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Microplastics are a Serious Threat to Human Health and the Environment

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Abstract This article provides information about the environmental harm of microplastics in the environment around the world and the results of some studies conducted on them. Results of microplastic studies in water bodies. Currently, there is a growing interest in aquatic environments around the world. This is due to the increasing number of microplastics made up of common plastics, including polyethylene, polystyrene (polypropylene, polyamides and polyvinyl chloride). Based on research and scientific sources on microplastics, it can be concluded that microplastics are potential and priority pollutants. Marine and freshwater bodies, water biota, and drinking water sources are clinically significant, with insufficient reliable data on health problems.

Keywords Plastic products, Microplastics, Photodestruction, Pacific Ocean, Adsorption

1. Introduction

The production of plastic products in the world is constantly growing rapidly, because these artificial materials are widely used in all spheres of our life. From the advent of plastic to the present day, the salinity of the production of this material has increased on a very large scale. In particular, almost 9 billion on Earth in the period from 1950 to 2020. tons of plastic products were produced. Currently, only 9% of this volume is processed, 12% burned, and the remaining 79% is not processed and stored in landfills in the form of solid household waste and collected in illegal landfills [1,5,6,7].

Currently, one of the growing concerns of the world community is the pollution of water bodies with plastic waste. Under the UN Environment Program (UNEP), the fight against plastic pollution, including agreements on the Coordination of the marine environment, international law at the intergovernmental level is mandatory [2,8,9,10,11].

2. Materials and Methods

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Currently, Research is being carried out by foreign and domestic researchers on the analysis of the state of pollution levels of water bodies and water biota with microplastics [3,14,15,16,17,18,19,32]. Particular attention among these studies is attracted by the role of microplastics in the plastic contamination of water bodies. They are parts of industrial and agricultural products, chemicals, medical preparations (primary microplastics), as well as those formed by photodestruction of plastic products (they are secondary microplastics).

The potential storage of microplastics for a person affects its physical condition, in particular, the chemicals contained in microplastics and the life of natural microflora. Although the first data on the discovery of plastic microparticles in Plankton samples was discovered in the 1970, they did not attract scientific public attention until around 2000. The concept of microplastic - was first covered in the scientific literature in 2004 by biologist Richard Thompson [3]. According to a number of researchers, microplastics are elementary small particles of large plastics that initially decompose, with dimensions ranging from 1 μm to 5 mm [4,12,24].

3. Results Obtained and Their Discussion

Results of microplastic studies in water bodies. Currently, there is a growing interest in aquatic environments around

the world. This is due to the increasing number of microplastics made up of common plastics, including polyethylene, polystyrene (polypropylene, polyamides and polyvinyl chloride).

Microplastics differ not only in size, shape, and specific density, and are commonly found in bodies of water. Microplastics, capable of adsorbing various contaminants such as water-contained pesticides, pharmaceuticals, heavy metals, and personal products, serve as a distributor to a wide variety of ecosystems.

A.I. Research by Andrade (2011) and his co-authors suggests that microplastics, exposed to the sun's ultraviolet rays and mechanical forces such as waves, reduce their average molecular weight, causing them to disintegrate into small pieces. These pieces of plastic are fragile enough to become microplastics as a result of their decomposition into dust particles, and at the same time chemical washing from plastics occurs, which increases the toxicity of the water environment [13].

Thus, water pollution with microplastics is an urgent problem of protecting the environment and maintaining the stability of water properties [13,20].

Eriksen and his co-authors confirmed that for the first time in 2014, fresh water in the Lavrentiy large lakes system was also contaminated with microplastics [21].

In the results of the study conducted, the samples were examined by scanning electron microscopy (SEM) from 21 plots of 3 Lakes (Upper Lake, Guron and eri). The results of the tests showed that microplastics were found in all but one sample. They averaged 43,157 particles/km2. Samples from Lake Eri have been found to measure microplastic particles up to 0.36-0.99 mm in size, representing the highest rate of microplastics concentration, accounting for 85% of microplastics in all collected samples. Five categories of microplastics were identified during the studies, the most common being granule and cleavage particles which accounted for 81% of the total number [21].

Currently, an expedition is underway to study microplastics pollution in 10 seas of Russia [22]. Many plastic particles enter the Arctic seas of Russia with Atlantic currents from densely populated regions of Europe and America. In the Barents Sea, researchers have determined the maximum amount of microplastics of 30 PCs/m3.

The least particles of microplastics correspond to the above shares in the sequence of the Black Sea (9 PCs/m3), Laptev Sea (7 PCs/m3), White Sea (6.42 PCs/m3) and East Siberian Sea (2 PCs/m3).

Microplastics can also come to the Russian seas with Pacific Currents. This condition can be explained by the increased concentration of microplastics in the waters of Chukotka. Microplastics were found to occur in different volumes in the Chukotka (up to 26 PCs/m3), bering (up to 81 PCs/m3), and Okhota seas (up to 357 PCs/m3). Inland seas in Russian waters the concentration of microplastics of the Atlantic Ocean did not differ significantly from the seas of the Arctic Ocean. In Baltic Sea waters, 10 PCs/m3 Black Sea waters have been found to contain 7 PCs/m3 microplastics [23,25].

The effect of microplastics on organisms. In the Russian Federation, there are not enough sources about the results of the impact of microplastics on the aquatic environment and biota. However, foreign sources have recorded data on reproductive and eating behavior disorders associated with microplastics [26].

Physical properties of microplastics include volume, shape, surface, and ability to adsorb chemical contaminants and pathogens in the feed chain. According to research by foreign scientists, bioaccumulation of microplastics in the aquatic biota is a potential threat to higher trophic level organisms [27]. Microplastics contamination can have a negative impact on human health, as human trophic chain is at its peak. The greatest risk from food is associated with the regular use of seafood. According to the studies mentioned above, 11,000 particles can drop microplastic into the human body.

The source of intake of microplastics into the human body can also be drinking water [28]. The consumption of water in plastic containers for a year causes the absorption of up to 90 thousand particles, a situation that corresponds to 4 thousand particles in glass containers. The reception of microplastics from plastic bags is increased due to the use of plastic containers with toxic products, storage conditions, temperature violations and mechanical damage to the walls.

S.A.Mason and co-authors have studied drinking water from 259 samples of 11 global brands purchased in different countries. It was found that 93% of the samples analyzed had their own proof of microplastics [29].

It turned out that the microplastics are 0.15 mm. larger than, are not absorbed in the gastrointestinal tract, and microplastics can also pass into the lymphatic and circulatory systems through the penetration of smaller than 0.15 mm into the intestinal cavity.

13 fish caught from the Mediterranean Sea for research with the aim of studying microplastics were found in 80% of liver samples. In addition, microplastics can accumulate in the liver and muscles after fish enter the bloodstream. Microplastics collected in fish tissues can migrate through the nutrient chain to other high-profile organisms. A number of foreign researchers have found microplastic particles in human venous blood flow tissue samples, which are made up of a variety of microplastics chemicals, some of which can cause dangerous diseases through blood vessels in the human body [30]. Plastics usually contain additives, which improves their strength and elasticity properties. The environmental impact of plastics due to the washing of these additives leads not only to the aquatic environment, but also to harmful effects on human health [31].

4. Conclusions

Based on research and scientific sources on microplastics, it can be concluded that microplastics are potential and priority pollutants. Marine and freshwater bodies, water biota, and drinking water sources are clinically significant,

with insufficient reliable data on health problems.

The lack of studied research on the impact of microplastics on the human body, the lack of a methodology for hygienic normalization of microplastics in water means the need to carry out the research presented below:

Determination of the causes of microplastics contamination of water facilities, including sources of drinking water supply;

Development of unified methods for sampling water and sedimentary layers;

Comprehensive study of microplastics as a new influencing factor, and its identification using modern methods;

Studying the impact of microplastics on the human body and solving issues of its regulation in water bodies;

Development of methods of protection of water intake facilities from microplastics to ensure safe conditions for the safe use of drinking water for the population.

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