

Marine Plastic Waste Pollution Regulations: A Case Study of Indonesia

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Abstract- Indonesia's marine plastic waste pollution is severe and has a significant impact on Indonesia's marine environment, ecology, biodiversity, economy, and health. The aims of this study are to enrich the theoretical basis, provide a new way to solve the problem related marine plastic waste pollution and promote the reform of Indonesia marine plastic waste pollution law. By applying interdisciplinary approach and literature reviews, result showed that existing regulations not specifically regulate about marine plastic waste pollution. So, this study suggests to improve legal regulations and implementations. Also, clearly define the agencies or Ministers that have responsibility to handle about marine plastic waste pollution problem in Indonesia.

Keywords- marine plastic waste pollution, legal regulations, Indonesia

I. INTRODUCTION

In Indonesia marine plastic waste is not only from the land, but also from the sea, which accounts for two-thirds of Indonesia's total area. Recently, Indonesia's marine plastic waste problem has become increasingly prominent. It has an extraordinary impact on Indonesia's marine ecosystem because marine plastic waste not only pollutes the ocean but also consumes and poisons a large number of marine animals^[1,2].

Some studies have assumed that the amount of plastic waste entering the marine environment is affected by several variables, namely, river flow area, population density, and marine activities. It is estimated that 52.5 trillion tons of marine plastic waste is floating in the marine environment. McKinsey's report also said that the two main reasons for the leakage of marine plastic waste are that the value of uncollected garbage and some types of plastic is relatively small. The study also found that 75% of landfill leakage sources come from uncollected waste and 25% from the official system of municipal solid waste management^[3,4].

In November 2012, the United Nations Environment Program (UNEP) quoted a report of the World Bank entitled "waste: global solid waste management," which pointed out that the volume of the world's waste can reach 1.3 billion tons per year. The amount of solid waste in large cities will continue to grow

by 70%. The characteristics of plastics are light, strong, durable, and cheap, which makes the use of plastics increasing and widely used in daily life. This characteristic of plastic makes it very dangerous to the marine environment, and more plastic waste is harmful to the marine environment. Also, because plastics are not easy to decompose in soil or water, plastics can be deposited and accumulated for a long time. Most of the pollution of marine plastic comes from the generated waste by human beings. These wastes are thrown into the river and then flow into the ocean, or social activities directly dispose of the plastic waste into the sea. At present, the amount of Indonesia's marine plastic waste is still increasing, and nearly 60-80% of marine waste is composed of plastic waste^[5,6].

Protection to the ocean can support sustainable development, solve the existing problems, and future life continuity problems^[7,8]. Indonesian government's management of plastic waste is still insufficient. Most Indonesians believe that they live in a "throw culture," and the packaging of food and drink is made of plastic. Therefore, marine plastic waste pollution is a serious problem facing in Indonesia. But on the other hand, research on the legal issue related to marine waste pollution in Indonesia is not popular. The purposes of this study are to enrich the theoretical basis of marine plastic waste pollution law, provide a new way to solve the problem related marine plastic waste pollution and promote the reform of Indonesia waste law.

II. METHOD

This research is legal research using an interdisciplinary approach. Therefore, in the process of research, the basic theories and knowledge of environmental science, ecology, law, and other disciplines are used to analyze the legal problems of marine plastic waste pollution in Indonesia and put forward solutions. Besides, the literature review also conducted by reading a large number of papers written by domestic and foreign scholars. Relevant documents of the legal system of marine plastic waste, government reports, and electronic documents retrieved and downloaded. The collected papers related to this study will be sorted, classified, and a literature review will be written.

III. RESULT AND DISCUSSION

3.1 Current Issues of Marine Plastic Waste Pollution in Indonesia

Marine plastic waste refers to the artificially manufactured materials discarded, disposed, or abandoned in the marine environment. It is characterized by artificial plastic waste that floats intentionally or accidentally in the marine environment. According to the Marine Conservation Association, about 8 million tons of plastic flow into the ocean every year. If the environment cannot be controlled, by 2025, about 1 ton of plastic waste will be found for every 3 tons of marine fish. At the same time, in 2015, a research team led by Jenna R. Jambeck of the University of Georgia published a study in the journal *plastic waste from land to the ocean*, which said that more and more plastic waste could flow into the sea. According to data from 192 countries, Indonesia ranks second, with plastic waste production reaching 3.2 million tons, second only to China (8.8 million tons), the Philippines (1.9 million tons), Vietnam (1.8 million tons), and Sri Lanka (1.6 million tons). If 75% of the land-based waste spills in China, Indonesia, the Philippines, and Vietnam can be contained, the amount of waste flowing into the ocean worldwide will be reduced by 45%. *Plastic Waste input From Land into The Ocean* ^[9].

As an archipelago country, 187.2 million Indonesian people are living in coastal areas ^[10]. In Indonesia, plastic waste enters the marine environment through rivers, beaches, marine activities, and illegal dumping. The sources of marine pollution in Indonesia are unmanaged garbage and people's garbage that directly throws into the surface water. Generally, the origins of marine plastic waste in Indonesia are land and ocean itself. Land-based sources mean marine plastic waste pollution that comes from activities on the land (including waterfront, riverbanks, beaches, ports, and docks) and contaminate the surface water then flow to the sea. Land-based sources are the most significant source of marine pollution. Ocean-based sources mean plastic waste pollution caused by ships, weather conditions, or any seabed activities.

Based on the size, marine plastic waste classified into three groups, namely large debris (>20 mm, refers to the large part of plastic waste), intermediate debris (2-20 mm, usually refers to plastic resin particles, also known as nurdles), and microplastics (<2 mm, consist of small plastic fragments less than 5 mm in diameter). The continuous movement and collision of medium and large-scale debris and other plastic debris, as well as the impact of ultraviolet radiation and photooxidation degradation, will break the waste into smaller pieces, which can be as little as 2 mm. Other small plastic particles, also known as "scrubbers," come from hand cleaners, cosmetics, and bladder cleaning media, which also pollute the marine environment ^[11].

Plastic debris in the ocean can be naturally broken down into smaller parts because there are factors from UV activity and wear. As a result, the amount of degradation will be less than 5 microns (plastic particles) once the plastic debris flows into the broad ocean with these factors ^[12].

Microplastic is a kind of plastic particle with a small size and less than 5 mm. The density of microplastics is less than water, which leads to the floating of microplastics in the marine environment. Microplastics can sink due to the influence of microorganisms

and other particles. Wright once explained the possibility of microplastics entering marine species or fish, as well as their biological effect and interaction. In his study, he explained microplastics formation is due to sunlight, the presence of electricity, and the impact of microorganisms, which can lead to the degradation of plastics. High-density microplastics are deposited and accumulated in marine sediments. On the other hand, low-density microplastics are floating in the marine environment ^[13,14,15].

The pollution of plastic waste to the ocean is of great concern not only because of its ecological impact but also because it may have a significant effect on human health, especially on food safety. Plastics can be broken into small pieces, which makes them consumed by marine life and even small invertebrates. In 2015, a study in the deep-sea in Southwestern Sumatra found that plastic materials were found in eight of its ten sampling sites. Although most of the plastic particles are below 500 meters in-depth, the study found that plastic also penetrates the original area at a depth of 2000 meters. Indonesia's residents live in plastic, which has been broken into micro and nano-sized plastic and has spread to the bottom of the sea. People can't pick up all the marine plastic garbage ^[16,17].

The impact of marine waste pollution in Indonesia can be seen in four aspects, such as ecology, biodiversity, resident health, and economics.

In the ecological aspect, marine plastic waste can directly affect aquatic ecosystems, such as beaches, wetlands, coral reefs, fish habitats and breeding grounds and paths of migratory species. The impact of marine plastic waste depends on its type and location, and it can also lead to the death of coral reefs. According to the Australian coral reef research center (ARC), 89% of reefs exposed to plastic waste cause potential diseases, compared with only 4% of reefs not affected by waste. The study was confirmed by researchers who looked at 159 reefs from 2011 to 2014. As a result, exposure of plastic debris to coral reefs is most common in Indonesia, with 26 pieces per 100 square meters ^[18]. Indonesia is a country with abundant and diverse marine life. The area consists of three biogeographic regions and is a sanctuary for rich marine life - 76% of coral, mangrove, and vast seagrass beds live here. Indonesia's ecosystem is in danger because of the persistent leakage of marine plastic waste. With the rapid growth of urbanization and the population in coastal areas, the pollution degree of infiltration and destruction of various ecosystems will continue to increase the deterioration of the marine environment ^[19].

From the biodiversity aspect, plastic debris will destroy the ecosystem and marine biota which feed on the decomposition of plastic waste and store the material absorbed by the plastic debris in the aquatic biota. These hazardous chemicals are PCBs, DDE, PAH, and DDT. These substances are included in the blacklist in Annex A and the grey list in Annex B of the Stockholm Convention on persistent organic pollutants, which entered into force on August 26, 2010^[20]. As Greenpeace says, about 267 marine animals died of indigestion, 90 percent of which was caused by swallowing plastic. One of the destructive

consequences is that plastic is considered food for birds, fish, and marine mammals. Some mothers even feed their chicks plastic. When eating plastic, marine animals will feel full of food. Their bodies do not need nutrition. As a result, they will starve to death. Turtles even mistake plastic bags for jellyfish, one of the animal's favorite foods^[21,22,23].

In Indonesia, a dead whale was found with stomachs contain various types of debris, with a total weight of 5.9 kg. In the whale's belly, the fragments are 750 grams of plastic glass fragments (115 pieces), 140 grams of hard plastic (19 pieces), 150 grams of plastic bottles (four pieces), 260 grams of plastic bags (25 pieces), 740 grams of sawdust (six parts), 270 grams of slippers (two pieces), 200 grams of nylon bags (one piece), 3260 grams of collapsed rope (more than 1000 pieces)^[24].

Besides ecological and biodiversity impact, marine plastic waste also can bring a negative impact to human health. It happens because marine plastic waste can increase the accumulation and transfer of several pollutants, namely phthalates, bisphenol A (BPA), polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), nonylphenol and dichlorodiphenyltrichloroethane (DDT). Pollutants in marine organisms can enter the human body through the food chain because consumers can directly or indirectly eat seafood contaminated with micro plastics^[25].

Indonesia's economic sector is closely related and depend on the sea and marine product. This condition makes marine plastic waste pollution directly affects the economy in the country. The economic impact of marine plastic waste pollution had reached the US \$1.2 billion, including losses in fishing, shipping, tourism, and insurance business sectors^[26].

3.2 Relevant Regulations of Indonesia's Marine Plastic Waste Pollution

At present, Indonesia has no specific legal regulations to deal with marine plastic waste pollution. Indonesia's laws on waste control and management are shown in Figure 1.

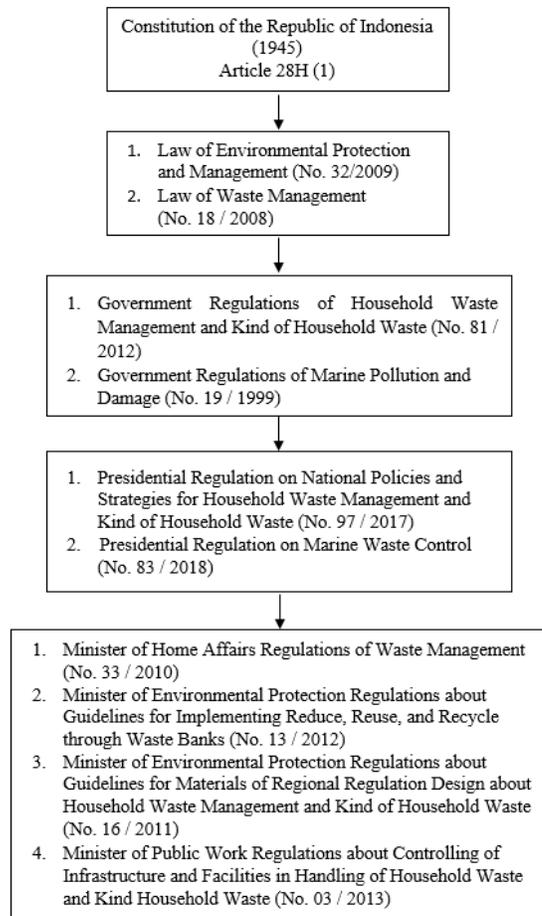


Figure 1. Scheme of Relevant Regulations about Marine Plastic Pollution in Indonesia

Constitution of the Republic of Indonesia (1945) is the basis and source for the formation of laws and regulations. Every chapter, article, and verse that contains the ideals to be achieved by the Indonesian people. As shown in figure 1, the highest level of law, which closely related to marine plastic pollution, is Article 28H (1). Article 28h, paragraph 1, of the Constitution of the Republic of Indonesia (1945) stipulates that "everyone has the right to live in the prosperity of body and spirit, to have a good and healthy environment and to have access to health services."

Constitutions of the Republic of Indonesia (1945) Article 28H is followed by the Law of Environmental Protection and Management (No. 32/2009) and Law of Waste Management (No. 18/2008). Indonesia promulgated the environmental protection and management law (No. 32/2009), which states that a good and healthy environment is the human rights and constitutional rights of every Indonesian citizen. It has established legal instruments for the prevention of pollution and environmental damage according to the development and needs of science, namely, a strategic environmental assessment (SEA), spatial planning, environmental quality standards, environmental damage standards, analysis of environmental impact problems, environmental management efforts and environmental monitoring efforts, licenses, environmental, economic means, basic environmental laws. Besides, Indonesia enacted the Law of Waste Management (18/2008), which regulates waste generally,

not specific to marine plastic pollution. This regulation also states waste management is a systematic, comprehensive, and sustainable activity, including waste reduction and disposal. The definition of waste management is contained in Article 1, paragraph 5, of Law of Waste Management (No. 18/2008).

In Indonesia, government regulations become implementation regulation for laws above it. The government regulations for Law of Environmental Protection and Management (No. 32/2009) and Law of Waste Management (No. 18 / 2008), namely: Government Regulations of Household Waste Management and Kind of Household Waste (No. 81/2012) and Government Regulations of Marine Pollution and Damage (No. 19/1999).

Government Regulations of Household Waste Management and Kind of Household Waste (No. 81 / 2012) aims to protect public health and environmental quality, prevent accidents and disasters related to the management of household waste and kind of household waste, and support sustainable economic development. These objectives have been set out in government regulations. This regulation also provided a basis for the implementation of waste management in Indonesia, especially in the local area. With the development of this regulation, local governments are also obliged to formulate local rules related to waste management immediately.

Government Regulations of Marine Pollution and Damage (No. 19/1999) established the management of the marine environment, and its natural resources are designed to provide maximum benefits for the well-being of people and the survival of other organisms, both now and in the future. More and more land and sea development activities and the use of the ocean and its natural resources may lead to the pollution and destruction of the marine environment, and ultimately reduce the quality and function of the sea.

The standing of presidential regulation is under government regulation to implement government regulation itself. The presidential regulations that closely related to marine plastic pollution are Presidential Regulation on National Policies and Strategies for Household Waste Management and Kind of Household Waste (No. 97/2017) and Presidential Regulation on Marine Waste Control (No. 83/2018).

On October 23, 2012, to implement the provisions of Article 6 of the government regulations on the management of domestic waste and a kind of household waste (No. 81/2012), the Indonesian government needs to formulate the presidential regulations on national policies and strategies for the management of stairs and similar domestic waste (No. 97/2017). This presidential regulation is the national master plan for the household waste management and kind of household waste, which contains guidelines, policies, strategies, detailed in the waste management program, and national objectives. It includes two policy directions: reduction policy, restriction, recycling, reuse, treatment strategy, classification, collection, transportation, treatment, and final treatment.

Following Presidential Regulation on Marine Waste Control (No. 83/2018) on marine waste management, to deal with marine waste, strategies, programs, and activities are to be coordinated. Measurable and aimed at reducing the quantity of marine waste,

especially the national marine waste management action plan 2018-2025, to reduce marine waste, especially plastic waste. The national action plan is a document that provides planning and guidance to Ministries, communities and stakeholders to accelerate the disposal of marine debris over the eight years 2018-2025.

For the National scale, the last standing of regulations in Indonesia is Minister Regulations that directly follow the Presidential Regulations. In this case, three Minister of Indonesia that have regulations related to marine plastic pollution is Minister of Home Affairs, Minister of Environmental Protection, and Minister of Public Works. There are four Minister Regulations, namely: Minister of Home Affairs Regulations of Waste Management (No. 33/2010); Minister of Environmental Protection Regulations about Guidelines for Implementing Reduce, Reuse, and Recycle through Waste Banks (No. 13/2012); Minister of Environmental Protection Regulations about Guidelines for Materials of Regional Regulation Design about Household Waste Management and Kind of Household Waste (No. 16/2011); Minister of Public Works Regulations about Controlling of Infrastructure and Facilities in Handling of Household Waste and Kind Household Waste (No. 03/2013).

Minister of Home Affairs Regulations of Waste Management (No. 33/2010) became the basis for local governments to manage waste. Under this regulation, the local government has the task of planning and implementing waste management. Planning relates to the reduction and handling of waste as outlined in the strategic plan and annual work plan. In contrast, the implementation refers to the difficulties in waste generation, recycle, and/or reuse of waste.

Minister of Environmental Protection Regulations about Guidelines for Implementing Reduce, Reuse, and Recycle through Waste Banks (No. 13/2012) regulates the management of national waste, promulgated regulations giving priority to the 3R (reduce, reuse, recycle). It also handled about principle and community participation and cooperated with relevant parties, local governments, producers, associations, and stakeholders.

Minister of Environmental Protection Regulations about Guidelines for Materials of Regional Regulation Design about Household Waste Management and Kind of Household Waste (No. 16/2011) aims to guide local governments in the formulation of Draft Local Regulation contents on Household Waste Management and Kind Household Waste. Draft contents contain: rights and obligations, licensing, waste handling, financing and compensation, community role, ban, supervision, and administrative sanctions.

Minister of Public Works Regulations about Controlling of Infrastructure and Facilities in Handling of Household Waste and Kind Household Waste (No. 03/2013) includes general planning, waste treatment, provision of final waste for treatment and treatment facilities and closure/rehabilitation of landfills. The waste specified in the Minister's regulations includes household waste and kind of household waste. It aims to: a. implementation of an effective and efficient waste control; b. expand waste treatment services coverage; c. improve the quality of environment and human health; d. maintain natural resources

from pollution and mitigation of climate change; and e. use waste as a one of energy resource.

3.3 Discussion

Regulations on the management of environmental protection must also be stipulated in the Constitution, as the critical environmental problems and interests caused by development activities will aggravate the damage and pollution to the environment. The regulations in this Constitution will serve as the basis for the following legislation. All of which are from the Green Constitution to be maintained. The Constitution of Indonesia 1945 stipulated in Article 28H (1) that "everyone has the right to a healthy environment." However, this rule is still abstract and unclear.

Law of Environmental Protection and Management (No. 32/2009) sets out general rules on supervision and environmental law enforcement. Also, the general regulations on the management, control and enforcement of waste pollution are set out in the Law of Waste Management (No. 18/2008). These two rules have also been further standardized in the implementation. However, obstacles are often encountered in the development and implementation of these rules. These barriers include inadequate interpretation and understanding of existing rules, legal gaps, and uncertainty about local governments that do not make enforcement rules. At the local government level, regulations often fail to achieve complete success in law enforcement and central government policies.

Without a specific and comprehensive legal system of marine plastic waste pollution, the government's national plan to reduce marine plastic waste pollution to 70% by 2025 will not be realized, because the pollution problem of Indonesia's marine plastic waste is increasingly complex and severe.

One of the essential aspects that restrict the implementation of marine plastic waste pollution control is the imperfect legal regulation system, including supervision. Some problems are not routine supervision, which is the obligation of the government. In addition, there is a lack of information, data, and documentation, also a lack of coordination among agencies in terms of oversight. Another problem is that the support system for marine plastic debris pollution monitoring activities has not been fully developed.

The Indonesian government has set up a national marine waste management coordination group, which is subordinate to and directly responsible for the president. The responsibilities of the national marine waste management coordination group are: to coordinate the activities of central government, local governments, agencies communities and stakeholders in marine waste management activities; to formulate policies to address obstacles and problems in marine waste treatment implementation; and to monitor and evaluate the action plan implementation.

According to presidential regulation No. 83 of 2018 on marine waste management, it clearly states the organizational structure for the disposal of marine waste. The system of the National Coordination Group for marine waste management includes the Minister for the Coordination of Ocean Affairs, Environment and

Forestry, Home and Foreign Affairs, Industry, Finance, Public Works and Housing, Transportation, Health, Education and Culture, Communication and Information, Education, Cooperatives, Small and Medium Enterprises, Tourism, Secretary of Cabinet, and Head of the Sea Security Agency.

In terms of law enforcement, the legal sanctions against the polluters of marine plastic waste, including the individuals and industrial enterprises that have been proved to pollute the environment, are inconsistent. Other problems, such as activities in the ocean, ships, and other debris processing into the sea without follow-up guidance, or even legal sanctions, concessions exist in the implementation of sanctions, so the lack of sanctions on marine plastic waste pollution is one of the problems of law enforcement.

Based on the above problems, we need to improve the legal regulation system of the comprehensive treatment of marine plastic waste pollution. One of the improvements was the development in Indonesia of a special regulation on the control of marine plastic waste pollution. This regulation proposes to revise the management measures for plastic waste, which can make a more comprehensive, coordinated, and practical change in the supervision and law enforcement of marine plastic waste pollution. Because marine plastic waste is an important part of marine waste pollution, perfect regulation is an effective way to solve the environmental pollution problems (including marine plastic waste pollution). Indonesia should gradually improve the legal system of marine plastic waste pollution, which will have specific guiding significance for the management, supervision, and Law enforcement of marine plastic waste pollution^[27].

Due to cross Ministers and agencies, the agenda of controlling marine plastic waste pollution needs to clarify institutional responsibilities. There is a need to include in the scope and mandate of Indonesia's legal regulations on the control of marine plastic waste pollution, and institutional cooperation framework for actions related to marine plastic waste.

Besides the reformation of Indonesia's cross Ministers and agencies, we also suggest to improve the legal regulation and strengthen the legal implementation for marine plastic pollution in Indonesia. Efforts to implement the marine plastic waste law, obviation and repression can be adopted. Preventive law enforcement through supervision and repression is carried out through the implementation of administrative sanctions. Therefore, in law enforcement, there is no need to provide administrative or criminal sanctions directly in the area of waste management. Still, preventive efforts seem to be more effective in implementation. Preventive law enforcement measures are recommended, as this will raise public awareness of the importance of good waste management.

To maximize the use of environmental law enforcement instruments, in particular, the implementation of criminal law, the Minister of environment, the chief of police, and the attorney general signed a joint agreement on the implementation of comprehensive environmental Law on July 26, 2011. The purpose of this MOU is to optimize the application of the "integrated criminal justice system" in the investigation and prosecution of environmental crime cases^[28].

Similarly, to improve the efficiency of law enforcement through the courts, the Ministry of environment and the Supreme Court signed a memorandum of understanding on June 18, 2009, on strengthening the capacity of environmental judges, which was then signed on September 5, 2011, through the Supreme Court Chief Justice environmental judge certification program^[29].

IV. CONCLUSION

Indonesia as an archipelagic country, that most of the country's territory is the sea. The marine plastic waste pollution problem in Indonesia seas is very important to be concerned. This is because marine plastic waste pollution in the sea has negative impacts on ecological, biodiversity, health, and economic aspects in Indonesia.

Efforts to overcome the problem and the impact of marine plastic waste in the sea can be made with regulations. Regulations relating to plastic waste at sea are regulated in various regulations, namely: laws, government regulations, presidential regulations, and Ministerial regulations. Existing regulations only regulate waste in general. From the several regulations, only one regulation is the closest, that is Presidential Regulation on Marine Waste Control (No. 83/2018). However, this presidential regulation regulates marine waste as a whole, not explicitly regulating marine plastic waste.

This study recommends the government to clarify which Minister or agencies that have responsibilities to Indonesia's marine plastic waste pollution because every agency needs to work together. Besides, the need to improve legal regulation and strengthen the legal implementation of marine plastic waste pollution in Indonesia.

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