

# Influence of a commercial adsorbent on the leaching behaviour and bioavailability of selected perfluoroalkyl acids (PFAAs) from soil impacted by AFFFs

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## Background

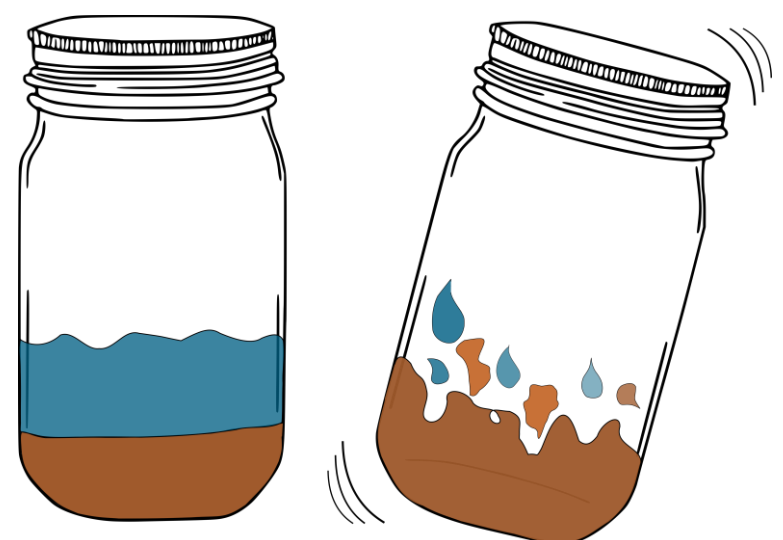
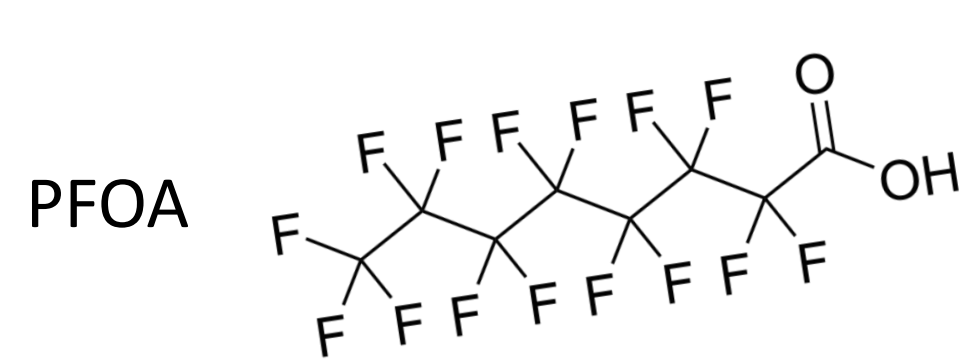
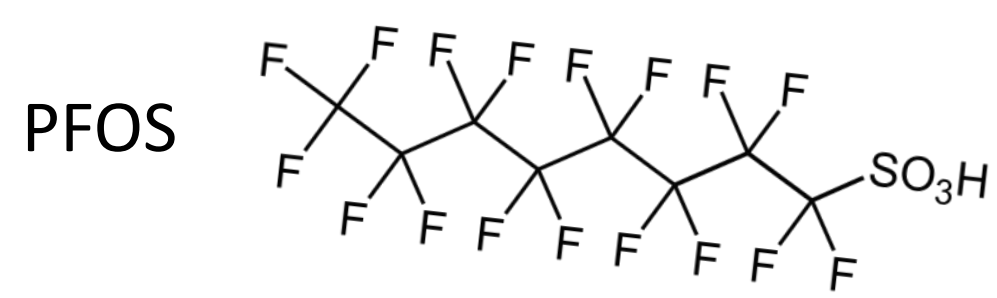
- Aqueous film forming foams (AFFF) are used to put out hydrocarbon fires
- AFFF used by commercial, public and military fire-fighting organization
- PFAAs were used as active ingredients in AFFF
- PFAAs are of increasing public health and environmental concern due to their worldwide occurrence, persistence, possible toxicity and potential to bioaccumulate
- Release into the environment during firefighting activities at airports has resulted in contaminated sites
- Contaminated areas may represent a source of PFAA leachate for many years
- Environmental distribution of PFAAs depends on their carbon-chain length and functional group

## Methodology

- Two contaminated field soils, HB and LT
- Originating from Australian Airports
- Treated with 25% (by weight) of a commercially available adsorbent
- Adsorbent: Activated carbon, kaolin clay, aluminium hydroxide, proprietary additives

Table 1: Concentrations of PFAA in untreated soil samples

Soil Concentration (ng/g)	HB	LT
Perfluorohexanoic acid (PFHxA) C6	45	68
Perfluorooctanoic acid (PFOA) C8	14	55
Perfluorohexane sulfonate (PFHxS) C6	123	447
Perfluorooctane sulfonate (PFOS) C8	2193	13362



- 24-h soil leachate extraction at pH 7 from untreated and treated soils



- 10 week uptake study of PFAA into *Elymus scaber*, a native Australian wheat grass
- Calculation of grass to soil accumulation factors (GSAF)



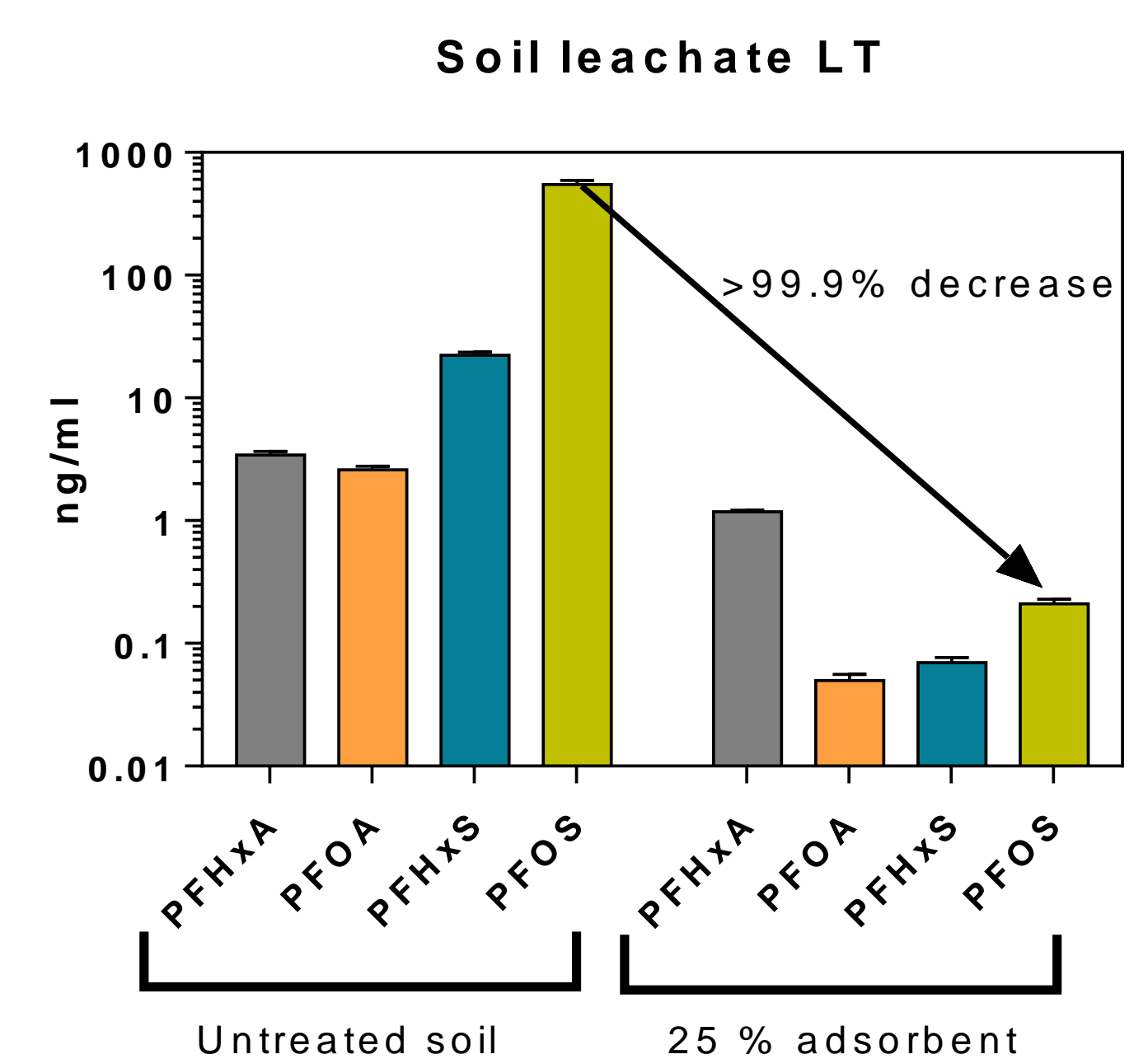
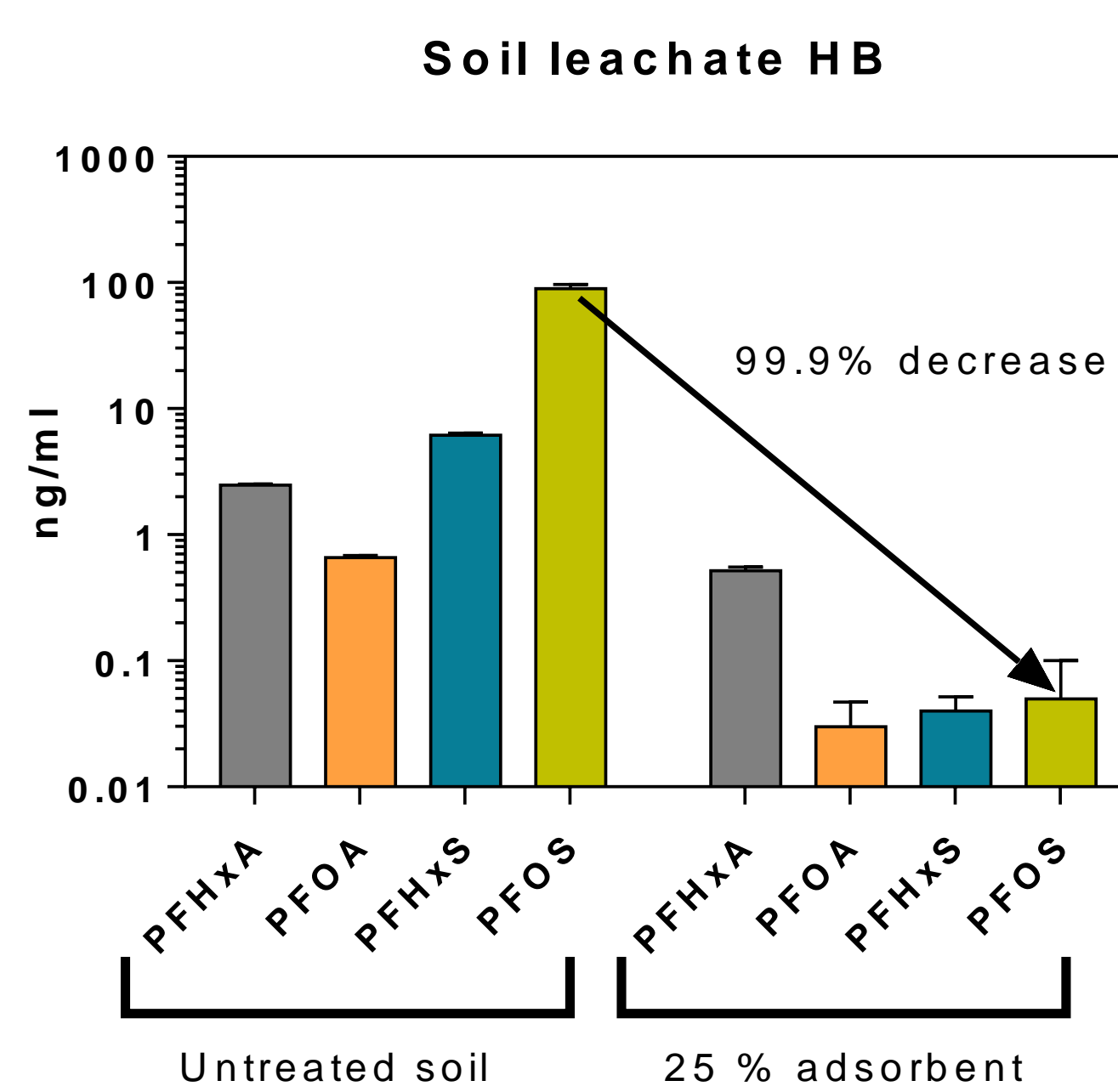
- 28 day accumulation study of PFAA into *Eisenia fetida*
- Calculation of biota to soil accumulation factors (BSAF)

Measurement of PFOS, PFHxS, PFOA and PFHxA in leachate, grass and earthworms using LC-MS/MS

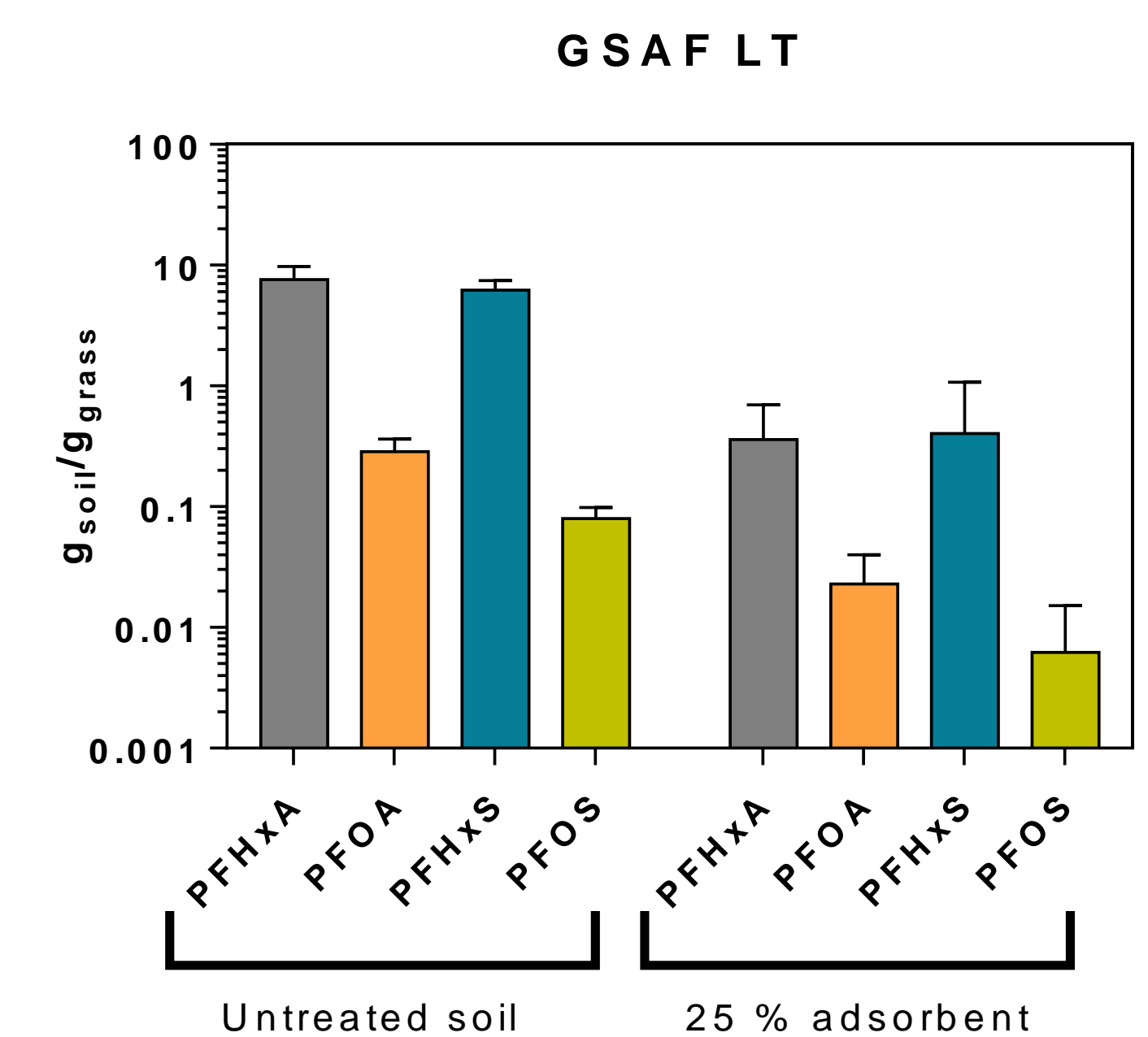
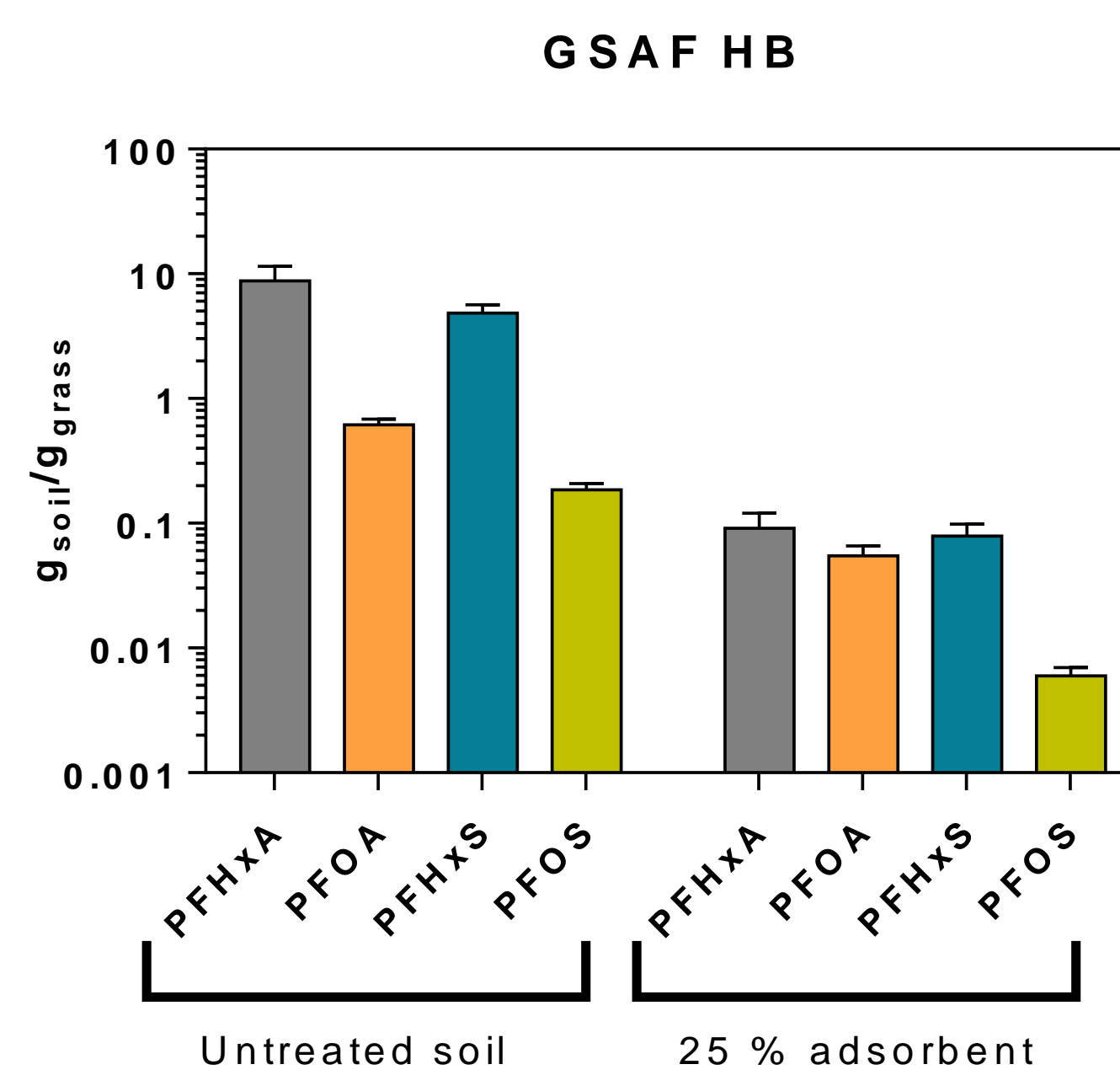
## Motivation

- Remediation of PFAA contaminated soil is a challenge
- Oftentimes large amounts of soil have to be removed from contaminated areas.
- On-site treatment of contaminated soils is being considered
- Activated carbon based adsorbent has shown to be effective in reducing leachate of PFAAs
- PFAAs accumulate from soil to plants and biota, providing an additional bridge to move away from source via local food-web
- Investigation of the bioaccumulation as well as leachability of PFAAs after treatment with adsorbent is necessary before on-site use

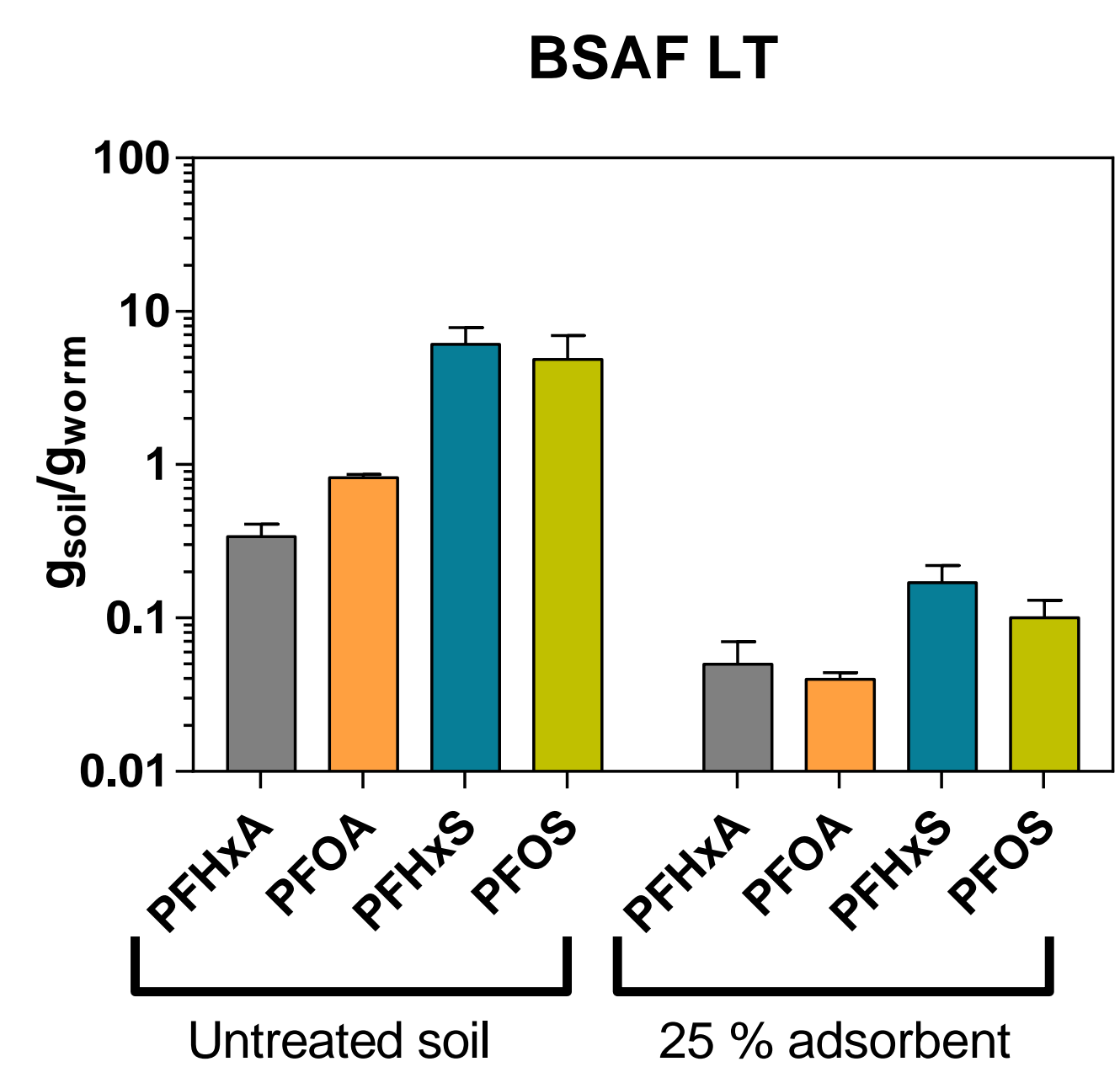
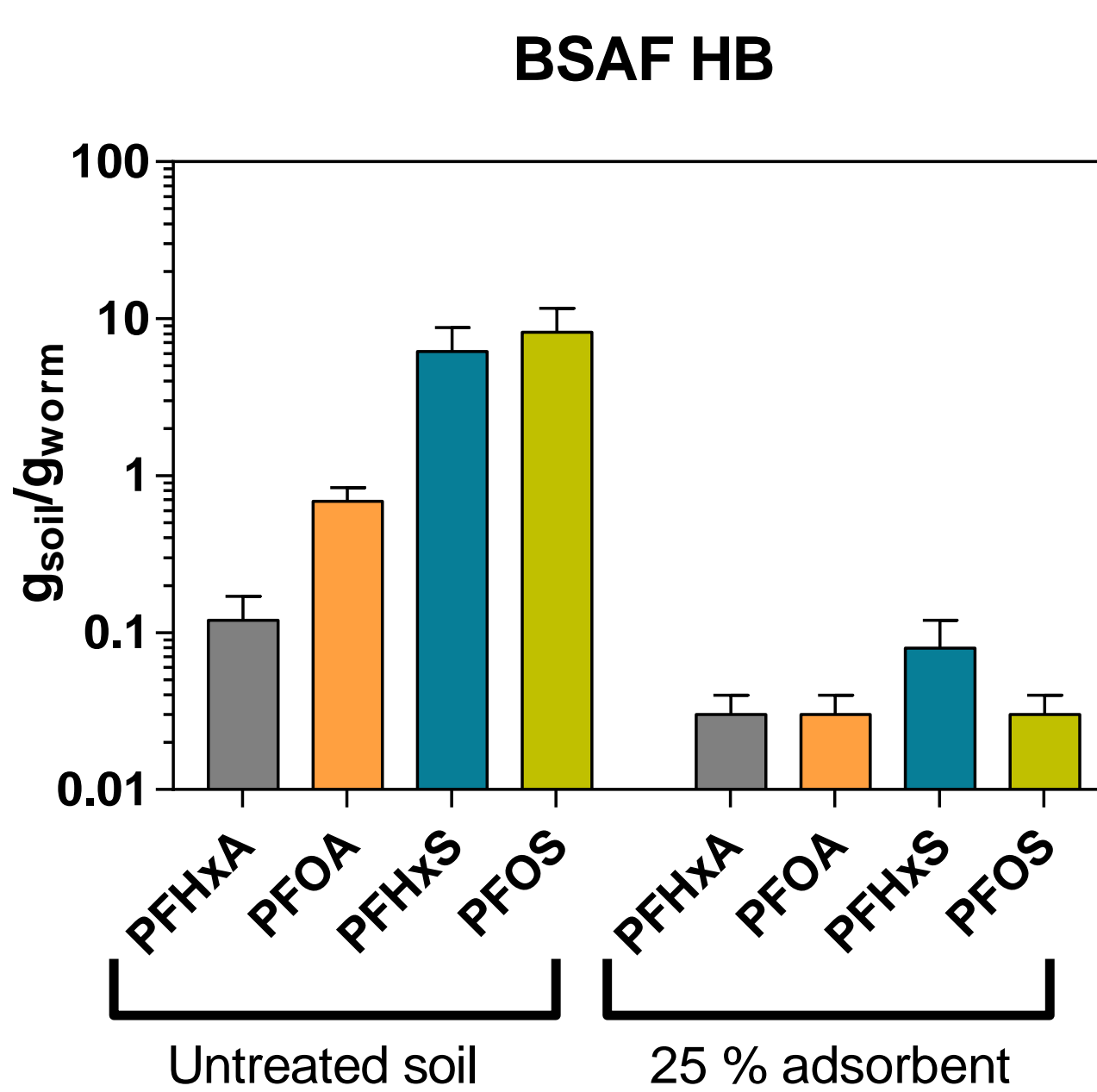
## Results and Discussion



- Leachate concentration of all investigated PFAAs decreased after application of 25% adsorbent
- Largest decrease seen for PFOS



- Decreased uptake into wheat grass after application of adsorbent
- Higher accumulation of molecules with shorter carbon chain
- 30-fold decrease in PFOS accumulation for HB soil



- Higher accumulation of PFHxS and PFOS
- Higher accumulation of longer carbon chain molecules
- Decreased accumulation of all PFAAs after application of 25% adsorbent

## Conclusion

- Adsorbent effective in reducing PFAA mobility and bioavailability in soils.
- Effective immobilization of PFAAs in contaminated area.
- Substantially reduces the ability of contaminated soils to act as ongoing source.
- Hinders further spread of PFAAs into ground- and surface water

## Acknowledgements

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