MICROPLASTIC FACT SHEET

Global Water Research Coalition

Microplastics- what are they ?

Microplastics are tiny solid plastic particles (smaller than 5 millimetres). This definition covers a very wide range of particle sizes including nano-sized. The research usually focuses on particles that are still visible, from 100-200 micrometres (i.e., 0.1-0.2 millimetres). Currently, the categories "large" (1 millimetres to 5 millimetres) and "small" (<1 millimetres) have been introduced [4,5].
Some plastic is manufactured as microplastics (e.g. microbeads) and washed down drains, while larger plastic debris degrades into micro-sized particles over time with exposure to sun and water. For example, microbeads can be found in body cleansing products.
There is also larger plastic debris which degrade into micro-sized particles over time with exposure to sun and water. Microplastics in aquatic systems are typically dominated by fibres and/or fragments while microbeads are a minor component.

Microfibers, a type of microplastics, are derived from synthetic textiles and slough off during daily use and machine washing of clothing (such as fleece jackets, etc.) and antifouling boat paint ships. Most microfibers released in water are between 0.1–0.8 millimetres in size [1] .
While microbeads are being phased out of consumer products such as in the United States, microplastics will not likely decrease due to fibres and breakdown fragments from macro-plastics [2].
Microfibers have been found in fish and marine animals. However, the toxicology of microplastics, including microfibers, and overall relevance for fresh waters, drinking water, and human health needs more research.
Macro-plastics, not microplastics, damage fish-eating birds, aquatic mammals and reptiles, and fish due to physical harm [2] .

Are they found in drinking water ?

There is currently very little knowledge and expertise on microplastic residues in drinking water and its potential impact. Virtually no research has been conducted so far as most of the research to date has been undertaken on the impacts in the marine environment. The reason for this is likely that no microplastics in the traditional size class of 300 to 500 microns would be expected to make it through a modern day drinking water treatment plant that has filtration. A plant that can remove cryptosporidium oocytes which are 4 to 6 microns in size should remove most microplastics. However, the possibility that many microplastics may be closer to the nano-size is a potential concern that has not been addressed [2]. This scenario needs to be looked into as it is well-known from nanoparticle research that nano-sized materials display a significantly different behaviour than their bulk counterpart [9].

Larger particles, as investigated in many studies, will presumably be retained during media filtration, bank filtration, artificial recharge or underground passage and membrane filtration . Data on the occurrence of very small microplastic particles in freshwater systems and their behaviour during water treatment are still completely lacking at this stage.
Water suppliers using surface water supplies impacted by upstream wastewater discharges may have microplastics, including microfibers, in their raw water prior to treatment and possibly in their treated water.
Uptake of microplastics with drinking water is unlikely, but cannot be excluded completely. However, in comparison to other exposure pathways (food wrapped/packed in plastic, inhalation

of plastic fibres – e.g. from textiles) the contribution of drinking water to the overall uptake of microplastics is expected to be of minor importance. Given a daily drinking water consumption of 2 L and a concentration of 4 fibres per 0.5 L, the resulting 16 fibres/day seem to be very little compared to the thousands of textile fibres which can be seen as residues in a tumbler filter and give an impression of the number of fibres potentially inhaled (TZW media release, 2017).

Are they removed from wastewater ?

A European study found 90–99% of microplastics were removed in wastewater treatment plants, but removal efficiency of smaller particles (20–300 µm) was lower [6]. A second study found 98% removal of microplastics through a wastewater treatment plant, though the remaining amount of microplastics discharged to receiving waters was still estimated at 65 million per day (or 0.25 microplastics/L) [7].
During conventional wastewater treatment, microplastics are mainly retained by sedimentation [8]. Most microplastics are captured within the sludge and in some countries are applied to land or incinerated. There is no known method so far to remove microplastics from sludge [10].

What are the Risks ?

The actual risks to human health and the environment remain highly uncertain, however microplastics measured in recent field studies have not yet been shown to cause adverse effects to aquatic wildlife (fish, shellfish, and macro-invertebrates) at environmentally relevant concentrations (in the laboratory or field) but estimation techniques remain inadequate [2]. Microplastics concentrations in waters containing the highest number of reported particles are below 10 particles per 1,000 litres, resulting in very low potential for exposure and uptake by biota.

What are water utilities doing about it ?

Water utilities are supporting research that will help them better understand the potential exposure of consumers to microplastics via drinking water . Finally, the toxicology of microplastics and overall relevance for drinking water production must be evaluated.
Water utilities are also supporting research that will help them better understand the ability of their treatment processes to capture microplastics and understand their transport and removal through the wastewater system. This research will ensure the extent, nature and source of the issue is accurately understood before implementing any costly solutions that may not be effective.
However, there is currently a lack of standardized sampling protocols and analytical methods to determine the occurrence of microplastics in fresh water resources, waste water, sludge/sediments and biological matrices. The Global Water Research Coalition (GWRC) is undertaking an inter-laboratory comparison of microplastic analytical techniques coordinated by the Water Technology Centre (TZW) in an effort to standardise methods and protocols and to compare and evaluate results of microplastic analysis in an international context.

What is required ?

- Further research on the occurrence and toxicological relevance of microplastics is needed.
- More research is also needed on the removal of microplastics and microfibers by various water treatment processes, particularly for sizes smaller than 300 µm.
- Investigations on the total microplastics uptake and the contribution of single pathways and their toxicological relevance are lacking.
- The fate and behaviour of nano-particulate plastic needs to be understood better.

References

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