Sample preparation and analysis of Brominated Flame Retardants (BFR) in environmental samples

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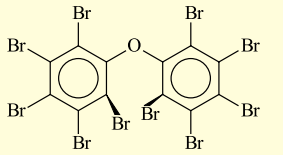
Summary

- Method for cleanup and analysis of BFRs in environmental samples
- Detection and quantification of a wide range of concentration of BFRs
- Several BFRs with very different chemical and physical properties are separated and quantified

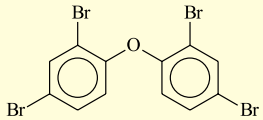
Introduction

Brominated flame retardants are applied to several materials for their flame retardant properties

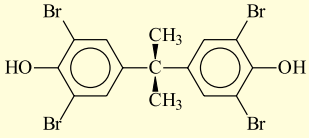
- *Electrical and electronic equipment*
- *Textiles, coatings; sofas, seats of cars, buses, and aircraft*
- *Plastics*
- *Building materials*
- *Paints*



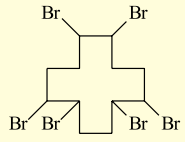
Decabromodiphenylether



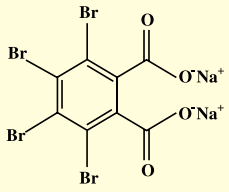
Tetrabromodiphenylether



Tetrabromobisphenol-A



Hexabromocyclododecane



Disodiumtetrabromphtalate

The BFRs have very different structures and characteristics. The most commonly used BFRs are the brominated diphenylethers (PBDE), hexabromocyclododecane (HBCD) and tetrabromobisphenol-A (TBBPA).

Their presence in the environment has become a matter of great concern

- *Highly persistent*
- *Accumulate in the environment*
- *Atmospheric long-range transport*
- *Found in animals on top of the trophic level*
- *Suspected to be harmful during long-term exposure*
- *Effects resemble the toxic effects of PCBs.*

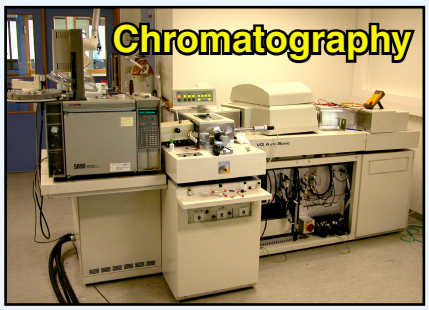
Method

Sample types

- *Biological samples (biological oils, fish, mussel, moss, etc.)*
- *Soil and sediment*
- *Sewage*
- *Water (waste water, drinking water etc.)*

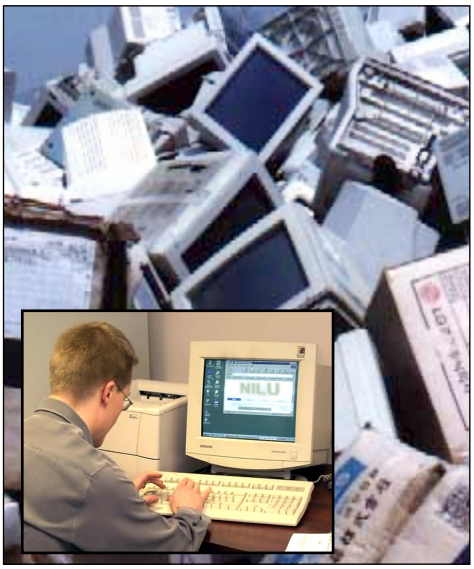
Cleanup and preparation

- *Addition of internal standards*
- *Solvent extraction*
- *Gel Permeation Chromatography*
- *Fractionated silica chromatography*
- *Derivatisation; allowing hydroxylated compounds to be separated on GC*
- *Addition of recovery standard to ensure the quality*



The instrument is a Gas Chromatograph coupled with a High Resolution Mass Spectrometer (GC/HRMS) used for analysis of PBDEs, TBBPA, BPA.

For analysis of HBCD a High resolution Liquid Chromatography coupled with Mass Spectrometry (HRLC/HRMS) is used. This allows separation of all three isomers (α, β and γ–HBCD).



BFRs are also used in electronic parts of colour televisions and personal computers.

	Chemical name
BDE-28	2,4,4'-tribromodiphenylether
BDE-47	2,2',4,4'-tetrabromodiphenylether
BDE-71	2,3',4',6- tetrabromodiphenylether
BDE-99	2,2',4,4',5-pentabromodiphenylether
BDE-100	2,2',4,4',6-pentabromodiphenylether
BDE-119	2,3',4,4',6-pentabromodiphenylether
BDE-138	2,2',3,4,4',5'-heksabromodiphenylether
BDE-153	2,2',4,4',5,5'-heksabromodiphenylether
BDE-154	2,2',4,4',5,6'-heksabromodiphenylether
BDE-183	2,2',3,4,4',5',6-heptabromodiphenylether
BDE-209	Decabromodiphenylether
TBBPA	Tetrabrombisphenol-A
BPA	Bisphenol A
α-HBCD	α-hexabromocyclododecan
β-HBCD	β- hexabromocyclododecan
γ-HBCD	γ- hexabromocyclododecan

Brominated compounds separated, identified and quantified by the method developed.

Conclusions

- Separation and identification of several BFRs in different types of samples
- Suitable for all levels of contamination in several different environmental samples
- Proven useful for locating sources of contaminations

Findings has shown various accumulative properties for different isomers.

References

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