

Takumi Takasuga, Ph.D.

Visiting Professor of Environmental Chemistry, Center for Marine Environmental Studies (CMES), Ehime University

(Director of Analytical division, SHIMADZU TECHNO-RESEARCH INC.)

Dr. Takumi Takasuga graduated from Ehime University Dept. of Environmental Chemistry, Graduate School of Agriculture in 1985. He received PhD degree in analytical chemistry at the Dept. of Applied Biological Chemistry, Graduate school of Agricultural and Life Sciences, the University of Tokyo in 2001. He is a member of the committee for quality control in environmental analysis of Dioxin (1999,2000,2006) in the Ministry of Environment (MOE), and in the committee for developing revised original draft of Japanese Industrial Standards (JIS) for Dioxins analysis (2004,2005), Chairman of Research Group on Ultra Trace Analyses (UTA) in Japan Environmental Measurement & Chemical Analysis Association (JEMCA). He received the 2nd Technique Prize (1993), the 5th Academy Prize for Environmental Chemistry (1996) from Japan Society for Environmental Chemistry. He received the Honorary Doctor Award from Örebro University Sweden in 2003. He has authored 105 original scientific publications and 8 book chapters and articles, both in English and Japanese. He presented 79 papers in international and 121 papers in national forums as oral or poster presentations.

Screening of Trace Organohalogen Compounds

Our research is focused on development and improvement of analytical chemistry for ultra trace organic compounds in environmental and biological samples.

We developed a comprehensive analytical methodology for organohalogen compounds in environmental samples with GC/LR or HRMS (EI/NCI). Our findings on the concentrations of brominated flame retardants (BFRs) and their metabolites in the blubber of finless porpoise was conducted in 2004.

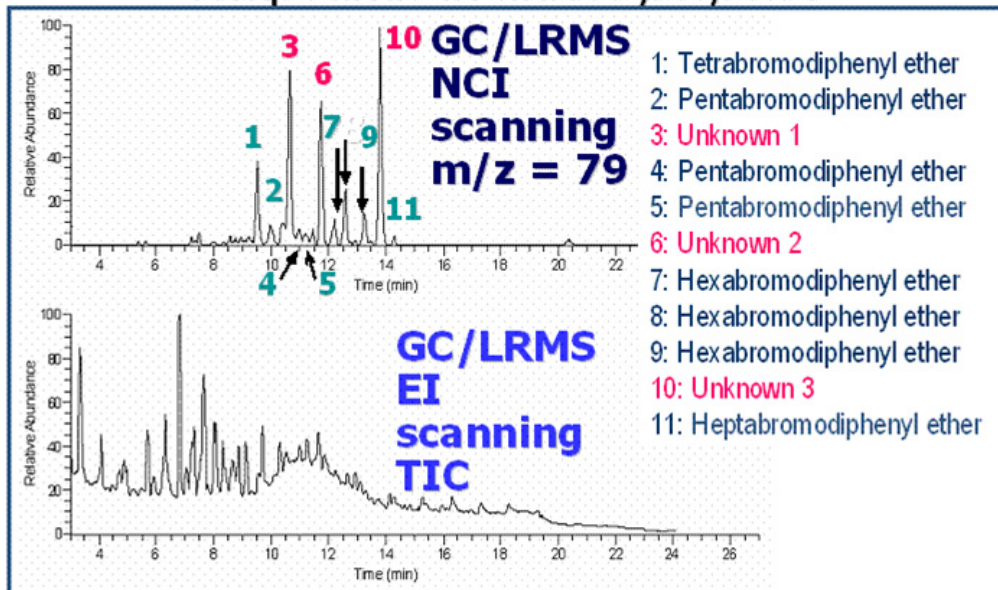
In addition, application of gas chromatography/high resolution time-of-flight mass spectrometry (GC-HRTOFMS) for environmental analysis was investigated. HR-TOFMS has high sensitivity to quantify sub-picogram levels of organohalogens with high resolution full-scan information and exact mass measurement within around 5ppm.

Additionally it is possible to identify unknown interfering compounds in routine dioxin analysis. Semi quantification data for POPs analysis by isotope dilution method with GC-HRTOFMS was compared for precision check with conventional GC-HRMS SIM data on biological samples.

Comprehensive analytical methodology for the investigation of organohalogen compounds in biological samples was developed by GC/TOFMS. Accurate mass measurement with wide range on TOFMS helped us to select organohalogen compounds from complicated matrix components derived from sample. In the blubber and liver of finless porpoise, PCBs were detected at the highest levels, and other organohalogen compounds were in the order of DDTs and its metabolites > chlordane compounds (CHLs) > hexachlorocyclohexane isomers (HCHs) > hexachlorobenzene (HCB) > polychlorinated diphenyl ethers (PCDEs) > hexabromocyclododecane (HBCD) > polybrominated diphenyl ethers (PBDEs).

Moreover 2,3,3',4,4',5,5'-heptachloro-1'-methyl-1,2'-bipyrrole (Q1) was successfully identified in finless porpoise sample, which is one of the marine halogenated natural products and widely distributed in the environment. Halogenated natural products such as BrCl₆-1'-methyl-1,2'-bipyrrole and Br₂Cl₅-1'-methyl-1,2'-bipyrrole, two of the brominated congeners of Q1 were also identified.

Results of GC-MS scanning and organobromine compounds in *finless porpoise*



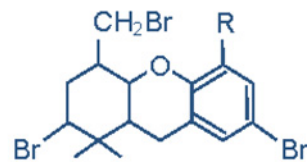
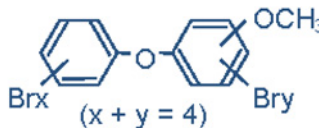
Unknown compounds → GC/HRMS or TOFMS
EI scanning Accurate mass

Chromatograms of GC/LRMS NCI scanning (above) and GC/LRMS EI (below)

Organo-bromine compounds in the blubber of *finless porpoise*

Less Polar Fr.

1. TeBDE
2. PeBDE
3. OMe-TeBDE
4. PeBDE
5. PeBDE
6. $C_{16}H_{19}OBr_3$
7. HxBDE
8. HxBDE
9. HxBDE
10. $C_{16}H_{18}OBr_4$
11. HpBDE



Tribromo (R = H) hexahydro-1H-xanthene derivatives

Tetrabromo (R = Br) hexahydro-1H-xanthene derivatives

Natural formed(?) Vetter et al., 2006

Organo-bromine compounds identified in the blubber of finless porpoise