Ultra-short-chain perfluoroalkyl acids: Environmental occurrence, sources and distribution

av

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Akademisk avhandling

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Abstract


Ultra-short-chain perfluoroalkyl acids (PFAAs) is a group of highly fluorinated and very stable chemicals. Their small molecular structure in combination with the acidic functional group result in highly polar compounds and concern has been raised as these substances may threaten our drinking water supplies.

The aim with this thesis was to study and assess the occurrence, sources, and distribution of ultra-short-chain PFAAs in the environment. The main objectives were to analyze ultra-short-chain PFAAs in surface water with different anthropogenic impact, in atmospheric deposition and surface snow at local and remote locations, and to examine the relevance of local and diffuse input pathways to Lake Vättern, Sweden.

The results revealed that ultra-short-chain PFAAs are released to the environment from various sources such as firefighting training sites, landfills, and hazardous waste management facilities. Trifluoroacetic acid (TFA) and perfluoropropanoic acid (PFPrA) were detected in all atmospheric deposition samples and surface snow samples, including those collected at remote sites in the Arctic. Atmospheric oxidation of volatile precursors was found to play a major role in the global distribution of these as well as being the main input pathway to Lake Vättern. A total annual flux of 120–170 kg and 1.3–2.0 kg was observed for TFA and PFPrA, respectively.

Trifluoromethane sulfonic acid (TFMS) was detected in most samples and was reported for the first time in atmospheric deposition and surface snow at local as well as remote locations. The discovery of TFMS at remote locations suggests that TFMS is globally distributed. Neither atmospheric degradation of volatile precursors, nor the long-range oceanic transport seem to be main sources of TFMS to the Arctic environment, and local sources seem to be of higher importance for TFMS input to Lake Vättern.

Keywords: PFASs, TFA, TFMS, point sources, precursors, solar radiation, atmospheric oxidation, atmospheric deposition, flux, Arctic

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