Session Biosphere: April 13th 11.00 hrs

1s7 Water efficiency and water reclycling: what are the options?

Already circular, but is it safe? Safeguarding drinking water resources in circular water systems

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Clean surface water and groundwater are essential sources of drinking water. We view these natural water bodies as pristine sources for drinking water production. However, in reality both surface water and groundwater are part of the circular water cycle, and thus susceptible to contamination. A particularly challenging threat is contamination with organic micropollutants (OMPs) arising from our use of pharmaceuticals, household chemicals, and pesticides. These chemicals are released into surface water in wastewater treatment plant effluent. For example, wastewater regularly contains a cocktail of pharmaceuticals, hormones, and chemicals from personal care products like detergents and fragrances, which are insufficiently removed during wastewater treatment. Similarly, leaching from surface water and agricultural fields transports OMPs, in particular pesticides, into groundwater. Together, this mixture of contaminants demonstrates that our drinking water is already circular by default. The scientific and societal challenge is to engineer the system to be both circular and safe by sustainably removing OMPs from drinking water sources.

This presentation provides first an overview of the challenges of OMPs in drinking water sources, demonstrating the de facto circularity of the water cycle and vulnerability of our drinking water sources. Thereafter, this presentation elucidates the need for improved understanding of the fate and transport of OMPs in complex, heterogeneous water systems in the pursuit of engineering sustainable OMP removal. To this end, focus is placed on enhancing OMP biodegradation using natural microorganisms in existing drinking water infrastructure. The presentation highlights recent results in engineering OMP biodegradation in groundwater used for drinking water production and in sand filters at drinking water treatment plants. In both cases, the crux of engineering such OMP biodegradation is creating advantageous conditions for biological activity without detrimentally affecting drinking water quality.

Finally, it is important to realize that the challenge of OMPs is not restricted to the water cycle. Contamination with OMPs currently occurs in nearly all of the materials in the circular economy. Therefore, this presentation finishes by considering how the knowledge gained from the drinking water sector can be used to ensure safe circular systems for the entire circular economy.

Keywords: organic micropollutants, circular water systems, drinking water, biodegradation