends to be transparent[15]. In accordance with observations in the Tanjung Batu waters area, there is some plastic bag waste and food packaging as a result of the habit of the local community in using plastic bags and other plastic packaging. Film has a lower density than other types of microplastics.

From the research results obtained in blood clams (*Anadara granosa*) samples, namely fiber with black color, fragments with red, brown and transparent white colors, as well as films with a slightly blackish transparent white color, while in Kedah clams (*Polymesoda erosa*) fibers with blackish color were found. black, fragments with red and brown colors, and films with a slightly blackish transparent white color. The color of each type of microplastic is the original color of the plastic before it undergoes the fragmentation process. However, the color of microplastics can also be determined by other factors. As in this test using KOH alkaline solution, Griet et al.[16], said that the use of KOH or NaOH will have a negative effect on the color of plastic because plastic can undergo a process of discoloration. The color of microplastics can fade not only due to the influence of KOH, but also due to exposure to sunlight during the fragmentation process. So the color of microplastics can be used as an index of photodegradation and as a determinant of how long the microplastics are in the sea and the level of weathering[17]. The longer the plastic is in the water, the color will fade. In addition, the use of KOH in the extraction of mussel digestive system[18] in combination with spectroscopy can be used to detect microplastics within the shell tissue as small as a few microns[19].

Microplastic particles found in the body of the blood clam (*Anadara granosa*) are affected by the tidal environment in the process of the blood clam filtering its food. Plastic that is thrown into the sea then sinks and degrades into microplastics, therefore the microplastics in the sand sediments and/or in the waters are mixed up and then ingested and eventually enter the body of the clam. In clam shells (*Polymesoda erosa*) microplastic particles were found to be affected by the concentration of silt in the waters, when the concentration of silt in the waters is high, the mussels require high energy to separate food and unwanted particles so that it can make it easier for microplastic particles to enter into the water. clam body. Particles can also enter from filtering food if the sediment and/or water is mixed with microplastics. Plastic waste that is dumped into the sea floats and collects on the seafront and then degrades into microplastic so that it blends with sediment or mud. Other causes that cause microplastics to enter the bodies of the two types of shellfish are because the biota sampling area in Tanjung Batu waters is a place for fishermen to dock their boats, as well as boat cleaning activities, repairing nets and other fishing gear and because of the habits of the local community. who throw plastic waste carelessly, which breaks down into smaller plastic particles which are then carried by currents into the waters. Therefore it is a concern because of its very small size, Microplastics make it possible to enter the bodies of marine biota such as fish and bivalves, as a result these pollutants can enter the food chain system (aquatic food chain). Thus the presence of these plastic pollutants in seafood consumed by humans can pose a food safety risk that needs to be studied more deeply.

Research on the topic of microplastics is still in the low category and according to some parties the impact of these microplastics can gradually damage the digestive tract of biota that consume these particles and ultimately damage the survival of underwater life, reduce the growth rate of inhibited enzyme production, decreases levels of steroid hormones, and disrupt reproduction. The number of human population in an area is strongly related to the density of plastic waste in the environment. The abundance of microplastics will increase if more and more plastic enters and accumulates in waters that are not managed properly. Some plastic will float above the water, the rest will sink to the seabed.

According to Lusher et al.[20] stated that several possible side effects occur when the interaction of the immune system and microplastics or nanoplastics causes immunotoxicity, such as decreased carrier resistance to infectious agents and tumors, immune activation (increased risk of allergic and autoimmune diseases), and abnormal inflammatory responses . However, this effect has so far not been reported in humans. But this does not rule out the possibility of happening, so it needs to be a concern for all of us.

Manalu[21] states that types of polymers can have an impact on human health, namely polypropylene and HDPE polymers, which are generally used for packaging plastic bags and beverages. Nylon type polymers are used as fishing line and nets can cause irritation to the eyes and human respiratory tract. Polyethylene Terephthalate (PETE) polymer types can potentially cause cancer in humans. The polymer can be consumed by humans through the body of the clam.

Conclusions

Based on the results of the research and discussion above, it can be concluded that the results of identification of microplastics in blood clams (*Anadara granosa*) and kepah clams (*Polymesoda erosa*) found in Tanjung Batu waters, Berau Regency show microplastic contamination on their bodies. Microplastic particles found included fibers, fragments and films.

Acknowledgments

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Conflicts of Interest

The authors declare no conflict of interest in any capacity, including competing or financial.

References

1. Ministry of Industry and Trade. *Plastic Consumption 1.9 Million Tons*. Jakarta: Ministry of Industry of The Republic of Indonesia.
2. Andrady AL. Microplastics in the marine environment. *Mar Pollut Bull*. 2011; 62:1596-1605.
3. Andrady AL, Neal MA. Applications and societal benefits of plastics. *Philos Trans R Soc Lond B Biol Sci*. 2009; 364:1977-1984.

4. Rochman CM, Brookson C, Bikker J, Djuric N, Earn A; Bucci K, Athey S, Huntington A, Mcilwraith H, et al. Rethinking microplastics as a diverse contaminant suite. *Environmental Toxicology and Chemistry*. 2019; 38(4):703-711.
5. Adisaputra MW. *Analysis of Microplastic Content in Bawis Fish (Siganus canaliculatus) and Mackerel Fish (Rastrelliger kanagurta) in Bontang Waters*. Faculty of Teacher Training and Education, Mulawarman University, Samarinda; 2021.
6. Zhang W, Zhang S, Wang J, Wang Y, Mu J, Wang P, Lin X, Ma D. Microplastics pollution in the surface waters of The Bohai Sea, China. *Environmental Pollution*. 2017; 231:541-548.
7. Alam P, Ahmade K. Impact of Solid Waste on Health and The Environment. *Special Issue of International Journal of Sustainable Development and Green Economics* (IJSDGE). 2013; 2(1):165-168.
8. Jambeck JR, Geyer R, Wilcox C, Siegler TR, Perryman M, Andrady A, Narayan R, Law KL. Plastic waste inputs from land into the ocean. *Science*. 2015; 347(6223):768-771.
9. Mardiyana M, Kristiningsih A. Dampak pencemaran mikroplastik di ekosistem laut terhadap zooplankton. *Jurnal Pengendalian Pencemaran Lingkungan* (JPPL). 2020; 2(1):29-36.
10. Nurjanah, Nurilmala N, Anwar E, Luthfiyana N, Hidayat T. Identification of bioactive compounds of seaweed *Sargassum* sp. and *Euchema cottonii* doty as a raw sunscreen cream. *Proceedings of the Pakistan Academy of Sciences: B. Life and Environmental Sciences*. 2017; 54(4):311-318.
11. Sugiyono. *Quantitative, Qualitative and R&D Research Methods*. Bandung: Alphabet; 2013.
12. Layn AA, Emiyarti, Ira. Distribusi mikroplastik pada sedimen di Perairan Teluk Kendari. *Sapa Laut*. 2020; 5(2):115-122.
13. Crawford CB, Brian Q. *Microplastic Pollutants*. Elsevier Science. 2017.
14. Virsek MK, Palatinus A, Koren S, Peterlin M, Horvat P, Krzan A. Protocol for microplastics sampling on the sea surface and sample analysis. *J Vis Exp*. 2016; 118:1-9.
15. Hiwari H, Purba NP, Ihsan YN, Yuliadi LP, Mulyani PG. Condition of microplastic garbage in sea surface water at around Kupang and Rote East Nusa Tenggara Province. *Pros Sem Nas Masy Biodiv Indonesia*. 2019; 5:165-171.
16. Griet V, Lisbeth VC, Janssen CR, Antonio M, Kit G, Gabriella F, Michiel K., Jorge D, Karen B, Johan R, Lisa D. A Critical View on Microplastic Quantification in Aquatic Organisms. *Environ Res*. 2015; 143(Pt B):46-55.
17. Hidalgo-Ruz V, Gutow L, Thompson RC, Thiel M. Microplastics in the marine environment: a review of the methods used for identification and quantification. *Environmental Science and Technology*. 2012; 46(6):3060-3075.
18. Ding J, Li J, Sun C, He C, Jiang F, Gao F, et al. Separation and identification of microplastics in digestive system of bivalves. *Chinese J Anal Chem Vol*. 2018; 46:690-697.
19. Thiele CJ, Hudson MD, Russell AE. Evaluation of existing methods to extract microplastics from bivalve tissue: adapted KOH digestion protocol improves filtration at single-digit pore size. *Mar Pollut Bull*. 2019; 142:384-393.
20. Lusher AL, Hollman PCH, Mendoza-Hill JJ. *Microplastics in Fisheries and Aquaculture: Status of Knowledge on Their Occurrence and Implications for Aquatic Organisms and Food Safety*. FAO Fisheries and Aquaculture Technical Paper. Rome: Food and Agriculture of The United Nations.

21. Manalu AA, Hariyadi S, Wardiatno Y. Microplastic abundance in coastal sediments of Jakarta Bay, Indonesia. *AACL Bioflux*. 2017; 10(5):1164-1173.