Retention of nanoplastics during the purification of drinking water

Svenja M. Mintenig1,2, Rossella Messina1,2, Patrick S. Bäuerlein3, Stefan C. Dekker1, Albert A. Koelmans3, Annemarie P. van Wezel1,2
1 Utrecht University, 2 KWR Watercycle Research Institute, 3 Wageningen University and Research, * E-mail: s.m.mntenig@uu.nl

Background

Microplastics have been detected in various freshwater ecosystems. Although it has not been possible to identify and quantify nanoplastics in the (aquatic) environment yet, nanoplastics are expected to be present as well. However, the human exposure to nanoplastics and potentially negative effects on human health are widely unknown.

Drinking water purification from surface water

In the Netherlands, drinking water is made from surface (40%) or groundwater (60%). At first, surface water treatment usually contains CFS and riverbank- or dune-filtration to remove suspended particles. Also further water treatment varies, but normally sand and activated carbon filtration are applied (Fig.1).

Experimental setup

Two different water types (surface and drinking water) and four types of nanoplastic were used: the concentrations of polystyrene spheres of 2 sizes (50 & 200 nm) and 2 charges (uncharged and carboxylated) were determined using UV-Vis spectroscopy (229 nm).

Results

1. Coagulation- flocculation- sedimentation

2. Rapid sand- filtration

Conclusions

1. Coagulation- flocculation- sedimentation

   • Nanoplastic removal by 38-73% after 20 minutes, and by 86-100% after 60 minutes.

   • Bigger nanoplastic was removed more efficiently while particle charge had no impact.

2. Rapid sand- filtration

   • A breakthrough of nanoplastic was detected within the first minutes.

   • Nanoplastic removal varied between 87% (50 nm carboxylated) and 15% (200 nm carboxylated).

Reference:
Riosan-Otte, F, Bosse, J, Speight & Gurney Univ, Schner, J 2016 How do you like your tap water? Science 351:9-14

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