

Brominated Flame Retardants in the Norwegian Marine Environment; Analytical Aspects for GC/MS measurements

Herzke, D., Schlabach, M., Planting, S.,

Department for Chemical Analysis
Norwegian Institute for Air Research
9296 Tromsø
Norway

Introduction:

Polybrominated biphenyls, diphenylethers, and other brominated organic compounds are used as flame retardants in plastics and textiles worldwide at a constantly increasing amount and variety.

They are produced in large volumes for some decades with a still increasing tendency (in 1990 130 000t BFR/a world wide).

Until now it is known that some but not all brominated flame retardants bioaccumulate and can those be detected in environmental samples.

The following samples from different Norwegian monitoring programmes were screened for PBB, PBDE, 2,4,6-Tribromophenylallylether (TBPAE) and Hexabromobenzene:

Minke whale meat (*Balaenoptera acutorostrata*) from Barents Sea and Norwegian Sea
Cod liver (*Gadua morhua*) from the Norwegian coast
Tusk liver (*Brosme brosme*) from Norwegian sea and Nordfjord
Burbot liver (*Lota lota*; a fresh water cod) from Lake Hurdalssjøen and Lake Mjøsa
Egg from White tailed Seaeagle (*Haliaeetus albicilla*) and Osprey (*Pandion haleaetus*)

Methods

- Pooled samples homogenized with sodium sulfate and extracted with n-hexane/ethylacetate
- Clean-up with GPC and Alumina chromatography
- Separation by GC (HP Ultra-II) and quantification by LRMS-EI (Fisons MD800, detection of M^+ , and $[M-Br]^+$ or $[M-2Br]^+$ for some compounds) and LRMS-NCI (HP Engine, Methane as reagent gas, detection of Br^- and Br_2^-)

Results:

Sample type	Whale meat				Cod liver				Tusk liver		Burbot liver		
Sampling site	Barents sea	Barents Sea	Norwegian Sea	Norwegian Sea	Lofoten	West coast	South coast	Oslofjord	Norwegian Sea	Nordfjord	Lake Hurdal	Mjøsa/Furnes	Mjøsa/Lillehammer
Fat content in %	0.47	1.03	0.72	3.62	67.7	75.2	45.2	40.0	60.4	46.8	45.7	49.7	42.7
	ng/g fat weight												
4,4-DiBB (15)	<2.13	<0.97	<1.39	<0.28	<0.01	<0.01	<0.02	0.25	<0.02	<0.02	<0.02	<0.02	<0.02
2,2',5,5'-TetBB (52)	<2.13	<0.97	<1.39	<0.28	<0.01	<0.03	<0.04	0.05	<0.03	<0.04	<0.04	<0.04	<0.05
2,2',4,4',5,5'-HexBB (153)	<10.6	<2.91	9.72	<1.38	0.89	1.33	0.66	2.13	2.57	18.6	58.6	378	75.2
2,2',4,4'-TetBDE (47)	25.5	34.0	294	304	22.2	25.9	108	80.8	60.4	303	326	2 101	759
2,2',4,4',5-PenBDE (99)	6.38	9.71	131	96.1	1.14	1.10	1.15	1.95	2.45	4.23	94.1	1 833	778

- PBBs are near or below detection limit, HBBz and TrBPAAE are below detection limit for all samples
- 2,2',4,4'-TetBDE (47) and 2,2',4,4',5-PenBDE (99) are detected in all whale and fish samples; 2,2',4,4'-TetBDE (47) were detected in some of the egg samples
- Concentration level in Minke whale samples from the Norwegian Sea are comparable with samples from the Dutch coast (Σ PBDE: ~800 ng/g l.w.)¹.
- Concentration level in Cod and Tusk liver samples from the Norwegian Sea are comparable with samples from the North Sea (Σ PBDE: 2 - 360 ng/g l.w.)².
- The highest concentrations are found in the fresh water species (Burbot) comparable to measurements from a Swedish sampling site downstream a textile factory using PBDE (Σ PBDE: n.d. - 4600 ng/g l.w.)³.
- The analysed fish samples show indications for spatial trends.
- Control measurements of samples with GC/ MS-EI proved undisturbed (no Coelution) signals of the analysed brominated components

Acknowledgement

This research is funded by the Norwegian Research Council. The support with samples by Einar Brevik and Jon Knutzen, NIVA, Oslo, Bodil Øvrevoll, NiS, Bodø and Vidar Berg, NVI/NCVM, Oslo are greatly acknowledged.

References

1. de Boer, J. et al., *Organohalogen compounds*, 1998, 35: 383-386.
2. de Boer, J. *PhD Thesis* 1995, Vrije Universiteit Amsterdam, the Netherlands
3. Sellström, U., Kierkegaard, A., De Wit, C., and Jansson, B., *Environ. Toxicol. Chem.* 1998, 17: 1065-1072.