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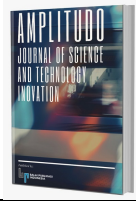

Impact Pollution Microplastics in Rivers in Indonesia

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Abstract: Problems surroundings existence in Indonesia are very diverse, which include associated pollutants withinside the river. Ecology surroundings river in Indonesia has its very own complexities of problems, possibilities and demanding situations which are exceptional from different regions. The major trouble in ecology river surroundings is trouble pollutants garbage plastic mainly microplastic. The cause of this studies is to explain photo and effect pollutants microplastics in rivers. Method used is qualitative or evaluate literature. Microplastic is skilled plastic degradation and length diameter < 5mm. Source microplastic is composed from particularly number one and secondary. Microplastics can input rivers thru effluents from home and business activities. Domestic sewers and business retailers are getting the primary approach of shipping to the river flow. The effect of microplastics at the surroundings may be withinside the shape of pollutants to the aquatic surroundings, together with growing water turbidity and the effect of microplastics on organisms, specifically aquatic organisms, particularly the capability for microplastics to be digested even with the aid of using the smallest organisms withinside the habitat.

Keywords: Ecology; Microplastic; River.

Introduction

Mature this, increase speedy and developing populace wishes guy resulted surroundings observe sacrificed for Fulfill wishes existence human. However, there's mutual courting Among people and their surroundings. Environment impact existence human and vice versa instances surroundings stimulated with the aid of using people. Man exist withinside the surroundings and now no longer ought to separated from him. With thereby surroundings Becomes element critical in existence guy for Fulfill his wishes (Effendi et al., 2018).

Ecology is reading technology mutual courting Among organism or organization organism with surroundings. Ecology observe precept stability and concord all thing nature. Happening catastrophe herbal is instance the disturbance stability and concord nature. Ecology see creature existence according with role. All creatures that stay in nature play special roles in create concord and stability in nature (Purnama, 2018).

Problems garbage plastic second this already penetrate to territorial waters, along with watersheds (DAS). one kind trash withinside the location genre river in want interest unique is garbage plastic. River anticipated as song transportation essential garbage degraded plastic Becomes microplastic to sea (Schmidt et al., 2017). Flow location very susceptible river to pollutants garbage plastic so that might disturb stability the encompassing ecosystem. Based on heritage again and hassle the researcher to do research extra keep on approximately impact pollution microplastics in rivers in indonesia.

Method

This have a look at used a qualitative literature assessment method. The information on this have a look at is statistics approximately the overall description and effect pollutants microplastic to ecology surroundings river in Indonesia. The primary information reassets are acquired via commentary and files from journals or articles on Google Schoolar.

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Result and Discussion

Plastic debris consisting of microplastics are a big pollutant withinside the aquatic environment. Properties along with buoyancy and excessive particle resistance purpose plastic debris to be found in numerous sizes in rivers, lakes or even oceans and gather in sediments all through the world (Klein et al., 2015). Microplastic described as particle plastic with a diameter of < five mm (Lusher et al., 2017). Microplastic made from from numerous polymers, along with PE (*polyethylene*), PP (*poly propylene*), PS (*polystyrene*), PVC (*polyvinyl chloride*), and PET (*polyethylene terephthalate*). Microplastics have been additionally discovered in numerous shapes, along with balls, fibers, films, fragments, and foams (Hidalgo-Ruz et al., 2012). Microplastics withinside the waters are withinside the water column, even as the ones close to the coast or upstream may be trapped in marine sediments (Victoria, 2017). The capability for microplastics to be ingested via way of means of small invertebrates and small fish will constantly be there. The inheritance of microplastic accumulation may be very probable to arise via the meals chain to a excessive trophic level. Microplastic accumulation withinside the digestive tract can intrude with the immune gadget, worried gadget and hormones due to the opportunity of interplay with different debris withinside the blood. According to (Castañeda et al., 2014) chronic natural materials and poisonous contaminants are without difficulty adsorbed onto the floor of microplastics and may be transferred to sediments and consumers.

Microplastics have their own characteristics when viewed from the particles they come from. Differences in particle origin will differ in the process of forming microplastics. Based on the source or origin, microplastics can be distinguished (Harmons, 2018):

Primary microplastics

Primary microplastics are plastic particles that are purposefully sized <5 mm for use in care/cleaning products, such as microbeads and scrubs and industrial applications such as plastic pellets. Microbeads and plastic scrubs have become a common component in cleaning products such as toothpaste, body wash, and facial cleanser so they are often enter the city sewage system. Wastewater treatment can remove most of the microbeads but not all of them. Some microbeads can go through a treatment process to enter the aquatic environment. Mason et al (2016) estimate that an average of 13 billion microbeads are released daily into waters in the United States alone. These staggering numbers have led to the creation of a federal law in the United States banning the manufacture of plastic microbeads for personal care products starting in 2017 through the Microbead-Free Waters Act of 2015. This policy is supposed to reduce new imports of microplastics in the United States. The global primary microplastic pollutant burden also requires policies to significantly reduce the amount.

Secondary microplastics

Secondary microplastics are larger fragments of plastic waste that have been degraded and entered the environment. Plastics are degraded through photooxidative flows in the environment so that their structure is brittle enough to break into smaller and smaller pieces over time. Formation of secondary microplastics from plastic debris depends on a number of exposure factors including exposure to ultraviolet light, oxygen concentration, temperature, mechanical forces, biofouling, and the size and shape of the debris pieces. In a recent study, Weinstein et al (2016) demonstrated that microplastic production from *polyethylene, polypropylene,* and *polystyrene* pieces placed in open mouths can begin as early as 8 weeks, producing fragments and fibers/filaments.

Water bodies are one of the entry and flow locations for the movement of macro and micro plastic particles in the environment (Patuwo et al., 2020). The main ingredient of plastic particles is the phthalate ester compound *Diethyl Hexyl Phthalate* (DEHP), which has stable properties and is difficult to degrade. This causes the accumulation of macro plastic levels and those that have been fragmented into micro sizes in the environment. The process of degradation of materials made from polymers and plastics can occur due to the influence of physical, chemical and biological factors (*biodegradation*). Biological degradation takes place with the role of microorganisms (*biotic*) as degradation agents and can occur in conditions with air (*aerobic*) and without air (*anaerobic*). Chemical degradation takes place in abiotic components with the role of chemical agents or physico-chemical. Furthermore, the dominant physical degradation is influenced by the physical movement of water, flow topography and the presence of macro materials along the flow (Vatseldutt, 2014).

Microplastics can enter rivers through effluents from domestic and industrial activities. Domestic sewers and industrial outlets are becoming the first means of transport to the river flow. Rivers are dynamic environments and along their flow rivers will receive accumulations of contaminants, including plastic particles originating from their watersheds, such as road runoff, agricultural runoff, wastewater inputs and garbage, which can contribute to the microplastic load in waterways. The biggest source of microplastics comes from human activities, so the densely populated lower reaches of rivers will contain more microplastics. In addition, the lower reaches of the river also receive microplastics from the upper reaches of the river (Horton et al., 2018). Rivers also act as transport media and media for degradation of plastic particles to the size of microplastics. Plastic particles that enter the river flow

will be transported to the river mouth and finally anchored to the shoreline. Plastic particles that are larger in size experience physical, chemical and biological degradation while in the river flow and finally in the sea area which leads to the formation of secondary microplastics (Mohamed Nor & Obbard, 2014). Distribution widespread microplastics in the area genre rivers has reported in many area genre rivers in Indonesia

Table 1. Invention Microplastics in Watersheds in Indonesia

Name	Information
Surabaya River Basin Area, Surabaya (Firdaus et al., 2020)	concentration microplastic at 3 points range Among 1.47-43.11; 0.76-12.56; and 1.43-34.63 particles/ L.
Gede River Basin Area, Jepara (Azizah et al., 2020)	Concentration obtained microplastics 438 particles /L
Bengawan Solo River Basin, Solo (Ayun, 2020)	Concentration obtained microplastics 200 particles / L
Estuary River Basin Area DKI River Jakarta, Jakarta (Sapta et al., 2019)	Concentration obtained microplastics 93 particles / L
Watershed Krukut River, DKI Jakarta (Prabowo, 2019)	Concentration microplastic 468 (particles/fish)

According to (Rummel et al., 2017), plastic waste is now a public concern. Garbage can damage the aesthetics of the environment and have a bad effect on living things for large plastic or macroplastic debris (> 5 mm). These large plastic debris will become brittle and fragment due to weathering to become microplastic (<5 mm). The size of the microplastic makes it suitable for digestion by small organisms at a higher level low. Although no studies have so far reported ecologically plausible adverse effects on primary consumers, it is known that too much microplastics are consumed by living things can be harmful and have an impact on health because microplastics are easily attached to substances that are harmful to living things. especially human life.

Large plastic debris or macro plastics can impact the environment. This macro plastic disrupts environmental aesthetics, but it can also have an impact on the economy of the tourism industry. Plastic can interfere with fishing processes, energy production by aquatic plants and aquaculture, so that plastic can become a significant environmental problem. Apart from having an impact on the environment, plastic is also capable of disrupting aquatic biota. Plastic debris can float and settle to the bottom of the waters. These contaminants are widespread and ubiquitous in the aquatic environment with great potential. Due to their small size, microplastics can easily be ingested and consumed by aquatic organisms. Their composition and relatively large surface area make plastics susceptible to waterborne organic pollutants and to leaching of plastics which are considered toxic. So the consumption of microplastics can be toxic at the base of the food chain (Matthew et al., 2013).

The impact of microplastics on the environment can be in the form of pollution to the aquatic environment, such as increasing the turbidity of water. This occurs due to the accumulation of macro and fragmented plastic levels into micro sizes in the waters (Vatseldutt, 2014). Microplastics can also affect other than the aquatic environment, such as reducing soil fertility and blocking circulation in the soil. The next impact goes to the food chain which will indirectly affect the quality of the ecosystem and the environment in general (Browne et al., 2017).

The impact of microplastics on organisms, especially aquatic organisms, is the potential for microplastics to be digested even by the smallest organisms in the habitat (Tankovic et al., 2015). Digested and accumulated microplastics can cause digestive tract disorders, inhibit growth, inhibit enzyme production, reduce the amount of steroid hormones, affect reproduction, and can cause exposure to additives (Kazour et al., 2019). Microplastic will follow the flow of surface water and empty into the sea and have a much wider impact. Fragmentation of fishing line and netting fragments from the activities of residents around the coast or estuaries can disrupt the organ function systems in organisms. Matthew et al (2021) found the presence of microplastics in zooplankton, so it can be seen that even micro-sized organisms can be contaminated with microplastics. Contamination of zooplankton indirectly affects the entire food chain in the sea. This is because zooplankton act as primary consumers that utilize energy sources produced by primary producers. Microplastic many contain compound dangerous such as PCBs, metals, and PBDEs, in which the compounds the could dangerous if accumulates in the body human. Based on expert research of the Federal Environment Agency did analysis in the laboratory in connection with ten the most plastic used in the world. Of the eight volunteers, microplastic detected in feces with average concentration of 20 particles microplastics per 10 grams of stool (Schwabl et al., 2019).

Based on explanation the originating microplastics from rubbish degraded plastic. Have potency for disturbing balance ecosystem and impact negative for environment specifically area genre rivers. this show that necessary preventive measures minimize and reduce happening impact pollution microplastic to environment specifically area genre rivers.

Conclusion

Microplastic is experienced plastic degradation and size diameter < 5mm. Source microplastic consists from

namely primary and secondary. Microplastics can enter rivers through effluents from domestic and industrial activities. Domestic sewers and industrial outlets are becoming the first means of transport to the river flow. The impact of microplastics on the environment can be in the form of pollution to the aquatic environment, such as increasing water turbidity and the impact of microplastics on organisms, especially aquatic organisms, namely the potential for microplastics to be digested even by the smallest organisms in the habitat.

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References

Ayun, N. . (2020). *Analisis mikroplastik menggunakan FT-IR pada air, sedimen, dan ikan belanak (Mugil cephalus) di segmen Sungai Bengawan Solo yang melintasi Kabupaten Gresik*. Digital Library UIN Sunan Ampel.

Azizah, P., Ridlo, A., Suryono, C. A., Kelautan, D. I., Perikanan, F., & Diponegoro, U. (2020). *Mikroplastik pada Sedimen di Pantai Kartini Kabupaten Jepara* , Jawa Tengah. 9(3), 326–332.

Browne, M. A., Underwood, A. J., & Chapmana, M. G. (2017). Some problems and practicalities in design and interpretation of samples of microplastic waste. *Analytical Methods*, 9, 1332–1335.

Castañeda, R. A., Avlijas, S., Simard, M. A., & Ricciardi, A. (2014). Microplastic pollution in St . Lawrence River sediments. *Canadian Journal of Fisheries and Aquatic Sciences,* 71(12).

Effendi, R., Salsabila, H., & Malik, A. (2018). Pemahaman Tentang Lingkungan Berkelanjutan. *Modul* (ISSN-P 0852-1697, e-ISSN 2598-327X), 2877, 75–82.

Firdaus, M., Trihadiningrum, Y., & Lestari, P. (2020). *Microplastic pollution in the sediment of Jagir Estuary, Surabaya City, Indonesia*. Marine Pollution Bulletin, 150.

Harmon, S. M. (2018). The effects of microplastic pollution on aquatic organisms. *Emerging Matter of Environmental Urgency,* 249–270.

Hidalgo-Ruz, V., Gutow, L., Thompson, R. C., & Thiel, M. (2012). Microplastics in the marine environment: A review of the methods used for identification and quantification. *Environmental Science and Technology,* 46(6), 3060–3075. https://doi.org/10.1021/es2031505

Horton, A. A., Jurgens, M. D., Lahive, E., Bodegom, P. M. V., & Vijver, M. . (2018). The influence of exposure and physiology on microplastic ingestion by the freshwater fish Rutilus rutilus (roach) in the River Thames, UK. *Environmental Pollution*, 236, 188–194.

Kazour, M., Terki, S., Rabhi, K., Jemaa, S., Khalaf, G., & Amara, R. (2019). Sources of microplastics pollution in the marine environment: Importance of wastewater treatment plant and coastal landfill. *Marine Pollution Bulletin*, 146, 608–618.

Klein, S., Worch, E., & Knepper, T. P. (2015). *Occurrence and spatial distribution of microplastics in river shore sediments of the Rhine-Main Area in Germany*. https://doi.org/10.1021/acs.est.5b00492.

Lusher, A., Hollman, P., & Mandoza-Hill, J. (2017). Microplastics in fisheries and aquaculture. *In FAO Fisheries and Aquaculture Technical Paper* (Vol. 615, Nomor July). http://www.fao.org/3/a-i7677e.pdf

Mason, S. A., Garneau, D., Sutton, R., Chu, Y., Ehmann, K., Barnes, J., & Rogers. (2016). Microplastic pollution is widely detected in US municipal wastewater treatment plant effluent. *Environmental Pollution*, 218, 1045–1054.

Matthew, C., Pennie, L., Elaine, F., Claudia, H., Rhys, G., Julian, M., & Tamara, S. G. (2013). Microplastic Ingestion by Zooplankton. *Environmental Science & Technology,* 47(12), 6646–6655.

Matthew, M., Hanspeter, H. A., & Mine, B. T. (2021). The global threat from plastic pollution. *Science*, 373(6550).

Mohamed Nor, N. H., & Obbard, J. P. (2014). Microplastics in Singapore's coastal mangrove ecosystems. *Marine Pollution Bulletin*, 79(1–2), 278–283.

Patuwo, N. C., Pelle, W. E., Manengkey, H. W. ., & Schaduw, J. N. . (2020). KARAKTERISTIK SAMPAH LAUT DI PANTAI Tumpaan Desa Tateli Dua Kecamatan Mandolang Kabupaten Minahasa. *Jurnal Pesisir dan Laut Tropis*, 8, 70–83.

Prabowo, G. R. M. (2019). *Kandungan Mikroplastik Pada Ikan Sapu-Sapu (Hypostomus Plecostomus) di Kali Krukut*. Institutional Repository Universitas Bakrie.

Purnama, S. G. (2018). Dasar Kesehatan Lingkungan Sang. E-*Jurnal Universitas Udayana*, 1–97.

Rummel, C. D., Jahnke, A., Gorokhova, E., Kühnel, D., & Schmitt-Jansen, M. (2017). Impacts of biofilm formation on the fate and potential effects of microplastic in the aquatic environment. *Environmental Science and Technology Letters*, 4(7), 258–267.

Sapta, L. ., Rachmat, Purba, N. P., Mochamad, U. K., & Agung, L. P. S. Y. (2019). *Karakteristik sampah mikroplastik di Muara Sungai DKI Jakarta*. Garuda.

Schwabl, P., Koppel, S., Konigshofer, P., Bucsics, T., Trauner, M., Reiberger, T., & Liebmann, B. (2019). Detection of various microplastics in human stool: A prospective case series. *Annals of Internal Medicine,* 171(7), 453–457. https://doi.org/10.7326/M19-0618

Tankovic, M. ., Perusco, V. ., & Godrijan, J. . (2015). Marine plastic debris in the north-eastern adriatic. Proceedings of the MICRO 2015 Seminar on *Microplastics*, 15–16.

Vatseldutt, S. A. (2014). Isolation and Characterization of Polythene Degrading Bacteria from Polythene Dumped Garbage. *International Journal of Pharmaceutical Sciences Review and Research*, 25(38), 205–206.

Victoria, A. V. (2017). *Kontaminasi Mikroplastik di Perairan Tawar*. Teknik Kimia ITB, January, 1–10.

Weinstein, J. E., Crocker, B. K., & Gray, A. D. (2016). From macroplastic to microplastic: degradation of high-density polyethylene, polypropylene, and polystyrene in a salt marsh habitat. *Environmental Toxicology and Chemistry*, 35(7).