

# Study on Pollution Countermeasures of Microplastics of Sewage Plant in China

Xueqin Wang\*

*Institute of Intelligent Manufacturing Engineering, Chongqing College of Architecture and Technology, Chongqing, 400044, China*

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**Abstract:** Microplastics refers to plastic particles with a diameter of less than 5mm. Due to their characteristics of large dosage, small particle size, easy to absorb pollutants, large surface area, weak hydrolysis capacity, difficult degradation, easy transmission in the food chain, microplastics has become a persistent organic pollutant that poses a major threat to human health and ecosystem. Although the existing sewage treatment plants in China have a relatively high removal rate of microplastics, they just simply transfers microplastics from sewage to sludge, and do not really degrade microplastics. So the sewage plant is an important source of microplastics into the environment. Based on the summary of the microplastics pollution and treatment of the sewage plant, this paper proposes the targeted countermeasures for the pollution control of microplastics and the depth treatment of microplastics in the sewage plant. It provides the basis for the pollution control and the depth treatment of microplastics in sewage plants.

## 1 INTRODUCTION

Microplastics are plastic particles less than 5mm in diameter through various ways into the ecological environment. (Eerkes-Medrano, 2015; Reecm, 2014) Studies has shown that microplastics are widely found in water ecosystems, soils and sediments and even in drinking water, human feces and polar environments. Microplastics have the characteristics of large dosage, small particle size, large specific surface area, easy to adsorbed pollutants, weak photolysis capacity, difficult degradation, and are a potential persistent organic pollutant. Moreover, microplastics are easily eaten by organisms of different nutritional levels in the environment, so that they are transmitted and enriched in the food chain. Microplastics enter into the body primarily through the respiratory tract, digestive tract and skin, and are toxic to the corresponding tissues and organs through particle internalization or migration. Microplastics through physical damage, causing intestinal flora imbalance, change enzyme activity, activation of immune cells, cause oxidative stress and interference with endogenous hormones on the body's digestive, nerve, respiratory, immune, reproductive endocrine

system toxic effects, and even may even lead to genetic lesions, cancer and other acute and chronic diseases. Therefore, microplastics have more serious impact on human health and ecosystem than large plastics. (Barnes, 2009) It is a widely distributed, environmental toxicity and biotoxic pollutant.

## 2 CURRENT STATUS OF MICROPLASTIC POLLUTION AND TREATMENT IN SEWAGE PLANT

### 2.1 Current Pollution Status of Microplastics in The Sewage Plant

The microplastics detected in sewage treatment plants in different regions and cities in China show different types and rules, but the main components of the microplastics are polyester, polystyrene, polypropylene, polypolyethylene, polyamide, polyester, etc., and the shape composition is mainly fiber, rod, film, thin sheet and other. (Long, 2019) Li et al. studied 28 sewage treatment plants in China, and found that the content of sludge

microplastics was  $1.6 \times 10^3$ - $56.4 \times 10^3$  / (kg dry sludge), and the average content of microplastics was  $22.7 \times 10^3$  / (kg dry sludge). (Li, 2018)

In terms of source, the microplastics in the sewage plants mainly include primary microplastics and secondary microplastics. The primary microplastics in urban sewage mainly come from personal hygiene washing products (such as facial washing milk, shower gel and other products), chemical fiber clothing, car tires, etc. The Secondary microplastics are plastics used in production and human life and released into the environment or are produced by continuous decomposition and crushing during sewage treatment. The world produces more than 3 00 million tons of plastic every year, and China's plastics production exceeded 75 million tons in 2017. (China Plastic Processing Industry Association, 2018) Due to the low reuse rate of plastic products, the production of plastic waste increases rapidly. This also leads to the increasing amount of secondary microplastics in the environment.

## 2.2 Current Treatment of Microplastics in Sewage Plant

First, the relevant regulations and control standards of microplastics are not in place. Up to now, China has issued the Notice on The Restricted Production and Sale of The Use of Plastic Shopping Bags, Regulations on the Prevention and Control of Pollution in the Processing and Utilization of Waste Plastics, Implementation Plan for banning the Entry of Foreign Waste and Promoting the Reform of the Solid Waste Import Management System and Express Packaging Supplies and other regulations and standards. This provides some guarantee for the management, recycling and disposal of waste plastics, but the relevant regulations and standards of microplastics are still very lacking, resulting in a large number of primary microplastics and secondary microplastics to eventually enter the sewage plant.

Secondly, the whole process management of microplastics is not in place. In the production process of some products, the unlimited addition of plastic micro beads leads to the large use and discharge of microplastics at the source. Microplastics are not properly treated in trade, use, recycling and disposal, and some microplastics are released into the environment and eventually entered into the sewage plant. For example, in 2017, the General Office of the State Council issued the

Implementation Plan for Banning the Entry of Foreign Waste into the Reform and Promoting the Import of Solid Waste. According to the plan, China before the end of 2017 banned the import of waste plastics from domestic sources. (Kou, 2018; Xinhua News Agency, 2018) This will play a positive role in controlling the plastic waste pollution in China, and will also help the world strengthen the treatment and recycling of plastic waste and reduce plastic waste production; (Verena, 2018) but the cross-border transfer of plastic waste can not be fully controlled.

Finally, the existing sewage plants in China do not have a special microplastics treatment technology. Although the sewage treatment process has a high removal effect on microplastics, reaching more than 90%, which is of great significance for reducing the discharge of microplastics into natural water bodies with water discharge. However, due to the large amount of domestic sewage discharge, a large number of microplastics are still discharged into the water through the sewage treatment plant. Sewage plant is an important source of microplastics into the environment. (Ziajahromi, 2016) At the same time, the existing sewage plants remove microplastics by settlement, adsorption, trap, interception, etc. These removal methods only make microplastics simply transfer from wastewater to sludge, (Nizzetto, 2016) making the sludge of the municipal sewage plant enrich about 90%-98% of microplastics. (Fendall, 2009) If the microplastics in sewage plants and sludge are not treated in depth, it will lead to microplastics to enter the environment again, causing secondary pollution of microplastics.

## 3 POLLUTION COUNTERMEASURES OF MICROPLASTICS IN THE SEWAGE PLANT

### 3.1 Source Control to Reduce Microplastic Emissions

Like many other pollutants, once formed, its treatment difficulty and disposal cost will improve, and the treatment efficiency will also be limited by the technology. Therefore, we can formulate industry standards through the relevant departments, so as to greatly reduce the use and emissions of microplastics. For example, the implementation of more dense filter for the drainage of washing machines, use plastic substitutes and other methods

as far as possible to gradually reduce the use of plastic daily necessities, gradually control the total amount of micro plastics into the environment, Expanding public participation and promoting the public to consciously reduce the use of plastic materials and microplastics. This is also the current source control method for some European and American countries to reduce plastic pollution.

It is also very important to raise the whole social awareness of the pollution hazards of microplastics to consciously reduce the use of plastic materials and microplastics. At present, China's attention to micro plastic pollution and its ecological effects is still limited to the scientific research level, and the public has little or not realize the possible ecological harm caused by microplastics. Therefore, various forms of environmental science popularization and publicity and education activities should be widely carried out in schools, public places, enterprises and institutions and government departments, improve public awareness, further enhance the green lifestyle of people use plastic as little as possible, improve the recycling rate of plastic garbage, and form an atmosphere to reduce the use of native micro plastics in the whole society.

### **3.2 Developing Treatment Techniques of Sewage and Sludge for Microplastics**

First, strengthen the research on the water environment microplastics, to understand the migration and transformation mechanism. New environmental materials for treating microplastics are studied to achieve the removal of microplastics in each water environment. Study new adsorption, filtration and other materials to reduce the amount of entry into the sewage treatment plant.

Secondly, develop a sewage treatment technology for microplastics. At present, China's sewage treatment plants have not specialized pollution treatment technology for microplastics, the microplastic removal rate of ordinary sewage plants is not high enough, and the existing sewage treatment process is simply to transfer microplastic to sludge, and there is no real degradation of microplastics. Specialized removal microplastic technology suitable for China's national conditions and water quality still needs to be further studied and developed to reduce the concentration of microplastics in the Reduce the concentration of microplastics in the effluent of plant.

Finally, a sludge treatment process for microplastics is developed. The microplastics in the

sewage will eventually go to the sludge. Sludge treatment technology of biodegradable microplastics will need to be developed to avoid improper disposal of sludge leading to microplastics again entering the environment.

### **3.3 Improving The Relevant Laws and Standards for The Prevention and Control of Microplastic Pollution**

The existing laws and regulations and standards in microplastics control cannot meet the requirements of microplastics pollution control. On the basis of the existing laws and regulations, we should establish and improve the laws and regulations as soon as possible, and strengthen the enforceability and timeliness of the laws and regulations and relevant standards.

First, formulate and improve laws, regulations and standards for the prevention and control of primary microplastics, and formulate laws, regulations and standards related to the production, import and use of washing and protective products containing microplastics. Secondly, improve the laws and regulations on the prevention and control of plastic waste pollution, and formulate regulations and standards on the recycling and treatment of plastic waste. Clarify the responsibilities of all government departments in the production, use, recycling and treatment of plastics, and avoid secondary microplastics into the environment. Finally, the pollution discharge standards of industrial sewage and microplastics in the sewage treatment plants should be formulated, and the detailed rules for illegal acts and corresponding economic and administrative punishment measures should be clearly stipulated to control the discharge of microplastics to cause secondary pollution to the environment.

### **3.4 Strengthen The Whole Process Management of Microplastic Pollution**

The prevention and control of microplastic pollution is a whole process of supervision process. We need to control microplastic pollution from the whole process of production, trade, use, recycling and disposal.

In the process of production, on the one hand, we should reduce the use of plastic and plastic beads as raw materials, vigorously support the research and development of biodegradable plastics, and encourage the use of environmentally friendly

materials instead of traditional plastics. Improve the role of tax and other economic means to reduce the production of microplastics. In international trade, the cross-border transfer of plastic waste should be controlled. At present, only the import of waste plastic in domestic sources is prohibited in China. It is recommended to increase the scope of the prohibited import list and include waste plastic other than domestic sources in the prohibited import list; and the transfer of plastic waste from China should also be prohibited to other countries. On the other hand, the waste produced in the production process is properly treated to avoid the microplastics from entering the natural environment with the waste water and waste residue. Prevent the leakage of plastic and plastic waste during the transportation process. During the sales process, the products sold by the seller shall meet the relevant standards. In the process of use, encourage the recycling of waste plastics, promote the classification, recycling and disposal of plastic waste, and gradually reduce the landfill amount of plastic waste.

#### 4 CONCLUSION

At present, due to the inadequate microplastics related regulations and control standards, the lack of whole-process management of microplastics pollution, and the existing sewage plant has no treatment process or technology specifically for microplastics. So, the sewage plant becomes an important discharge source of microplastics. To effectively control the microplastics pollution and the depth treatment of the microplastics, this paper proposes four control countermeasures of microplastics, including source control, reducing microplastic discharge, developing sewage treatment technology for microplastics, improving relevant regulations and standards for microplastic pollution prevention and control, and strengthening the whole process management of microplastic pollution.

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