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Source: Pivokonsky, M., Cermakova, L., Novotna, K., Peer, P., Cajthaml, T., and Janda, V. (2018). Occurrence of microplastics in raw and treated drinking water. *Science of the Total Environment*. 643, 2018, pp1644–1651. https://doi.org/10.1016/j.scitotenv.2018.08.102

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1. Raw fresh water has not been treated and has not had any of its minerals, ions, particles, bacteria, or parasites removed. It includes rainwater, ground water, water from infiltration wells, and water from bodies such as lakes and rivers.

European Commission

Science for Environment Policy

Microplastics: new methods needed to filter tiny particles from drinking water

The presence of plastics in aquatic environments is a growing concern across the EU. This study explored the amount of microplastic particles present in raw and treated water at three water-treatment plants in the Czech Republic. While treated water contained fewer particles than raw[1] fresh water, the amount found in treated water was not negligible, and largely comprised tiny particles of <10 micrometres (µm) in diameter. Ways to filter microplastics from potable water must be identified and their risk to humans, sources and routes into drinking water determined, say the researchers.

Plastic particles of less than five millimetres in diameter — microplastics — enter our water via means such as sewage discharge, cosmetics (e.g. tiny exfoliating beads in face scrubs), agricultural, manufacturing and industrial waste. Once they have entered an ecosystem, microplastics can accumulate and are highly persistent, thus posing a potential threat to our environment and health.

The EU aims to tackle this threat in various ways. It formed the Water Framework Directive in 2000, which seeks to raise the quality of European water bodies[2], and has introduced policies concerning plastic waste and pollution. For example, the European Strategy for Plastics in a Circular Economy, adopted in 2018, pushes for the sustainable design, use, production and recycling of plastic products throughout the EU.

Following the Plastics Strategy, the Commission has started work to restrict microplastics intentionally added to products, such as cosmetics, paints or detergents, In January this year, the European Chemicals Agency (ECHA) published its restriction dossier stating that health and environmental risks posed by intentionally added microplastics justify an EU-wide restriction. ECHA's Scientific Committees will now review the dossier and give their opinion. If agreed, an EU-wide restriction could be in place by mid-2021.

The EU is also preparing actions to address microplastics resulting from the use of products, such as tyres or textiles, or from primary plastic production, for instance spills of pre-production plastic pellets.

This study explored the quantity of microplastic particles[3] — from those visible to the naked eye to nanoparticles — found in raw fresh water and treated potable water. As there are so far no EU requirements for water-treatment plants to remove microplastics, due to the unavailability of analytical methods, the study aimed to explore the potential sources of these particles, and if and how different forms of treatment affected their concentrations.

Continued on next page.

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Microplastics: new methods needed to filter tiny particles from drinking water *(continued)*

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The researchers collected samples of raw and treated water from three different water-treatment plants in urban areas of the Czech Republic. The samples, taken on three separate winter days, included a number of different water sources and treatment technologies: plant one is supplied by a large reservoir, plant two by a smaller reservoir, and plant three takes water directly from a river that flows through an industrial region. Plant one uses conventional sand filtration, while plants two and three use two-stage separation (sedimentation and sand filtration at plant two; and flotation and sand filtration at plant three); plus additional granular activated-carbon filtration (active charcoal carbon filters are most effective at removing chlorine and particles, such as sediment, from water).

All samples were found to contain microplastics. As expected, the concentration of microplastics was significantly lower in treated than in raw water — an average of 83% lower — but numbers varied in every case, and the amount found in treated water was not insignificant, say the researchers.

The average microplastic content for raw water at plants one, two and three across the whole sampling period was 1 473, 1 812 and 3 605 particles per litre, respectively. These differences are likely due to factors such as water body type, ambient environment, human activity in the surrounding area, and weather conditions at the time of sampling.

The average microplastic content for treated water at plants one, two and three across the period was 443, 338 and 628 particles per litre – this demonstrates that significant amounts of the microplastics were removed by the treatment process. The results also indicate that flotation (a process used at plant three, which removed an average of 82% of microplastic particles during treatment) appears to be a suitable method for removing microplastics from raw water, as many plastics are light and buoyant.

The main microplastics found were polyethylene terephthalate, polypropylene and polyethylene, which are commonly and widely used in clothing, automotive parts, food and cosmetics containers, various houseware and toys, in packaging for disposable beverages and more.

Particles of between one and 10µm (the average size of a bacterium, or around one hundredth of a millimetre at largest) were the most abundant and accounted for up to 95% of the particles found. These small particles may, therefore, be a key way that microplastics are consumed by humans, but such tiny amounts have not yet been adequately quantified. Further research is thus needed to determine the concentrations of tiny microparticles in fresh-water ecosystems, and to provide more insight into their sources and routes into potable water.

2. The Water Framework Directive: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32000L0060.

3. Microplastics are defined as plastic particles with a maximum diameter of 5 mm.