Determination of emerging PFASs and extractable organofluorine in tissues from marine mammals

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Credits
This project is suitable for a 45 credit MSc or BSc student

Start date
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Background
Per- and polyfluoroalkyl substances (PFASs) are ubiquitous environmental contaminants. They occur in the blood of humans and wildlife globally, including remote Polar Regions (Giesy and Kannan 2001). Over 3000 commercial PFASs are known to exist (KemI 2015). Considering that only a few dozen PFASs are included in routine monitoring programs, it is very likely that exposure to these substances is underestimated. Recently, a new quantitative analytical technique - combustion ion chromatography (CIC) has been developed which captures all fluorinated substances in a single measurement. In CIC, all molecules containing fluorine are combusted to inorganic fluorine and then measured by ion chromatography. When combined with data from targeted (LCMS) analysis, the fraction of organofluorine associated with as-of-yet identified fluorine-containing substances in a sample can be quantified (Figure 1). Applications of this technique in samples of biota, water, sediments and human serum has revealed that considerable fraction of extractable organofluorine (EOF) cannot be accounted for by known PFASs (Miyake et al. 2007, Yeung et al. 2009, Loi et al. 2011, Yeung and Mabury 2013, Weiner et al. 2013).

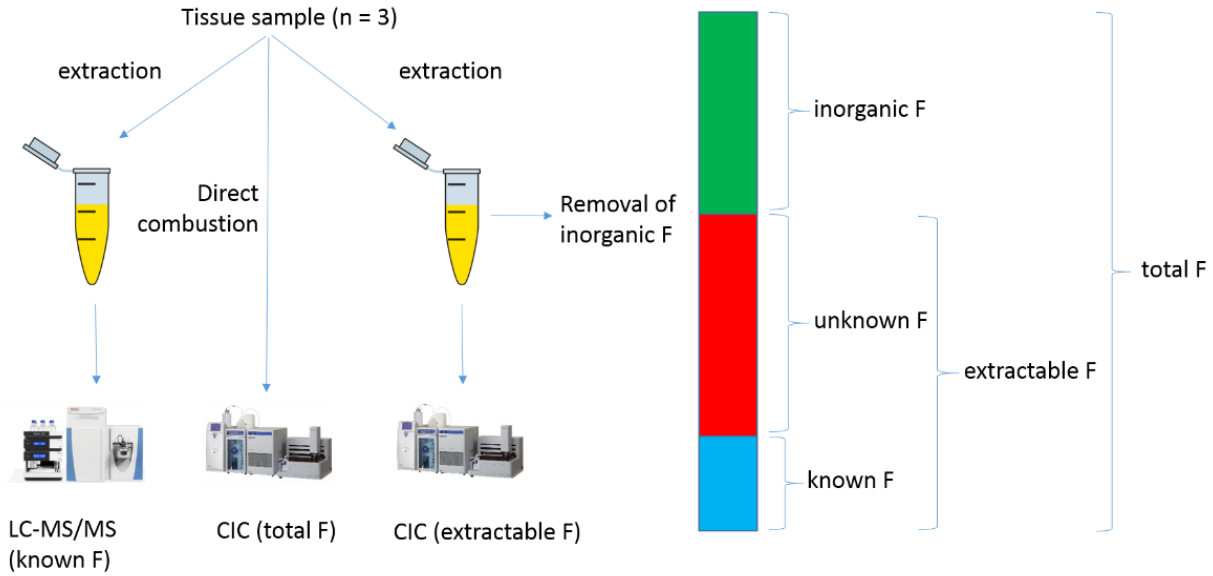

Figure 1. Relationship between total-, known- and extractable-F measurements.

Objectives

In this study we will evaluate a method for determination of PFASs and extractable organofluorine in tissues (see figure 1). Seal liver will be used for method testing/validation. The objectives are as follows:

1) Determine concentrations of emerging PFASs in tissue by LC-MS/MS.
2) Determine concentration of total and extactable organofluorine by LC-MS/MS.
3) Compare total F generated by LC-MS/MS to total F determined by CIC to elucidate the fraction of organofluorine captured by targeted methods.

Methods

Seal liver tissues will be provided by the Swedish Museum of Natural History. A total of 3 replicates of each tissue (each 0.5g) will be used for the entire analysis. The first replicate is extracted and analyzed for a suite of known PFASs by LC-MS/MS. The second portion is combusted directly without internal standards (the internal standards will interfere with the CIC analysis) for determination of total fluorine (i.e. organic + inorganic) using CIC. The 3rd portion is extracted without internal standards and a wash step is used to remove the inorganic fluorine. The resulting extract is then subjected to combustion IC for determination of extractable organofluorine.

References

Gebbink et al. 2016. *Chemosphere* 144,2384-2391
Giesy and Kannan. 2001. *Environ. Sci. Technol.* 35, 339–342
KemI 2015. Report Number 361164, Stockholm, Sweden.
Loi et al. 2011. *Environ. Sci. Technol.* 45, 5506–5513
Miyake et al. 2007a. *J. Chrom A.* 1143, 98-104.
Weiner et al. 2013. *Environ. Chem.* 10, 486-493.
Yeung et al. 2009. *Environ. Int.* 59, 389-397
Yeung and Mabury 2013. *Environ. Sci. Technol.* 47, 12505-12513