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Legislation and Policy on Pollution Prevention and the Control of Marine Microplastics

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Abstract: Marine microplastic pollution and plastic pollution are two different things but they are related. In the past 10 years, several countries and regions have issued a ban on microbeads. We analyze the above countries or regions according to three aspects: whether there is special legislation for marine microplastic pollution, the subject of the regulations, and the prevention and control measures. The common feature of the policy documents of these countries is that they target the ban of only microbeads and no other types of microplastics. Based on a comparative study, we found three dilemmas in the regulation of marine microplastic pollution. We conducted a comparative analysis of the legislation or policy documents of the above-mentioned countries and regions in order to identify how they solve the above difficulties. We summarized three legislative and policy regulation models and analyzed their respective advantages. Based on legal theories and empirical methods, some observations and suggestions are made regarding the regulation of primary and secondary microplastic pollution, especially in China's situation.

Keywords: microplastics; microbeads; toxic substance; plastic

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1. Introduction

The new UNEA Resolution, 'End Plastic Pollution: Towards a legally binding instrument', establishes an Intergovernmental Negotiating Committee that will develop the specific content of the new plastic pollution treaty with the aim of completing its work by the end of 2024 [1]. The environmental burden from plastic litter continues to increase globally, posing environmental, economic, and aesthetic issues with complex challenges and impacts [2]. We are not unfamiliar with marine plastic waste pollution. According to the data published in the 2020 China Marine Ecological Environment Bulletin, the main types of marine waste in the monitoring waters of the Yellow Sea, the East China Sea, and the northern South China Sea area in 2020 included wood, paper, glass, rubber, metal, and plastic [3]. Plastic garbage accounts for more than 80% of seabed garbage, beach garbage, and floating garbage. This coincides with the conclusion that 85% of marine garbage is plastic, as noted in the report From Pollution to Solution: a global assessment of marine litter and plastic pollution, which was released by the United Nations Environment Programme (UNEP) [4].

Marine microplastic pollution refers to the pollution of plastic particles that are less than 5 mm in diameter, and these can be divided into primary microplastics and secondary microplastics [5]. Primary microplastics mainly refer to plastic particles that are added to products such as plastic beads in skin-care products [6]. Secondary microplastics mainly refer to plastic particles that are formed by large plastic waste after long-term physical changes and other factors [7]. These mainly come from the decomposition of plastic waste at sea under the action of sunlight, waves, and currents; the input of plastic waste from the land; the discarding of plastic waste from ships at sea; and the discarding of floating devices in aquaculture [8].

Firstly, according to the definition and classification of microplastics, secondary microplastics are mainly produced by physical changes in large plastic waste so plastic waste

is an important cause of secondary microplastics. Primary microplastics mainly come from product additives and they are another independent important cause of microplastic pollution.

Secondly, traditional marine plastic pollution mainly affects large marine organisms, but when plastic degrades and forms microplastics, its particle size is small, its specific surface area is large, its quantity is huge, and its ability to adsorb pollutants in the environment is strong so it is more easily ingested by a variety of marine organisms, thus flowing into the marine biosphere [9]. Microplastics can adsorb bacteria, viruses, or other pollutants (e.g., heavy metals and organic pollutants) [10]. This exposes all marine organisms, from plankton and shellfish to birds, turtles, and mammals, to a serious risk of poisoning, behavioral disorders, hunger, and suffocation.

Thirdly, microplastics can accumulate continuously along the food chain and their harmful effect gradually amplifies, affecting human beings. These particles are present in aquatic environments in high concentrations and may adversely affect aquatic organisms [11]. The accumulation of marine microplastics in organisms will lead to more harmful substances being ingested by humans at the top of the food chain [12]. The health consequences of microplastics (with a size of between 0.1 μm and 5 mm) manifest because these materials can translocate into the circulatory system and accumulate in the human lungs, liver, kidneys, and even brain [13]. A study shows that estuaries are severely affected by microplastic pollution; the accumulation of microplastics and adsorption of contaminants by microplastics could also lead to serious risks besides ingestion; and few technologies can efficiently remove microplastic pollution in sewage treatment plants [14]. Scientists have pointed out that compared with non-degradable "white pollution" plastics, microplastics are more harmful to the environment and human beings. [15].

Therefore, the World Health Organization believes that microplastics may become the source of the next human "epidemic". Fronting the international community, Andrew Forrester, from the Advisory Committee of the Boao Forum for Asia and the founder and chairman of the Australia Fortescue Metals Group, reminded everyone that global plastic waste pollution has become a "must answer" [16] problem. In the face of such serious marine microplastic pollution, identifying how to prevent and control it has become an important issue in national legislation and policies.

Section 2 analyzes the legislation and policy dilemmas of marine microplastic pollution prevention and control in all the countries mentioned. Section 3 summarizes the progress and models of legislation and policy in the prevention and control of microplastic pollution in several typical countries. Section 3 also compares the advantages and disadvantages of the methods adopted by typical countries to solve the above difficulties. Section 4 concludes that based on the phased nature of marine microplastic pollution research, the basis for comprehensive legislation in various countries is not enough. We should make full use of existing international conventions and give full play to the functions of traditional domestic pollution prevention and control legislation. In this process, China should actively explore multi-channel solutions to reduce the generation of microplastic waste and prevent further pollution.

2. Legislation and Policy Dilemma of Marine Microplastic Pollution Prevention and Control

2.1. The Source of Marine Microplastic Pollution Is Extensive, and It Is Difficult to Determine the Subject of Legal Regulations

The subject of the regulation of marine environmental pollution prevention legislation usually regards a specific kind of behavior that causes environmental pollution. For example, in order to prevent pollution damage to the marine environment caused by coastal engineering construction projects, Article 45 of the Marine Environment Protection Law of the People's Republic of China stipulates that it is prohibited to establish new chemical pulp and paper, chemical industry, printing and dyeing, tanning, electroplating, brewing, oil refining, shore flushing and ship dismantling, and other industrial production projects that seriously pollute the marine environment without effective control measures in coastal land areas [17]. Another example is the Convention on the Prevention of Marine

Pollution by Dumping of Wastes and Other Matter 1972 [18], which, in order to prevent and control marine pollution, prohibits the dumping of waste and other substances to achieve the above legal purpose. The convention adopts the means of classification control. A so-called "black- and grey-list" approach is applied for waste, which can be considered for disposal at sea according to the hazard that they present to the environment. For the blacklisted items, dumping is prohibited. The dumping of grey-listed materials requires a special permit from a designated national authority under strict control provided that certain conditions are met. All other materials and substances can be dumped after a general permit has been issued [19]. Durable plastics, such as fishing nets and ropes, are on the blacklist to prohibit their dumping. Although this measure cannot solve all pollution problems, it is at least a practical and specific scheme.

Logically speaking, the behavior that causes pollution is the subject of the regulation of environmental pollution prevention and control legislation. Based on this, the rights, obligations, and responsibilities of the relevant subjects are established. Marine microplastic pollution is a phenomenon caused by specific pollutants rather than a specific behavior regulated by law. Every law against marine pollution develops from the preparatory work of science [20]. The premise of preventing and controlling marine microplastic pollution is to clarify the pollution behavior, pollution mechanism, and pollution source, and the current scientific research results have not reached such a level.

The primary microplastics are synthetic or semi-synthetic microscopic polymers, mostly including microbeads added to cleaning agents, e.g., toothpaste, and cosmetic products such as face powders or foundations [21]. Therefore, the legislation in various countries at this stage mainly focuses on measures such as prohibiting the addition of microbeads to related products and prohibiting the sales, import, and export of such products. For example, the Microbead-Free Waters Act of 2015 in the United States prohibited the production of washing cosmetics with microbeads from 1 July 2017. For rinse-off cosmetics that are also non-prescription drugs, the deadline was 1 July 2018 to stop manufacturing the products described in the law. The deadline was 1 July 2019 to stop the introduction or delivery for the introduction of these products into interstate commerce [22]. The pollution caused by secondary microplastics is even more serious. The sources of secondary microplastics include land-based garbage, marine production, and operational activities [23]. Given the large amount of microplastics entering the environment, it is generally assumed that most microplastics in the environment are secondary microplastics [24]. The universality of the source makes the relevant legislation on secondary microplastic pollution more difficult.

2.2. Prevention and Control Legislation of Marine Microplastics Will Be Challenged by Industries and There May Be Contradictions between Economic Development and Pollution Control

Microbeads are a type of primary microplastic and they are an important source of primary microplastic pollution according to existing research. Microbeads do not undergo biodegradation, photodegradation, or thermal degradation, and their half-life can be as long as hundreds of years [25]. They lead to water pollution and soil pollution and ultimately affect human health and the ecological balance. Microbeads were added to toothpaste and soap as a substitute for natural exfoliating agents by the industry in the mid-1990s. Around 2012, because scientists discovered their pollution characteristics and potential harm, various countries began to gradually ban the use of microbeads in cosmetics. As an important filler and thickener in toiletries, microbeads are widely used in sunscreen, liquid foundation, toothpaste, eyeshadow, and other products that people use in their daily lives [26]. It is difficult to differentiate and quantify microbeads in the environment. It is estimated that the use of polyethylene microbeads in liquid soap alone resulted in the consumption of 2.4 mg of polyethylene microbeads per person per day, thereby emitting a total of 263 tons per year of polyethylene microbeads in the United States from liquid soap use [27].

The use of microbeads has brought great economic benefits to industries and has also provided a certain convenience to people's lives. Banning the use of microbeads will

inevitably force the relevant industries to use alternative products. The use of alternative compounds, the adjustment of production technologies, the tables in the operation line, etc., will inevitably lead to increases in product costs, increases in consumer purchase costs, and other consequences. If legislation or policies further affect the interests of practitioners, the formulation and application of such legislation or policies will inevitably be obstructed by the industry, and the promotion of legislation in certain countries has also proved this. Marine economic growth has had an impact on changing the marine environment and this cannot be ignored. The effect of this impact is not a simple linear relationship but varies due to the different marine industrial structures [28]. Traditionally, under the polluter pays principle, each individual (or more generally, society) has the right to a clean environment and must be paid or compensated to give up that right [29]. However, the damage to the ecological environment cannot be compensated for with money and citizens' environmental rights should not be traded for money. Identifying how to balance economic development and environmental pollution prevention and control will be difficult for legislators.

2.3. Cross-Border Pollution Caused by Marine Liquidity Urgently Needs International Cooperation

The fluidity of the ocean will inevitably lead to cross-border marine microplastic pollution. Cross-border pollution prevention and control is by no means a problem that can be solved by a single country; it requires the cooperation and common governance of all countries. However, due to the large differences in the levels of economic development of various countries and the uneven nature of technologies, such as environmental pollution monitoring, prevention, and control, as well as differences in the systems of policies and regulations, the enthusiasm and willingness of the people, industries, and governments of various countries to participate will inevitably hinder international cooperation. At present, marine microplastic pollution is spreading all over the world. The limitations of the treatment effects of individual countries' measures are another dilemma of marine microplastic pollution prevention and control.

3. Progress and Models of Legislation and Policy in the Prevention and Control of Microplastic Pollution

As microplastic pollution is a new type of problem accompanied by developments in science and technology, the legislation of various countries is currently in the testing stages. Identifying the legal means that can be used to prevent and control marine microplastic pollution has become a worldwide problem.

3.1. National Legislation and Policy

The United States passed the *Microbead-Free Waters Act of 2015*. In 2016, Canada formally recognized plastic beads as toxic substances under its *Environmental Protection Act* [30]. The New Zealand government also banned the addition of microbeads to personal-care products from 1 July 2018. Although New Zealand consumes fewer personal-care products containing microbeads than other countries, New Zealand banned them considering their environmental impact and the international image of the New Zealand government [31]. Decree No. 2017-291 of 6 March 2017, prohibiting the placing on the market of rinse-off cosmetic products for exfoliation or cleansers that contain solid plastic particles, was published in the *Official Journal of the French Republic* on 8 March 2017 [32]. According to statistics, from 2012 to 2015, the European Association of Industry spontaneously took measures to reduce the production and use of washing products containing synthetic solid particles, reducing the amount of microbeads in such products by 82% [33]. Thailand's Ministry of Public Health announced on 24 December 2019 that Thailand would formally ban the import, production, and sale of cosmetics containing microbeads. The ban took effect on 1 January 2020. In 2020, Ireland became the first EU country to ban the use of microbeads in household and industrial cleaners. The scope of products prohibited is no longer limited to rinse-off cosmetic products. The main measures taken by the mentioned countries and regions are listed in Table 1.

Table 1. National legislation or ban on marine microplastic substances.

Country or Region	Year	Measures
United States	2015	Banned the production and sale of cleansing cosmetics with plastic beads in the United States at the federal level (*Microbead-Free Waters Act of 2015*).
Canada	2016	Recognized plastic beads as toxic substances (*Environmental Protection Act*).
The United Kingdom	2017	Banned cosmetics and cleaning products containing plastic beads.
New Zealand	2018	Banned the addition of plastic beads to personal-care products.
Northern Ireland	2018	Prohibited the use of plastic beads (*The Environmental Protection* (*microbeads*) (*Northern Ireland*) *Regulations 2018*).
France	2018	Banned products containing plastic particles.
Thailand	2019	Banned the import, production, and sale of cosmetics containing plastic beads.
Ireland	2020	Banned the use of plastic beads in households and industrial cleaners.

It can be clearly seen that the above countries and regions mainly focus on microbeads in exfoliating products and that they have not taken effective measures for all microbeads in cosmetics and other products [34]. At the same time, because the research on the mechanisms of microplastic pollution is only in the initial stages, all of the above-mentioned national legislations only take measures against microbeads that cause microplastic pollution, and prevention and control programs have not been formulated for other pollution behaviors and substances.

3.2. Three Models of Legislation and Policy

Some countries and regions have formulated a series of legislative and policy measures against marine primary microplastic pollution in the past 10 years. Based on their formulation of technologies and strategies, the approaches of the above measures can be divided into three models.

3.2.1. Model 1: Add or Delete Provisions on the Basis of Existing Laws and Give a Negative Evaluation on the Addition, Production, Sale, and Introduction of Products Containing Microbeads

A typical representative of this model is the U.S. Microbead-Free Waters Act of 2015. In recent years, the United States has carried out monitoring and studies on microplastic pollution in the freshwater system of the Great Lakes. Microplastic pollution has also attracted the attention of the public, state governments, and the federal government [35]. Before 2013, the United States had no relevant legislative measures specifically aimed at microplastic pollution, but in the years after 2013, the United States successively formulated relevant legislation for microplastic pollution such as those in New York and Illinois.

By 2015, more than half of the states in the United States had enacted relevant legislation, which directly promoted the legislative process of the federal government for microplastic prevention and control. In December 2015, the U.S. Congress passed the Microbead-Free Waters Act of 2015, which officially banned the production and sale of cleaning cosmetics with microbeads in the United States at the federal level.

The legislative method of this act in the United States was to add a special provision for microbeads at the end of Article 301 of the Federal Food, Drug, and Cosmetic Act, which included the prohibition of adding microbeads to related products and the prohibition of the production, sale, import, and export of such products. The advantage of this legislative method was that, without making a large-scale amendment to existing laws, the addition,

deletion, and other methods based on existing laws gave a negative evaluation of the behavior of adding, producing, selling, and introducing products containing microbeads. If relatively new types of primary microplastics are found in future developments in science and technology, they can also be regulated in this way.

3.2.2. Model 2: Microbeads Are Directly Identified as "Toxic Substances", and the Provisions on "Toxic Substances" in the Environmental Protection Legal System Are Applicable to Regulate Relevant Behaviors

A typical representative of this model is Canada. In 2014, about 100,000 kg of microbeads were included in detergents and exfoliating products in Canada, and about 10,000 kg of microbeads were included in domestic personal skin-care products. The severity of microplastic pollution led the Canadian government to take a series of remediation measures. In 2016, the Canadian government identified microbeads with a size of 5 mm or less as "toxic substances" under the Canadian Environmental Protection Act 1999. The production or import of microbeads was prohibited from 1 January 2018, and the sale of products with microbeads was prohibited from 1 July 2018. The production and import of natural health products and over-the-counter drugs containing microbeads were prohibited from 1 July 2018 and 1 July 2019, respectively [36].

The Canadian government identified microbeads as "toxic substances" for control purposes and its legislative approach was to introduce new pollutants and pollution phenomena into the provisions of the existing legal system under "toxic substances" and use the existing measures of "toxic substances" to regulate and control them. The advantage of this method was that it could regulate and control new pollutants and solve emerging pollution phenomena without large-scale amendments to existing legislation. At the same time, it could avoid the obstruction of the industry to a certain extent and use the existing "toxic substances" prevention and control system to control the pollution of microplastics. With the deepening of research, scientists have discovered many types of microplastics, and have a greater understanding of their circulation and toxicity [37]. These microplastics also absorb toxic chemicals linked with various diseases and thus through ingestion, these chemicals are released and ingested by fish and mammals [38]. Sometimes, for nanomaterials and microplastics, it is not so much the substances themselves that are toxic but the forms in which they appear. That is the problem with the Canadian legislation.

3.2.3. Model 3: Guide the Development of the Industry through Policy Documents and Give a Negative Evaluation of the Addition, Production, and Sale of Microbeads

A typical representative of this model is China. In 2017, the National Department of Ecology and Environment added microbead additives, as well as cosmetics and chemicals that contain microbeads, to the list of high pollution and high environmental risks [39]. *The Guiding Catalogue of Industrial Structure Adjustment* (2019 Edition) issued by the National Development and Reform Commission on 30 October 2019 has been formally implemented since 1 January 2020, among which the third category of elimination stipulates that "the production of daily chemical products containing plastic beads shall be prohibited by 31 December 2020, and sales shall be prohibited by 31 December 2022" [40]. This regulation became the Chinese version of the ban on microbeads. In March 2020, the State Administration for Market Regulation and the China National Standardization Administration issued *the Standard for the Determination of Microbeads in Cosmetics* (Draft for Comments), which explained the definition, testing standards, and methods for the production of microbeads [41]. On 10 July 2020, nine ministries and commissions, including the National Development and Reform Commission, issued the *Notice on Solid Promotion of Plastic Pollution Control* [42]. Not only does the notice propose specific requirements for the overall prevention and control of plastic pollution but it also ensures the completion of the objectives and tasks of plastic pollution control in various stages as scheduled. In the annex of the notice, the detailed standards for daily chemical products containing microbeads at the present stage were also specified; that is, the following was added: "in order to play the role of sanding, exfoliating and cleaning, washing cosmetics (such as bath agents, facial cleansers, sanding cream,

shampoo, etc.) with solid plastic particles with particle size less than 5 mm, toothpaste and tooth powder". To date, the basic elements needed to implement the "ban on microbeads" have been clearly defined. The implementation of the above requirements is bound to be difficult, which requires the support of supporting regulatory measures and legislation.

To date, China has not issued laws specifically for the prevention and control of microplastic pollution besides the ban on microbeads. In the process of implementing *the Basel Convention* on the control of the transboundary movements of hazardous waste and its disposal, many laws have been promulgated in China. The main laws and regulations related to marine environment pollution are listed in Table 2.

Table 2. Laws and regulations related to marine environmental pollution.

Documents	Main Purposes
Marine Environmental Protection Law of the People's Republic of China 《中华人民共和国海洋环境保护法》	The purpose of this law is to prevent and control pollution damage to the marine environment caused by land-based pollutants, coastal engineering construction projects, marine engineering construction projects, dumping waste, ships, and related operations.
The Regulations Concerning the Prevention and Cure of Pollution Damage of Marine Environment by Pollutants from Land 《中华人民共和国防治陆源污染物污染损害海洋环境管理条例》	This is formulated in accordance with the *Marine Environment Protection Law of the People's Republic of China* to strengthen the supervision and management of land-based pollution sources and prevent land-based pollution from damaging the marine environment. It is applicable to all units and individuals discharging land-based pollutants into the sea within the territory of the People's Republic of China.
Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste 《中华人民共和国固体废物污染环境防治法》	The purpose of this law is to prevent solid waste from polluting the environment. By reducing the generation of solid waste, making full and reasonable use of solid waste, and ensuring the harmless disposal of solid waste, this law aims to prevent and control environmental pollution by solid waste.
Regulations of the People's Republic of China on the Prevention of Vessel-Induced Sea Pollution 《防治船舶污染海洋环境管理条例》	This regulation is designed to prevent sea pollution by ships. All vessels in the sea areas and harbors under the jurisdiction of the People's Republic of China shall in no case discharge oils, oil-based mixtures, waste materials, or other toxic substances in violation of the stipulations of the *Marine Environmental Protection Law of the People's Republic of China* and these regulations.
The Guiding Catalogue of Industrial Structure Adjustment (2019 Edition) 《产业结构调整指导目录（**2019**年本）》	This bans the production of daily-use chemical products containing plastic beads.
The standard for the Determination of Microbeads in Cosmetics 《化妆品中塑料微珠的测定》	This specifies the definition, testing standards, and methods of production for microbeads.
Notice on Solid Promotion of Plastic Pollution Control 《关于扎实推进塑料污染治理工作的通知》	This specifies the detailed standards for daily-use chemical products containing plastic beads.

These laws are roughly divided into two aspects: domestic waste management and the prohibition of "foreign garbage" imports. The main purposes of these laws are to actively

carry out international cooperation, strengthen the management of garbage imports and exports, and crack down on the illegal transfer of waste. In order to better carry out relevant training and strategic research, the Ministry of Environmental Protection and Tsinghua University jointly established the Asia Pacific Regional Center. In terms of organizational structure, China has formed a waste import and export management pattern in which the Ministry of Environmental Protection oversees and jointly enforces the law with inspection, quarantine, and customs departments. At the same time, the Ministry of Environmental Protection and the Hong Kong Environmental Program jointly regulate the waste transfer activities between Hong Kong and the mainland.

The implementation of laws and regulations on marine environmental pollution has formed the legal system of waste pollution. For example, the Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste [43] provides comprehensive provisions for solid waste management. A large number of administrative regulations, departmental rules, and technical guidelines formulated for different wastes in China further refined the law and together constitute the legal system of solid waste management in China.

To further improve the prevention and treatment levels of various key solid waste pollution phenomena in various ways, in 2008 and 2020, The National Hazardous Waste List was revised to make the management more scientific and precise; the Internet of Things and big data were introduced to make the supervision of hazardous waste more timely. A large amount of money has been invested in the construction of facilities, perfecting the collection and transportation system of domestic waste. A number of treatment programs were formulated to treat many types of key agricultural waste such as plastic film. This further enhanced the standardization of the industrial solid waste utilization industry and strived to increase its scale.

From 2013 to 2020, the Chinese government continued to strengthen law enforcement and judicial work. China investigated and cracked down on more than 10,000 related cases and managed 48 waste plastic distribution centers and 15,000 medical and health institutions. The relevant judicial interpretation has been revised to make the conviction standards of environmental pollution by solid waste clearer.

4. Legislation and Policy Suggestions on the Prevention and Control of Microplastic Pollution

4.1. Make Full Use of the Existing International Cooperation Framework to Carry out Marine Microplastic Pollution Prevention and Control

In view of the similarity between marine microplastic pollution and chlorofluorocarbon pollution, some scholars have suggested establishing documents and mechanisms similar to the Montreal Protocol for substances that deplete the ozone layer at the international level [44]. In the middle and late stages of marine microplastic prevention and control, unified international legislation and mechanisms are important measures, but it is conceivable that it is difficult to form a similar international mechanism in the early stages. In the initial prevention and control stages, the most effective and convenient method is to maximize the use of existing international cooperation frameworks to carry out microplastic pollution prevention and control.

First, the United Nations Convention on the Law of the Sea (hereinafter UNLOSC) [45] establishes a basic cooperation framework for marine pollution prevention and control. The UNLOSC stipulates that all ratifying states have a general "obligation" to protect and preserve the marine environment. Part XII of the UNLOSC specifically deals with marine protection and preservation and obliges states to use "the best practical means at their disposal" to prevent, reduce, and control marine pollution from any source in accordance with the convention. In Part XII of the UNLOSC, an additional clause stipulates this obligation to avoid polluting the marine environment of other countries and transforming one kind of pollution into another. Article 207 of the UNLOSC deals with the prevention and control of land-based pollution. Articles 213 and 222 encourage state parties to abide by the provisions of the convention and formulate applicable international rules and

standards for the prevention, reduction, and control of land-based pollution of the marine environment. In theory, the UNLOSC stipulates that all countries have the obligation to implement their laws restricting the discharge of plastics into the marine environment. Of course, due to the lack of implementation of the regulations and standards in the UNLOSC, as well as the lack of a framework for "harmful substances", whether marine microplastics can become regulated objects under the convention needs to be determined.

Paragraph 2 of Article 194 of the UNLOSC prohibits one country from polluting or damaging the environment of another country. In view of the inherent multinational nature of the ocean polluted by microplastics and the fact that plastic easily crosses ocean boundaries due to ocean currents, this article is more likely to force states to control microbeads. However, according to paragraph 2 of Article 194, the certificate of origin may become a complex factor in the control of marine microplastics. Firstly, it is very difficult for existing technology to distinguish the source industry and the country of origin of microbeads. Secondly, it is also difficult for current technologies to distinguish between primary microplastics (microbeads) and secondary microplastics. If the affected countries identify microplastic pollution as the source of environmental degradation in accordance with Article 194, paragraph 2, there are few ways to distinguish between the sources of these two kinds of microplastics and determine whether the source of pollution is due to a country's microbeads or due to the decomposition of plastics already in the sea. Different sources could lead to different applicable specifications.

In addition to the UNLOSC, the 1972 London Convention, 73/78 MARPOL convention, Basel Convention, and Stockholm Convention play a positive role in the prevention and control of marine microplastics from different perspectives. Maximizing the use of existing international cooperation agreements is an important and feasible measure in the early stages of marine microplastic pollution prevention and control.

4.2. In the Initial Stages of Domestic Prevention and Control, We Should Continue to Adopt Policy Guidance, and Future Legislation Should Adopt the Methods of "Introduction" and "Transformation"

In view of China's national conditions and the division of department responsibilities, in the initial stages of marine microplastic pollution prevention and control, it is advisable to continue to use policy guidance to carry out marine microplastic pollution prevention and control from the perspective of industry guidance and control. In the medium- and long-term prevention and control of marine microplastic pollution, based on accumulated experience, we are attempting to further control behaviors related to marine microplastic pollution by law. Before the introduction of special legislation for the prevention and control of marine microplastic pollution, it is appropriate to adopt the methods of "introduction" and "transformation" to achieve legislative control.

Firstly, direct legislation for primary microplastics using the "introduction" method is explained. "Introduction" refers to the characterization of substances that cause marine microplastic pollution into the types of pollutants that have been established in domestic legislation, as well as the use of legislation to regulate the established control system for such pollutants. For example, Canada defines plastic particles as "toxic substances" under environmental protection laws and introduced new pollutants into the existing legislative pollutant control system. At present, China has a ban on microbeads but there is no direct legislation on them. In order to better prevent and control the pollution of primary microplastics, it is necessary for China to directly legislate against the pollution of primary microplastics in the future. China banned the production of daily chemical products with microbeads on 31 December 2020 and will ban the sale of daily chemical products containing microbeads from 31 December 2022. However, after comparison, it is not difficult to see that the current ban in China, which is similar to that in most countries around the world, is mainly aimed at microbeads in cosmetics. The current regulation scope is obviously too narrow. China should follow the examples of New Zealand and Ireland and expand the regulation objects to industrial cleaning agents and other more technical levels where products that replace microbeads have been produced.

In the current legislative system related to marine environmental protection in China, there are the following concepts: "pollutants", "pollutants in the environment", "pollutants that should be prevented and controlled", "land-based pollutants", "water pollutants", and "toxic pollutants". According to Article 42 of the Environmental Protection Law of the People's Republic of China [46], enterprises, institutions, and other producers and operators that discharge pollutants must take measures to prevent and control the pollution and harm to the environment caused by waste gas, wastewater, etc., which are generated by production, construction, and other activities. Microbeads obviously have the properties of pollutants.

According to the Chapter X Supplementary Provisions of the Marine Environment Protection Law of the People's Republic of China, land-sourced pollutants refer to pollutants discharged from land-based sources [47]. According to Article 102 of the Law of the People's Republic of China on the Prevention and Control of Water Pollution, water pollutants refer to substances that cause water pollution that is directly or indirectly discharged into water bodies. Toxic pollutants refer to pollutants that cause disease, abnormal behaviors, genetic variations, physiological dysfunctions, body deformations, or the death of an organism or its descendants after being directly or indirectly ingested into the body [48]. Some microbeads come from land-based pollutants and some microbeads are water pollutants and the characteristics of the damage caused by the long-term accumulation of microbeads also indicate toxic pollutants. However, the existing legislation related to the above pollutants in China is scattered across various laws and fully covers neither the characteristics of microbeads nor the types of primary microplastics that may be identified in the future. Therefore, in future legislation, not only should we introduce microbeads into the existing legislative pollutant system but we should also consider how to revise this system, which is targeted and covers other types of primary microplastics that may be identified in the future. In the context of the overall management of the marine ecological environment on land and sea, we should consider the particularities of the marine ecological environment and China's marine environmental management system, which should be connected with the relevant provisions of the Environmental Protection Law, the Civil Procedure Law, and the Civil Code.

Secondly, the prevention and control of secondary microplastics have "transformed" into the prevention and control of land-based pollution. Microplastics are found in the environment as a result of human activities both on land and in various water bodies; the major source of plastic pollution is land, from where 80% of the plastic originates [49]. According to existing research results, secondary microplastics mainly originate from the decomposition of marine plastic waste under the action of sunlight, wind waves, and ocean currents; the input of land-based plastic waste; the discarding of plastic waste from marine vessels; and the discarding of floating devices in aquaculture. Although there are not many policies related to microplastics in China at present, this does not mean that we do not have a management system for microplastics. China has established a relatively complete legislative and policy system for the management of solid waste and dangerous substances. For example, in response to solid waste pollution, our country promulgated the Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste in 1995 [50]. In terms of hazardous waste, there are the "management measures for hazardous waste transfer receipt", etc. These policies and legislation involve the management of the generation, transportation, and disposal of solid waste and hazardous substances, as well as the monitoring of landfills. Microplastics are a newly discovered problem in science and it usually takes some time from discovery to management. All countries around the world are currently in the stages of exploration and research. However, plastic is a form of solid waste and our country has many control measures for solid waste. Most of the floating garbage and marine microplastics come from land, and ship emissions account for only a small fraction. Therefore, the problems of marine floating garbage and marine secondary microplastics can actually be "transformed" into the management of land-based waste. Land source management involves the salvaging of garbage in rivers,

agricultural non-point source pollution control, urban surface runoff pollution control, etc. If we manage traditional agricultural garbage, industrial garbage, river garbage, and urban garbage well, the garbage entering the sea can be effectively controlled. That is, the problems of marine floating garbage and marine secondary microplastics could be solved to a certain extent by perfecting and strengthening the implementation of existing laws and policies. Formulating new laws and policies is not the only way to prevent and control marine microplastics.

4.3. Local Governments Should Make the Initial Attempt with the Government as the Main Body and Producers, Consumers, and Other Entities Participating

In view of the difficulties of marine microplastic pollution prevention and control, legislation and policy must be a long-term project. In the early stages of marine microplastic pollution prevention and control, the problems encountered in the implementation of the measures, and the specific effects that can be achieved, there are still many uncertainties. We can learn from the legislative process of the United States by first rolling out local legislation and policy control and considering unified legislative control at the national level when the time is appropriate based on accumulated experience. In terms of a local pilot selection, Hainan Island, Shenzhen, and other regions could be considered. Hainan is building a free trade port. The introduction of relevant legislation or policies on marine environmental governance will help to enhance the international image of Hainan's free trade port and it is easy to control the effectiveness of legislation and policies. As a special economic zone in China, Shenzhen has a relatively mature political, economic, and cultural environment. From the perspective of environmental legislation, it can also become a national experimental field and a pioneer in the prevention and control of marine microplastic pollution. The prevention and control of marine microplastic pollution require the joint participation of the government, industry, and consumers. The ocean is a public resource for humankind and the government, which the public trusts, must bear the responsibility of pollution prevention and control [51]. That is, the prevention and control of marine microplastic pollution is part of the responsibility of the government. Without effective measures, the government is inefficient. As the main source of product design and manufacturing, producers are also the source of pollution. Identifying how to build an accountability system for producers is an important part of marine microplastic pollution prevention and control. In this regard, based on the existing legislative experience of various countries, the extended producer accountability system [52] is one of the more important control methods and it should be adopted in China's marine microplastic pollution prevention and control legislation and policies in the future. As an important participant in the legislation and policies of marine microplastic pollution prevention and control, the degree of participation and cooperation of consumers determines the actual effect of the above legislation and policies. Identifying how to popularize the information related to microplastic pollution prevention and control and identifying how to mobilize the enthusiasm of consumers are other important issues that legislators need to consider. Legislators and policymakers should follow consumer habits and popularize information related to pollution prevention and the control of marine microplastics.

5. Conclusions

Microplastics are almost everywhere in our daily lives. A steady increase in marine litter has been estimated by scholars and scientific data [53]. Marine microplastic pollution has reached a point where it cannot be ignored. Whether in coastal areas or the deep sea, the pollution situation has become serious and marine organisms and human beings are directly and indirectly affected. It is imperative to prevent and control marine microplastic pollution by rolling out legislation. The legislation of each country is mainly aimed at primary measures for controlling the original types of microplastics. Identifying how to comprehensively prevent and control marine microplastic pollution through legislation is a problem that needs to be solved in the next stages. At present, there are still many

obstacles in the legislation for the prevention of marine microplastic pollution. Only on the basis of solving the above obstacles can comprehensive legislation be possible. Marine microplastic pollution is a global problem, not the problem of a single country or an individual. Therefore, the in-depth cooperation of countries around the world is the basis of the effective prevention and control of marine microplastic pollution.

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