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MICROPLASTICS WE CANNOT SEE

The WHO reported on the impact of microplastics on human health.

Currently, there is a growing global interest in microplastics, their presence in drinking water and potential risks they may pose to human health.

THE MOST WIDELY USED DEFINITION DESCRIBES MICROPLASTICS AS PLASTIC PARTICLES SMALLER THAN 5 MM IN LENGTH.

The term microplastics was introduced in the scientific literature in 2004 by British researcher Richard Thompson, outlining the global problem of plastic waste evaluation in his article. Since 2014, the number of scientific publications on the effects of microscopic polymer fragments in the environment has surged to reach hundreds of papers every year.

Also, the problem of microplastic pollution has drawn the attention of media and environmental activists, as the discovery of microplastics exacerbated the overall problem of plastic pollution and gave rise to massive campaigns against synthetic polymers.

Activists with their faces wrapped with plastic bags while holding placards on plastic threat to create an awareness programme in Kolkata (India).

IN FRESHWATER STUDIES, THE SHAPE OF PARTICLES VARIES WIDELY, WITH FRAGMENTS, FIBRES, FILM, FOAM AND PELLETS BEING THE SHAPES MOST OFTEN REPORTED.

To assess potential risks to human health, the WHO analysed over 50 scientific studies on the occurrence of microplastics at various stages of the water cycle, the potential health impacts fr om microplastic exposure, and the removal of microplastics during water treatment. This work culminated in Microplastics in Drinking Water, an extensive analytical review. We summarise its key findings below.

Definition

According to the report, microplastics encompass a wide range of materials with different chemical compositions, shapes, colours, sizes and densities. There is no scientifically-agreed uniform definition of microplastics, although most of them focus on the composition and size of particles. A widely used definition describes microplastics as plastic particles smaller than 5 mm in length.

Microplastics are defined as particles up to 5 mm in length.

Occurrence

In various concentrations, microplastics are ubiquitous in the environment. The WHO urges decision-makers and general public to improve the regulation and management of plastics and reduce their use where possible to decrease waste inputs into the environment.

THE MAIN INPUTS OF MICROPLASTICS INTO WATER ARE SURFACE RUN-OFF AND WATER TREATMENT SYSTEMS.

Classification

In freshwater studies, the shape of particles varies widely, with fragments, fibres, film, foam and pellets being the shapes most often reported. Fragments and fibres are the predominant particle types found in drinking water.

PP, PE, PS, PVC, and PET are the polymers detected most frequently, an order that agrees roughly with production volumes. Due to their polymer density, they may also be more common in studies that sample the upper layer of water.

Sources of occurrence and spread

The WHO reports that there are two main inputs of plastics into the environment: microplastics specifically manufactured in the microplastic size range and used by people intentionally (industrial abrasives, microbeads used in cosmetics, etc.) and those formed by the fragmentation and weathering of various synthetic materials (clothing, tyres, plastic bottles and tableware, etc.). The main inputs of microplastics into water are surface run-off and water treatment systems. In bottled water, there is some evidence that microplastic occurrence appears to be at least partially attributable to the bottling process and/or packaging.

Microbeads used in cosmetics are also microplastics.

PARTICLES ARE EASILY REMOVED FROM THE BODY, WITH NO ACCUMULATION OF MICRO- AND NANOPLASTICS REPORTED.

Potential risk to human health

Potential risks to human health associated with microplastics come in three forms: the particles themselves which present a physical hazard, chemicals they are formed of (unbound monomers, additives used for the production of polymers, and sorbed chemicals from the environment), and microorganisms that may colonise on microplastics. The WHO analysed each of the potential risks, summarised the data on its probable impact and presented them to the public.

The experts came to the conclusion that people typically ingest many different types of particles which consist of a variety of substances. Particle toxicity is dependent on a range of physical properties, including size, surface area, shape and surface characteristics. Still, the experts have not identified any critical risks to human health. As evidence, the report provides experimental data on laboratory mice that have been exposed to repeatedly increased doses of microplastics. However, no data on any diseases that followed such extreme exposure was made public. Other studies confirmed that predominantly particles are easily removed from the body, with no accumulation of micro- and nanoplastics reported.

There is evidence that microplastic occurrence appears to be at least partially attributable to the bottling process and/or packaging.

THE STUDY SUGGESTS THAT THE RISKS TO HUMAN HEALTH HAVE NOT BEEN IDENTIFIED, SINCE THERE IS NO RELIABLE EVIDENCE OF ADVERSE EFFECTS FROM EITHER MICROPLASTICS-RELATED CHEMICALS, PATHOGENS, OR PHYSICAL EXPOSURE TO PLASTIC PARTICLES.

Analysis of other aspects of human interaction with microplastics, in particular, the impact of monomers, degraded plastics, micro- and macroparticles of various shapes, which we encounter in the process of nutrition and respiration, has yielded the same results.

Since there is no reliable evidence of adverse effects from either microplastics-related chemicals, or pathogens that are part of biofilm, or physical exposure to plastic particles, the study suggests that the relevant risks to human health have not been identified. Also, there is no evidence of potential health damage from microplastics contained in food (fish, shellfish).

Impact of water treatment systems

The analysis of water samples taken from water supply systems in different countries showed that the highly effective filtration systems in place purify drinking water from microplastics, with the degree of purification exceeding 90%. However, the WHO experts consider the risk that microplastics create conditions for the formation of biofilms from bacteria harmful to human health far lower than the well-established risk of the quality of drinking water sources posed by the high concentrations and diversity of pathogens in human and livestock waste. In this regard, the WHO stressed that no special monitoring of drinking water to assess microplastics or special treatment systems was required.

The existing filtration systems provide highly effective purification of water from microplastics.

ACCORDING TO EXPERTS, INFORMATION ON THE PRESENCE OF MICROPLASTICS IN DRINKING WATER AND ITS IMPACT ON HUMAN HEALTH IS LIMITED.

Insufficient information

According to experts, information on the presence of microplastics in drinking water and its impact on human health is limited, with no fully justified and reliable scientific research in this area.

The report repeatedly emphasises that up to date there is limited evidence on the impact of microplastics, thus urging scientists to continue working on this topic.

In conclusion, the WHO noted the importance and indispensability of plastics in a number of economic sectors, stressing the value of polymers in health care and the prevention of the spread of dangerous diseases, and encouraged increasing the share of recycling and a reasonable use of resources.

Expert view

Roman Kozlovskiy, Head of the Department of Chemical Technology of Basic Organic and Petrochemical Synthesis at Mendeleev University of Chemical Technology of Russia, Professor and Doctor of Chemistry:

“Microplastic particles never spontaneously penetrate into water, food or our household items. The environmental damage caused by such particles is much less than that caused by natural dust storms or volcanic eruptions. This is a fringe concern that is raised by lobbyists solely in commercial interests, being yet another instrument of competition between industrialists. It is not microplastics that pose a huge problem but bulky plastic waste, both industrial and domestic. In developed markets, this problem is already being tackled

“MULTI-LAYER AND BREATHABLE FILMS ALLOW FOOD PRODUCTS TO BE STORED FOR WEEKS. WITHOUT THEM, AGRICULTURAL OUTPUT WILL NEED TO BE INCREASED BY ABOUT 20% MEANING THAT THE ADDITIONAL 20% OF FOOD WASTE WILL NEED TO BE DISPOSED OF.”

in a variety of ways, with a lot of options at hand for reusing plastic waste.

“Recycling plastics in Russia is hampered by the lack of waste sorting culture, which makes the work of separating plastic waste in the landfill virtually impossible. For example, in Sweden, wh ere kitchen furniture has seven containers for all types of domestic waste instead of one, sorting is cultivated as early as in kindergarten.”

According to experts, the problem is more likely attributed to bulky plastic waste which needs to be sorted and recycled.

“THE SITUATION IN THIS COUNTRY IS NOT ABOUT TECHNOLOGICAL CHALLENGES ASSOCIATED WITH POLYMER RECYCLING. IT IS ABOUT PEOPLE'S FEELING OF RESPONSIBILITY, AUTHORITIES' CONCERN AND POWERFUL ADMINISTRATIVE LEVERAGE THAT WE REQUIRE.”

Mikhail Katsevman, Head of R&D at POLYPLASTIC, President of the Russian Association of Plastic Processors:

“Manufacturers of cosmetics, household chemicals, and pharmaceuticals add microplastics to their formulae on purpose to improve their consumer properties, and obtain permits to use them from the most stringent regulatory authorities. Otherwise, it would be impossible to bring the product to the world market. If microplastics are so harmful, how can these formulae be approved? There is no official ban on microplastics yet, and it is unclear why the word 'microplastics' has a negative connotation attached to it. All this is triggered by unfounded media coverage of very serious problems associated with the "ecology" of everyday life.

People who advocate the removal of plastic from our daily lives rarely think about the consequences. Currently, some 179 mt of spoiled food is dumped in Russia. If we rush headlong into reducing the use of modern multifunctional plastic, this figure will grow significantly. Multi-layer and breathable films keep food fresh for weeks and sometimes even months. Without them, agricultural output will need to be increased by about 20% meaning that the additional 20% of food waste will need to be disposed of. Polymers have become an integral part of our lives and technological processes across almost all industries. Today, 360 mt of plastics are produced in the world, including 2.7 mt (!) of biodegradable polymers in the form of packaging items that will decompose into CO_2 and H_2O in just six months. To solve the waste management problem, we should look back to our past experience of redeeming glass bottles and recycling paper waste into books.

Modern films can extend the shelf life of food.

“PLASTICS RECYCLING IN RUSSIA IS HAMPERED BY THE LACK OF WASTE SORTING CULTURE.”

In China and some other countries, people can pay for their subway rides inserting a plastic bottle into a reverse vending machine,