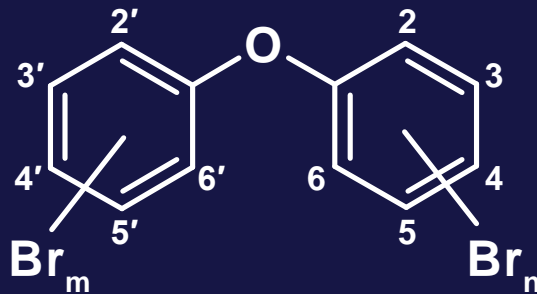


Analysis of PBDEs in culture media and protein sources used for human in vitro fertilization

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Osaka Prefectural Institute of Public Health

PBDEs



$$m + n = 1-10$$

Theoretically 209 congeners exist

Flame retardants
added to many consumer
products, e.g.,
electronics and furniture

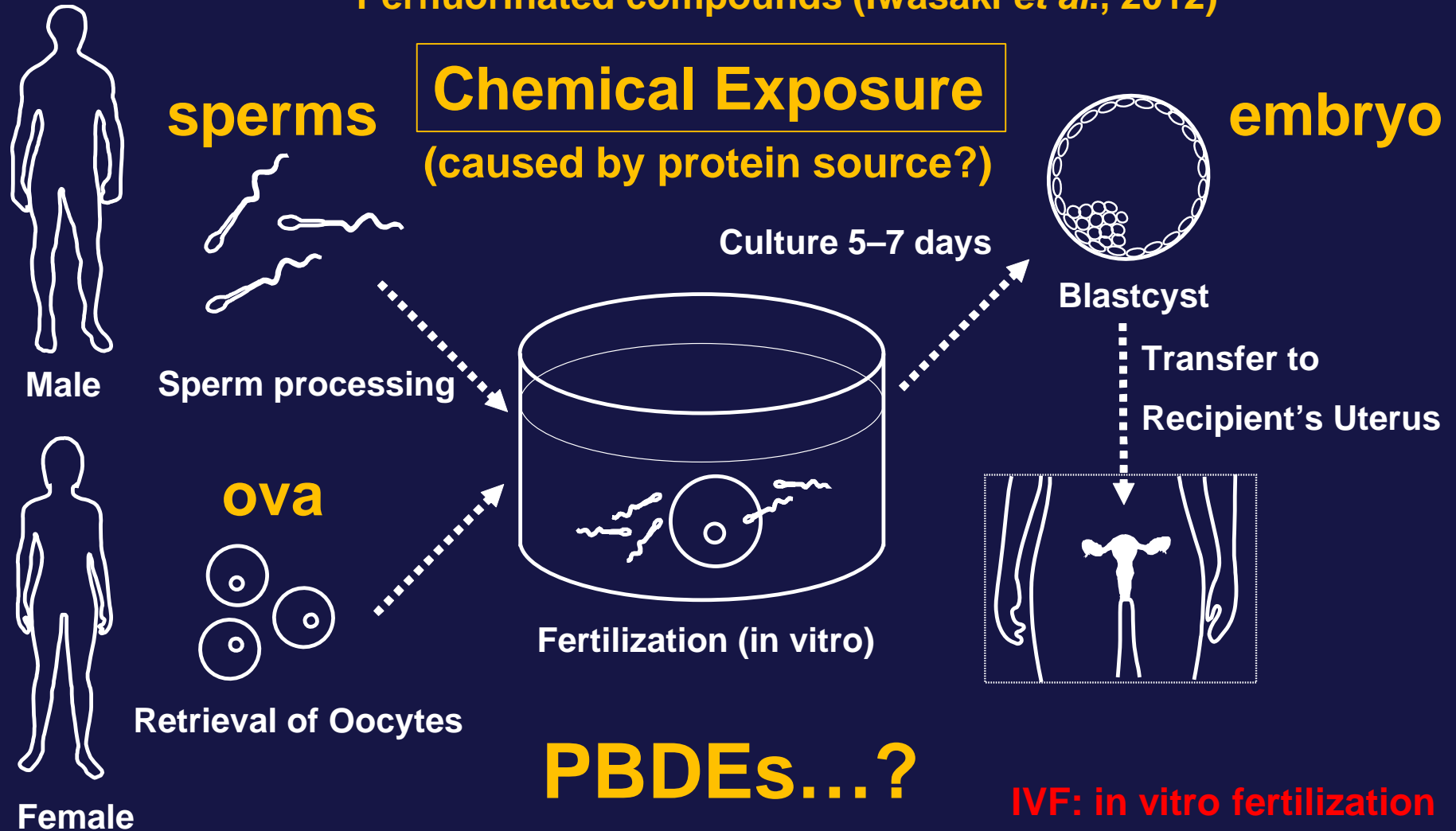
- Persistent in the environment
- Lipophilic and bioaccumulative
- Classified as the Persistent Organic Pollutants (POPs)
- Ubiquitous contaminants in human blood

PBDEs: Polybrominated diphenyl ethers

Background and Objectives

Phthalates (Takatori *et al.*, 2012)

Perfluorinated compounds (Iwasaki *et al.*, 2012)



Samples



A total of 30 samples were commercially obtained from 5 global manufacturers.

- ✓ 15 IVF media (IVFM)
- ✓ 9 sperm preparation media (SPM)
- ✓ 6 protein sources (PSs)

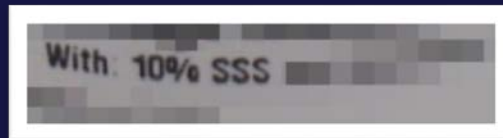
Note

Two different types of media

The IVFM and SPM samples were available as two different types of products: one was a **“ready-to-use”** medium that already contained sufficient amounts of PS and the other was a **“PS-free”** medium that generally requires protein supplementation manually prior to clinical use.



An example of **“ready-to-use”** medium (PS-supplemented medium)



SSS: serum substitute supplement



An example of **“PS-free”** medium

PS



Human serum albumin (HSA)

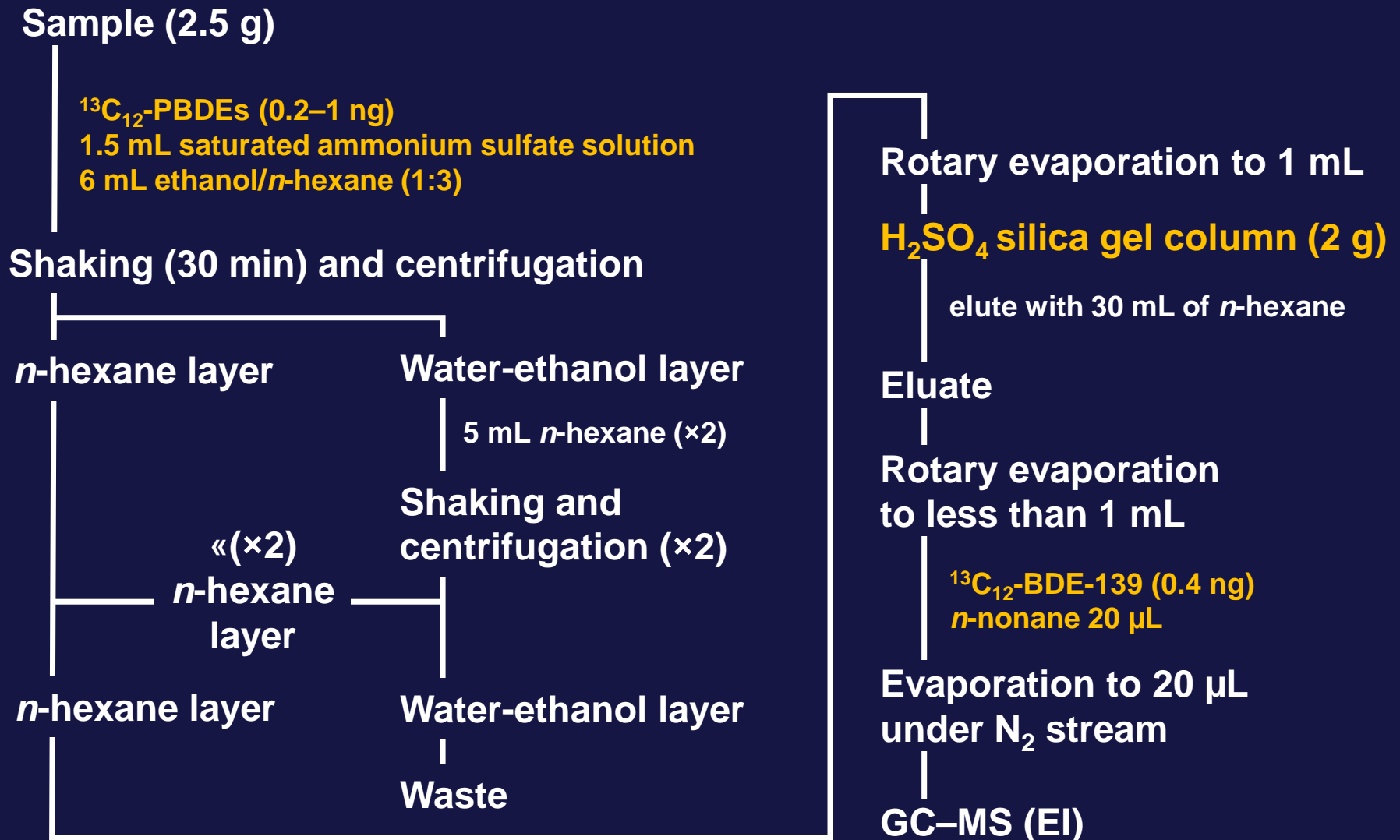


Serum substitute supplement (SSS)

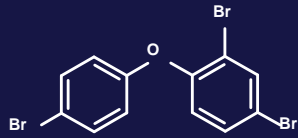
composed by HSA and immnoglobulin

All of these proteins are blood-derived products

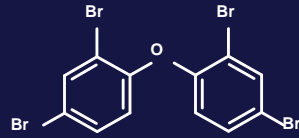
Pretreatment Procedure



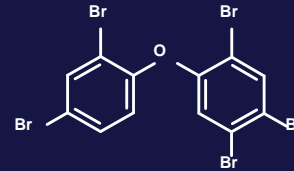
Analytes



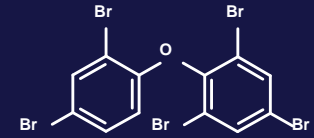
**2,4,4'-TrBDE
(BDE-28)**



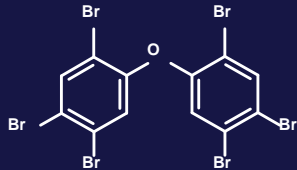
**2,2',4,4'-TeBDE
(BDE-47)**



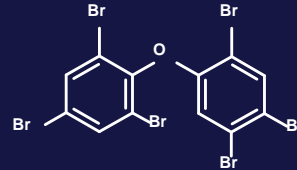
**2,2',4,4',5-PeBDE
(BDE-99)**



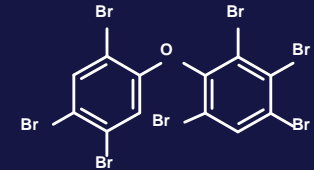
**2,2',4,4',6-PeBDE
(BDE-100)**



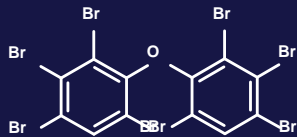
**2,2',4,4',5,5'-HxBDE
(BDE-153)**



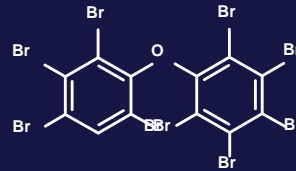
**2,2',4,4',5,6'-HxBDE
(BDE-154)**



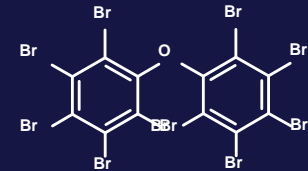
**2,2',3,4,4',5',6-HpBDE
(BDE-183)**



**2,2',3,3',4,4',6,6'-OcBDE
(BDE-197)**



**2,2',3,3',4,4',5,6,6'-NoBDE
(BDE-207)**



**2,2',3,3',4,4',5,5',6,6'-DeBDE
(BDE-209)**

LODs and Recoveries

LODs

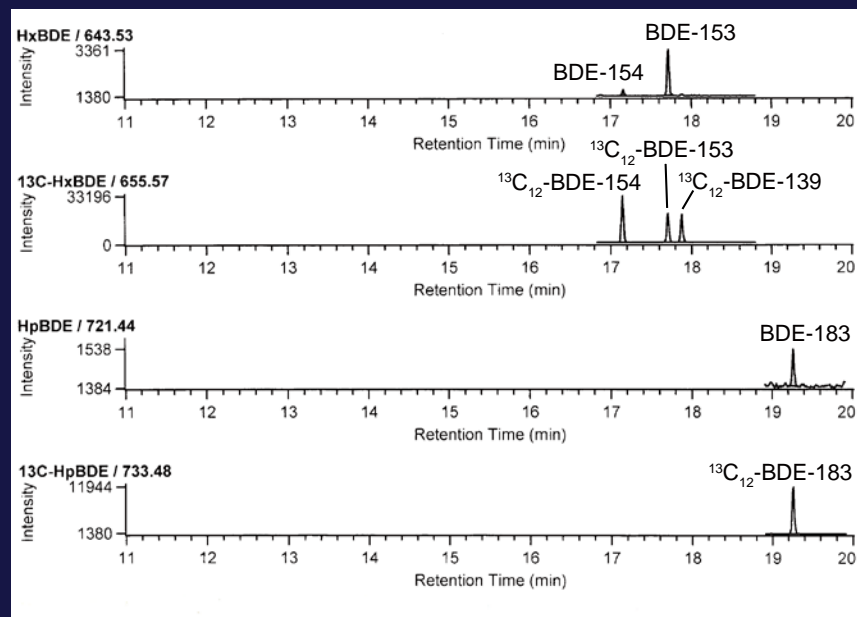
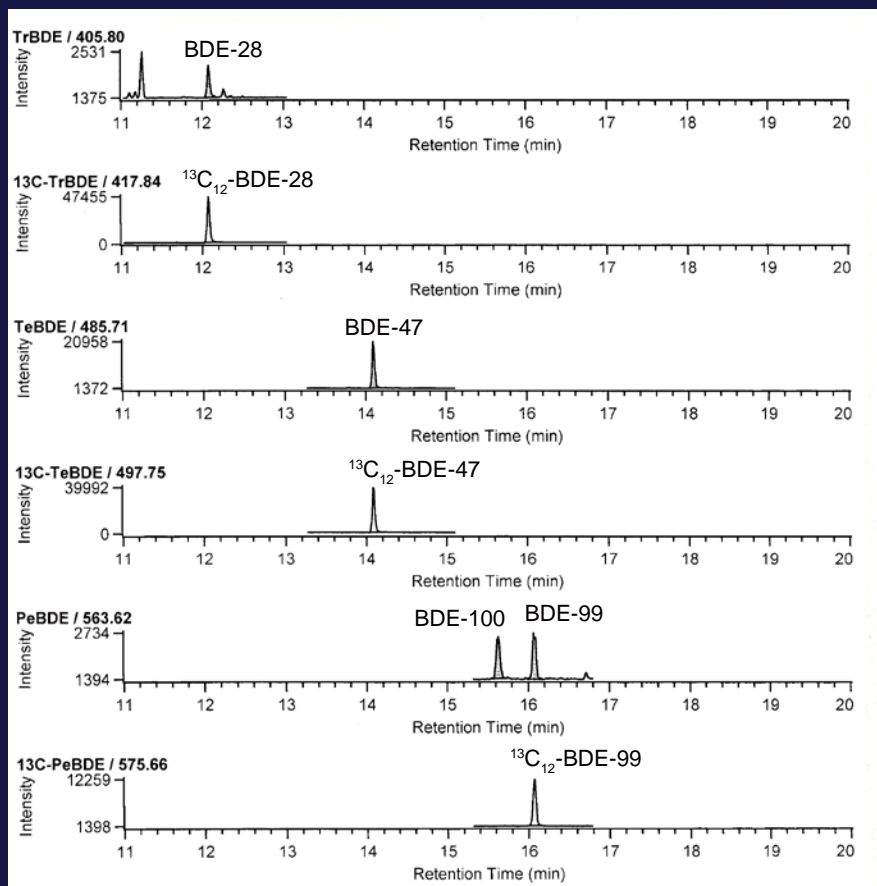
0.5 to 10 $\mu\text{g g}^{-1}$

Recoveries

- ✓ $^{13}\text{C}_{12}$ -labeled internal standards: 50–120%
- ✓ 10 native PBDEs: 90–115%* (RSDs: 1–10%)

*mean of corrected value with the recoveries of their respective $^{13}\text{C}_{12}$ -labeled internal standards

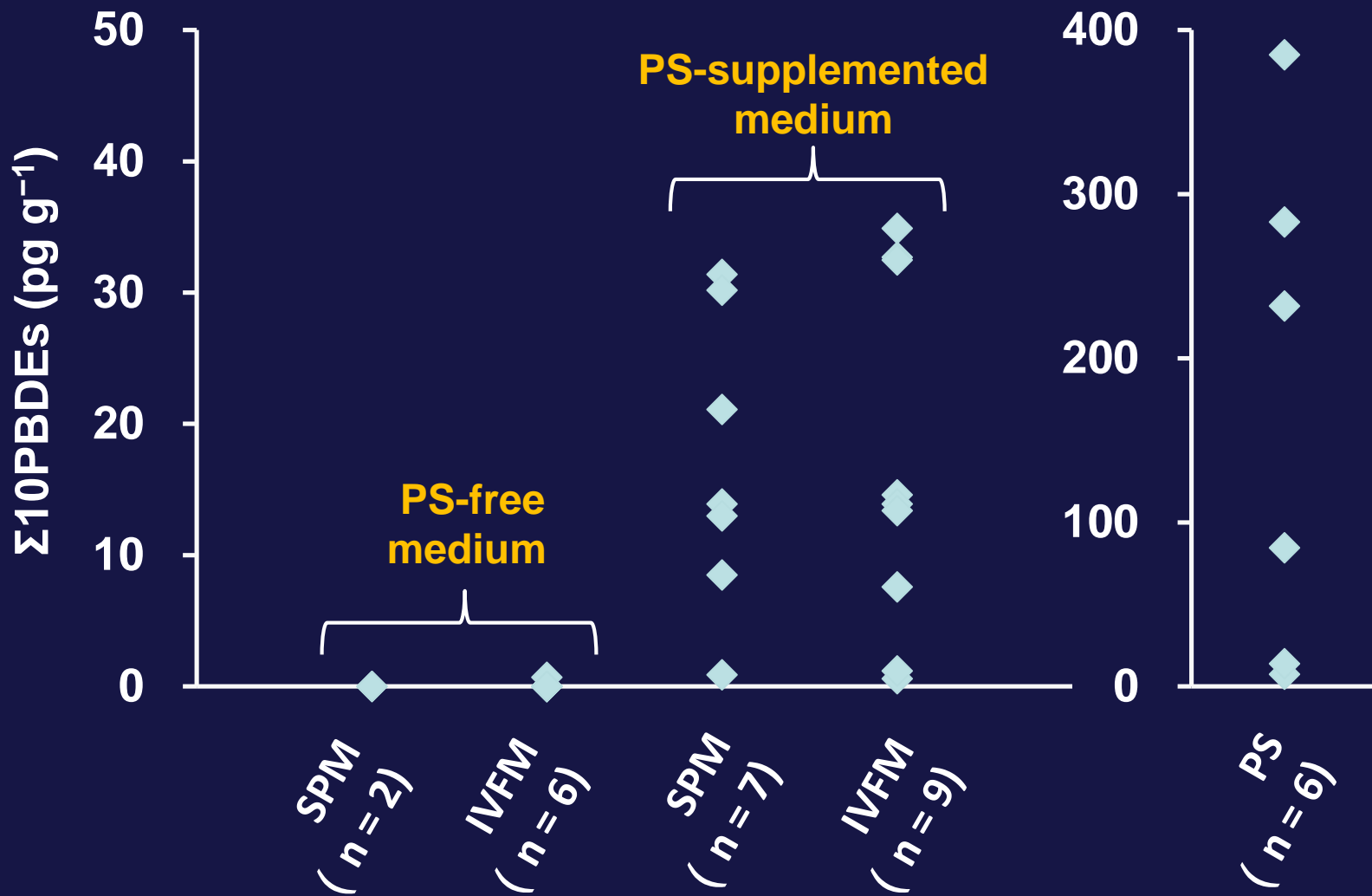
Chromatogram of PBDEs in the PS sample [code A035110]



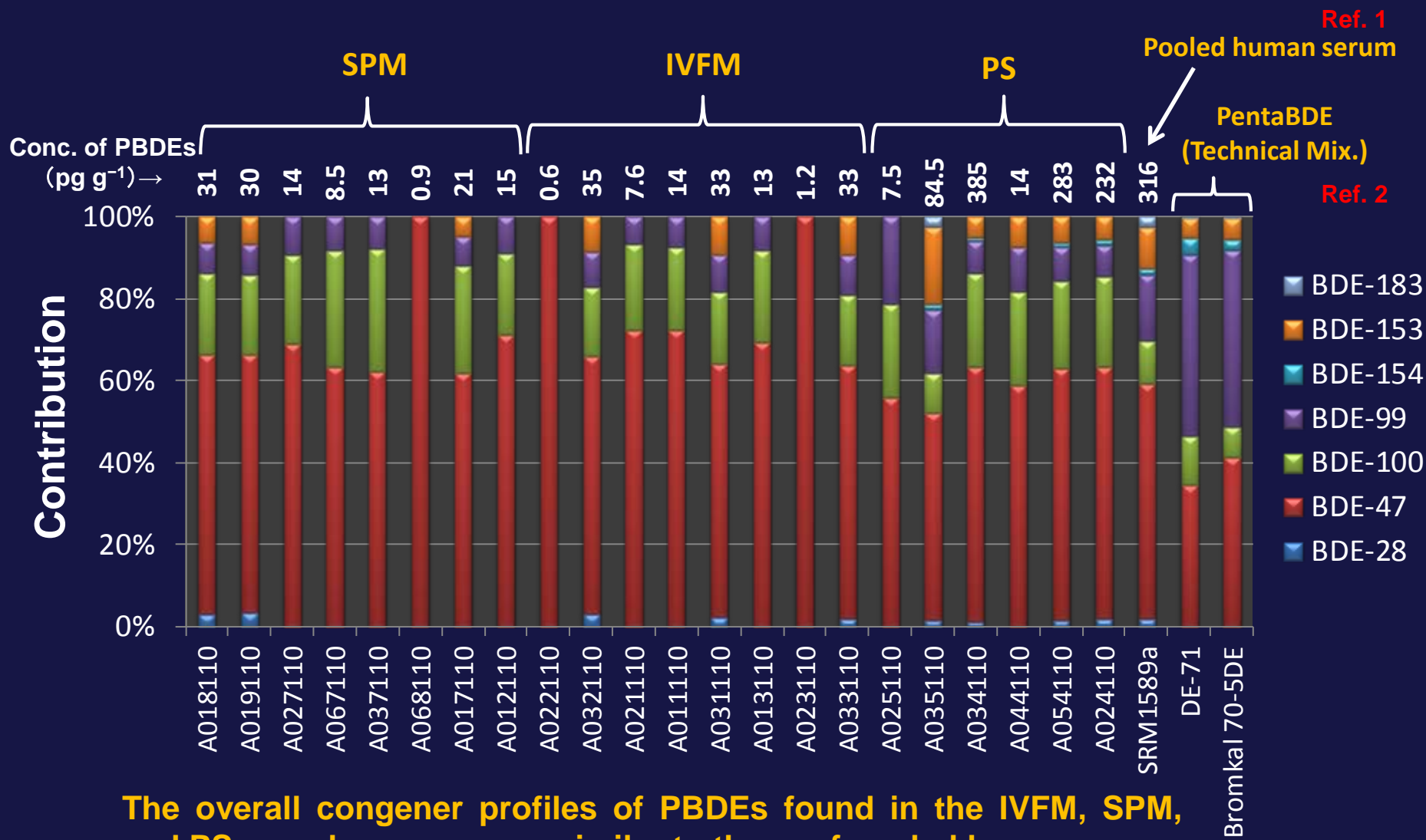
The dominant congeners found were
BDE-47, -100, -99, and -153

Four representative congeners of technical octaBDE and decaBDE mixtures (BDE-183, -197, -207, and -209) were not detected in any of the samples except for one; PS sample [code A035110] contained BDE-183 at 2 pg g⁻¹

Concentrations of PBDEs in media and PS samples



Comparison of congener profiles

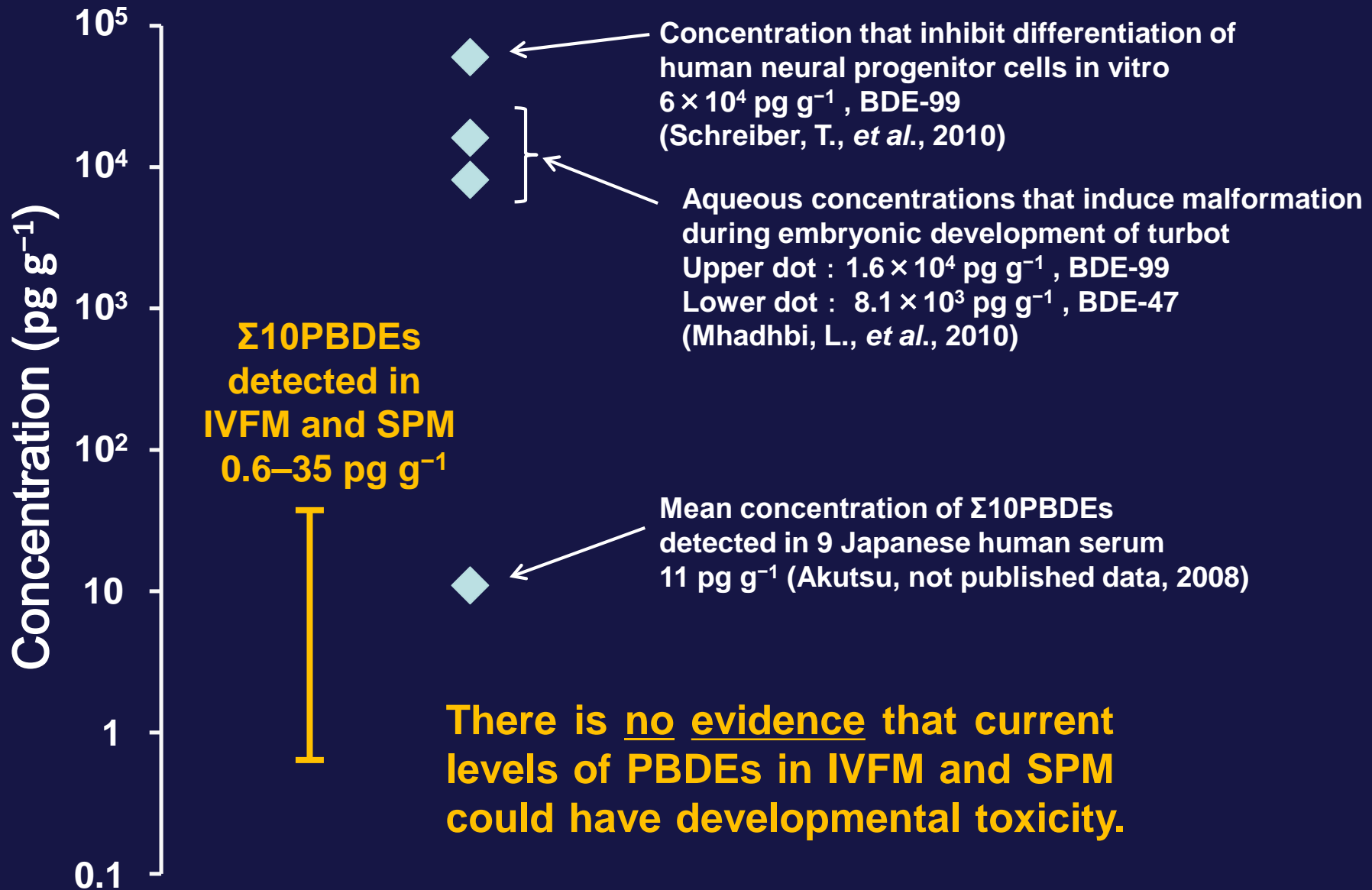


The overall congener profiles of PBDEs found in the IVFM, SPM, and PS samples were more similar to those of pooled human serum than to those of technical pentaBDE mixtures

Ref. 1) NIST, 2011

Ref. 2) La Guardia *et al.*, 2006

Comparison of the levels of PBDEs found in this study with the literature data regarding developmental toxicity





Conclusions

- ◆ Trace levels of PBDEs (0.6–385 pg g^{-1}) were detected in several IVF-related media and PSs.
- ◆ Supplementation with PS can be the potential cause of PBDE-contamination of IVFM and SPM.
- ◆ Human sperms, ova, and embryos might be exposed to PBDEs in the artificial cultivation environment during the IVF process.

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Detection of polybrominated diphenyl ethers in culture media and protein sources used for human in vitro fertilization

collaborators

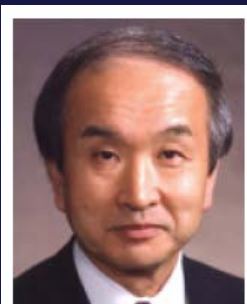


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