University of Antwerp
Faculty of Science

ECOSPHERE

The ECOSPHERE research group aims to study aquatic and valley ecosystems that are continuously challenged by natural and anthropogenic stressors. The research focuses on acquiring fundamental and applied knowledge at different levels of structural and functional organisation in order to underpin environmental management decisions.

MASTER THESIS SUBJECT 2023

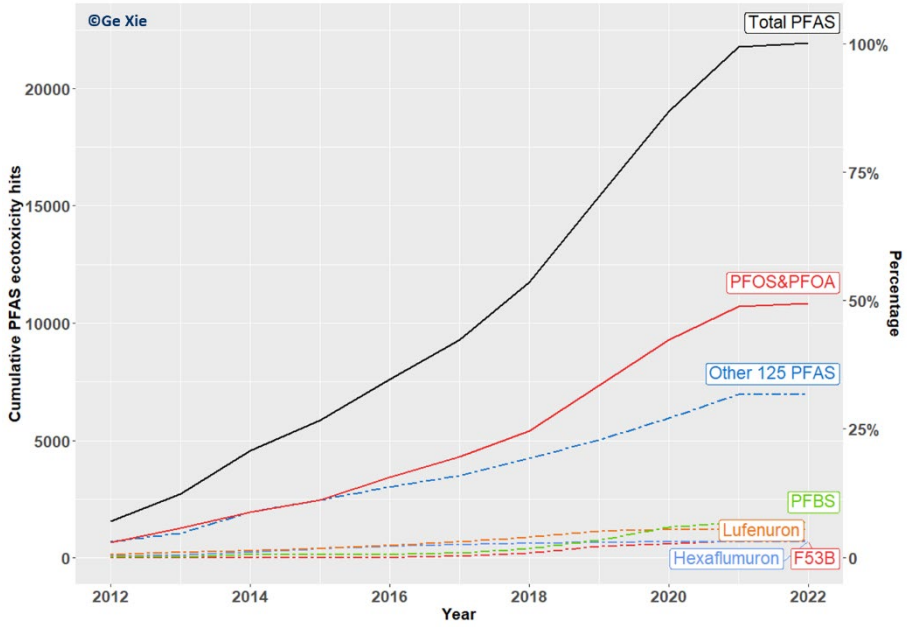
Effects of the chemical structure of per- and polyfluoroalkyl substances (PFAS) on the bioaccumulation and toxicity to terrestrial and aquatic plants and invertebrates

Research group: ECOSPHERE

Hosting laboratory: CGB – Building U

Promotor(s): Thimo Groffen (Thimo.Groffen@uantwerpen.be)

Daily supervision: Thimo Groffen



The PFAS toxicity of many different types of PFAS is still poorly understood. With over 10000 different types of PFAS known, the data suitable for assessing ecological risks to aquatic and terrestrial ecosystems are lacking for the majority of PFAS. We want to understand the accumulation and ecotoxicity of these poorly studied PFAS, in order to establish environmental regulations that are suitable to protect aquatic and terrestrial ecosystems from PFAS pollution.

- **This topic mostly contains ☒ literature study, ☒ lab work, ☐ field work, ☒ experimental work, ☐ GIS, ☐ numerical modelling, ☐ other: ……**
- **Possession of driver's license B is ☐ needed, ☐ recommended, ☒ not needed**
- **Possession of certificates needed: ☐ FELASA C, ☐ other: ……**

Summary Per- and polyfluoroalkyl substances (PFAS) are synthetic organic compounds that have unique properties which have led to a widespread industrial and commercial use, and subsequent contamination of the environment. The partitioning of PFAS to the abiotic matrices, which are important exposure routes for PFAS in the food chain, depends on chemical-, media- and site-specific characteristics. Organisms residing in polluted ecosystems may accumulate different PFAS depending on their physiological and structural characteristics, and on the bioavailability of PFAS (affected by among others their chemical structure). Quantitative measurements of bioaccumulation are well known for legacy PFAS, but not for the vast majority. Similarly, the relative lack of toxicological data for most PFAS is an uncertainty factor in ecological risk assessment (ERA).

The objective of this study is to investigate how the chemical structure of PFAS affect their bioaccumulation and toxicity in aquatic and terrestrial organisms. We will use a focused comparative testing (i.e. including PFOS and PFOA, for which such information on bioaccumulation and toxicity is present), in a phylogenetically broad range of organisms to provide baseline data for ERA. A probabilistic risk assessment approach using species sensitivity distributions will be used to investigate the chronic and acute toxicity of fifteen PFAS and to estimate toxicity benchmark concentrations for soil, sediment, and freshwater.

You will assist in setting up and conducting acute and chronic toxicity tests in at least one study species. Throughout the experiment, and at the end, you will be investigating different toxicity endpoints that differ depending on the selected species. These endpoints are included in statistical models that determine EC50 values from dose-response curves, which are then compared among different types of PFAS and/or species. Furthermore, you will extract PFAS from the various matrices (e.g. soil, water, biota) to determine PFAS bioaccumulation and calculate bioaccumulation factors for each type of PFAS and/or species. This study only includes experimental work and all work will be conducted indoors. Depending on the species, we could examine possibilities to conduct the exposures in a mesocosm facility.

Different possibilities within this topic include (other options can definitely be discussed):

- Comparison of bioaccumulation and sensitivity of multiple species to the same type(s) of PFAS
- Comparison of bioaccumulation and toxicity of different types of PFAS to the same species (≥1)

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