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Perfluoroalkyl Acids in Drinking Water: Sources, Fate and Removal

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PFAAs have been found to be present at a baseline level of ng/L in European surface waters and groundwaters. Although much less information is available on the presence of PFAAs in groundwater, concentrations in groundwater tend to be lower than concentrations in surface waters. Point sources to groundwater are former landfills and fire fighting practice areas and the main diffuse source is the infiltration of PFAAs contaminated rainwater. In order to unravel the sources of PFAAs to groundwater, different organic and inorganic tracers can be used. Since groundwater is treated to a much lesser extent for the production of drinking water, if PFAAs are present in the groundwater they will most certainly pass through the treatment. More monitoring of groundwater abstraction areas is therefore recommended for the drinking water companies.
The relationship between the concentration of PFAAs in source water and drinking water has been shown in several papers. The different treatment steps used such as coagulation, pellet softening, sand filtration, ozonation, slow sand filtration do not remove or affect PFAAs concentrations. Only the granualar activated carbon treatment step has been shown to be able to remove longer chain PFAAs whereas short chain PFAAs such as PFBA and PFBS are not removed during treatment.
PFAAs present in tapwater based beverages have been shown to be mostly originating from the ingredients used and not from food contact materials. In the beverages studied (cola, coffee) the tapwater used determined the PFAAs contents of the beverage produced to a large extent. Consequently beverages might provide additional sources of exposure to humans.
The removal of PFAAs from water by affinity adsorption was studied using two types of materials: hydrophobic (C18 like materials) and electrostatic (anion-exchangers). For the removal of short chain PFAAs such as PFBA, PFPA and PFHxA, anion-exchangers such as WAX or MAX are well suited, and an electrostatic removal mechanism is responsible for the adsorption. Longer chain PFAAs are better removed by hydrophobic materials such as OASIS-HLB or C18 like materials. The studied materials are extremely promising for the removal and it is recommended to develop the knowledge gained to a bench scale treatment installation in order to test the removal efficiencies at a larger scale.