Introduction

Perfluoroalkyl and polyfluoroalkyl substances (PFASs) are a large group of human-made chemicals that have been used in industry and consumer products worldwide since the 1950s.

According to public health experts, people can come into contact with PFAS by eating food, like fish, drinking water and breathing air that contains PFAS. Most non-worker exposures occur through eating food that contains PFAS or drinking contaminated water. According to the data from EPA and EWG, we can get the picture of PFASs distribution in Wisconsin as shown in Fig. 1.

In 2016, the U.S. EPA established cumulative-lifetime health advisories for PFOA and PFOS at 70 parts per trillion (ppt), Wisconsin Department of Health Services (DHS) recommended groundwater enforcement standards of 20 ppt for PFOA and PFOS individually and combined in the spring of 2019.

From Fig. 2 we can get the conclusion that:

a) The PFASs contamination cases in WI increased from 2017, as the increasing attention of PFASs from 2016.

b) In WI the mainly contaminant water are drinking water and groundwater.

c) The PFASs concentration in water of Wisconsin are higher than EPA advisories and DHS standards.

d) The mainly contaminants suspected source of PFASs is Wisconsin are firefighting foam and industrial manufacturing.

Results

PFASs can be divided into long-chain PFASs and short-chain PFASs. In our research, most PFASs found in WI are long-chain PFASs (there are more than 6 carbons in their molecule), and the short-chain PFASs (there are less than 5 carbons in their molecule) only occupy 15%. It is due to the short-chain PFASs have better mobility than long-chain PFASs. According to their group, PFASs can also be divided into sulfonic acid and acetic acid. From Fig. 3, we can get the information that the presence of sulfonic acid PFASs and acetic acid PFASs in WI are closely.

Method

A) Sediment loading: 10 g/L

B) Extraction solution: H2O:MeOH (V/V=1:1)

C) Contact time: 24 hours.

When we added PFASs and stir the sediment, we also added ultrapure water every 12 hours to make sure that PFAS is uniformly attached on sediment.

Conclusion

• PFASs contamination have been reported in ten counties of Wisconsin. The most reported contamination are in drinking water and groundwater.

• A total of 13 PFASs have been found in Wisconsin and PFOA and PFOS were the most frequently reported. In most contaminated sites, concentrations of PFAS are higher than 20ppt (Wisconsin’s standard).

• The most likely cause of pollution is firefighting foam and industrial manufacturing.

• There are at least 12 types of PFASs in sediment from Madison and Holmen. PFBA, PFHxA, PFOA, PFNA, PFDA and 6:2 FTS were the most significant. In particular, the content of PFBA is the most prominent in sediment in two regions, which is significantly higher than that of other PFASs.

Acknowledgement

This Project was supported by:

• Wisconsin Department of Natural Resources (DNR)

• College of Engineering & Applied Science