

## OCCURRENCE OF PBDEs IN FISH COLLECTED IN AND AROUND EUROPE, USA AND AUSTRALIA

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### Introduction

Polybrominateddiphenyl ethers (PBDEs) are used as flame retardants in a wide range of commodities, including plastics, electronic circuits, television sets, building materials and textiles. The extensive use of products containing brominated flame retardants like PBDEs has resulted in the release of these components into the environment. PBDEs are toxic, hydrophobic and highly persistent. They biomagnify in the food chain and are effectively transferred to animals.

They are found in all types of food for humans. The investigation of PBDEs in fish samples originating from different areas gets raising importance.

### Materials and methods

**Samples from Europe:** The samples reflect routine projects from January 2010 to end of September 2011 and were analyzed within the normal analytical day to day procedure. Typical fish species are Cod, Lumpfish, Haddock, Redfish, Pollock, Orange roughy, Halibut, Salmon, Herring, Tuna, Atlantic catfish, Mackerel, Blue whiting, Capelin, trout and others <sup>1</sup>.

**Samples from Iceland:** Muscle samples from 5 female Greenland sharks were obtained from sharks that accidentally have been caught in trawl or entangled in long lines from various areas around Iceland 2001/2003<sup>2</sup>.

**Samples from USA:** Food samples were purchased during 2003/2004 (1) and 2009 (2) in Dallas, Texas, from three large supermarkets representing national chains. (1): Canned and fresh tuna, catfish, halibut, herring, salmon, mahimahi, sardines, shark, shrimps, trout, perch, tilapia, (2): salmon, canned tuna, catfish, tilapia, cod, canned sardines in water, frozen fish sticks <sup>3,4</sup>.

**Samples from Australia:** Samples like prawns, mud crab, mullet, bream, flathead, tailor and longtom have been collected 2005/2006 in Moreton Bay area/Queensland, Australia. The bay supports diverse wildlife populations as well as both recreational and commercial fishing industries, and previous studies have detected elevated levels of PCDD/Fs in marine turtles, marine mammals and seafood from this location <sup>5</sup>.

**Analytical procedure:** All analyses were performed following isotope dilution method. Samples were freeze dried and a mixture of <sup>13</sup>C<sub>12</sub>-labelled standards were added prior to soxhlet extraction. Clean up was performed using a multistep adsorption column system. The final extract was reduced in volume by a stream of nitrogen to a final volume of 50 µl, adding <sup>13</sup>C<sub>12</sub>-labelled Hexa-BDE139 as recovery standard. The measurements were performed using high-resolution gas chromatography/high resolution mass spectrometry (HRGC/HRMS, HP 5890 coupled with Waters Autospec) at RP = 10,000 using a DB 5 (30 m, 0,25 mm ID, 0,1 µm film) column for gas chromatographic separation. The two most abundant masses were used for measurement (M<sup>+</sup> for Tri- and Tetra-BDE, and (M-2Br)<sup>+</sup> for Penta- to Hepta-BDE). The identification of BDEs was based on retention time and isotope ratio. The quantification was performed by using a five point calibration curve<sup>6</sup>.

Samples have been analyzed for up to 24 different BDEs.

**QC/QA measures:** For reason of quality control a number of internal and external procedures are performed: For each batch of 6 to 10 samples a QC control sample and a blank sample were analysed in parallel. In addition, a

number of samples was analysed in duplicate. The laboratory participated successfully at all relevant national and international interlaboratory control studies for PBDEs in various samples like e.g. Norwegian Institute of Public Health, Quasimeme and others

### Results and discussion

Results are given for lipid content and total PBDEs in Table 1. The lipid content as well as the total PBDEs show a wide range of concentrations. Lipids range between 0.1 and 67 %. The total PBDE concentrations are reported between 11 and 34 000 pg/g wet weight.

**Table 1.** PBDE levels, pg/g wet weight

Country of origin	n	Lipid content, %, mean	Lipid content, %, min	Lipid content, %, max	Total PBDEs, mean	Total PBDEs, min	Total PBDEs, max
Europe <sup>*)</sup>	48	11	0.1	67	1 880	17	17 400
Iceland	12	17	13	22	12 800	1 300	34 000
USA (1)	24	5.4	0.15	13.9	1 120	11	3 736
USA (2)	7	8.7	0.30	14.8	405	17	1 487
Australia	9	5.6	0.23	31.7	1 600	38	4 100

<sup>\*)</sup> excl. Iceland

Comparing the results for all samples, Greenland Shark samples originating from Iceland show the highest values measured in this investigation.

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