Management Plan on HBCD and its waste in Korea (Republic of)

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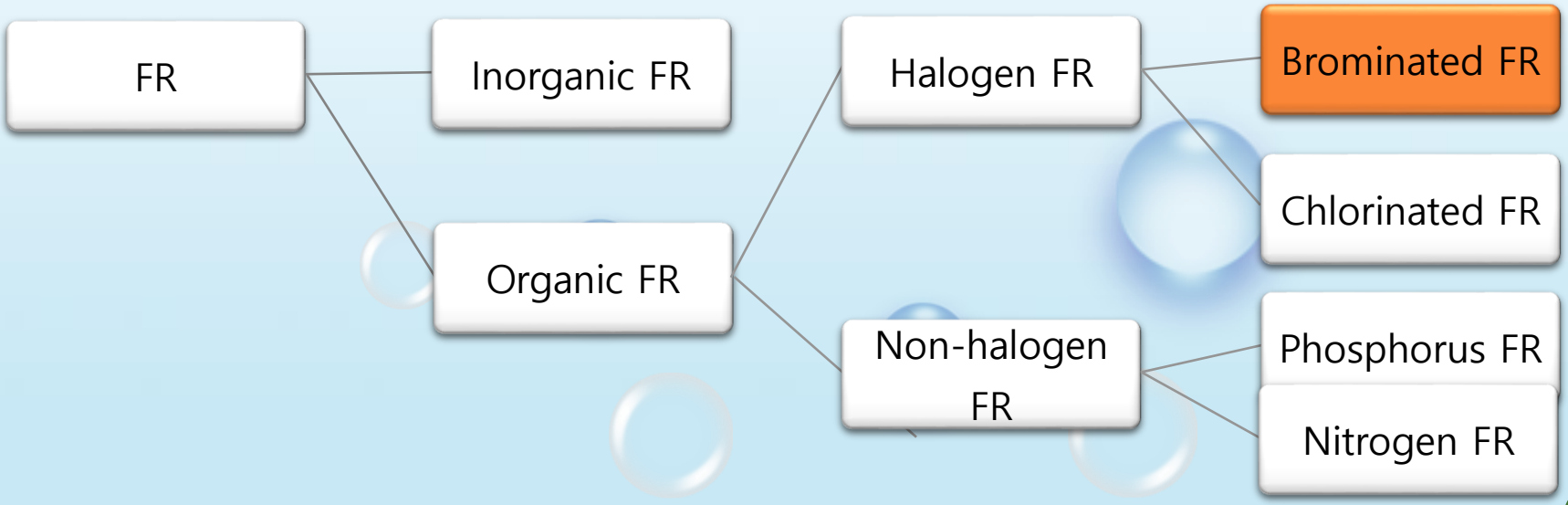
Contents

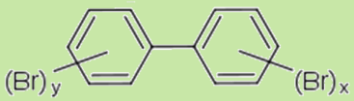
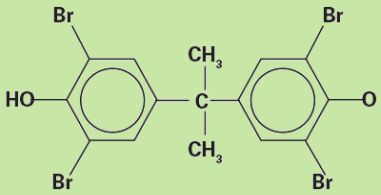
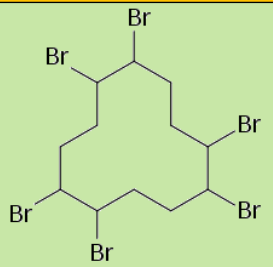
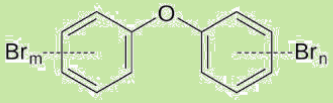
Introduction

- Petrochemicals : widely used (synthetic resins, fibers, rubber, etc.)
  → Easy to manufacture. Mass production system is established.
- Petrochemicals have a high risk of fire when heat is applying .
  → Added Flame Retardant [FR]
- Among FR, Brominated Flame Retardants [BFRs] account for about 40% of the global market with low price and high flame retardant effect.



Introduction

- The BFRs are widely available in several hundreds of types, including Polybrominated diphenyl ethers (PBDEs), Polybrominated biphenyls (PBBs), Hexabromocyclododecane (HBCD), and Tetrabromobisphenol A (TBBPA).
- The BRFs are excellent in versatility and economical efficiency, but may adversely affect human health and the environment.
- Toxicity of major BFRs

Type	PBDEs	TBBPA	HBCD	PBBs
Structure				
Cas No.	-	79-94-7	25637-99-4	-
Toxicity	Possibility of neurotoxicity and carcinogenesis	Found in breast milk and potentially hepatotoxic	Bio-concentration, neurotoxicity	Hypothyroidism, hepatic / renal toxicity

Source: BFR in Dust on Computers (THE CASE FOR SAFERCHEMICALS AND BETTER COMPUTER DESIGN), 2004.

Introduction

- Stockholm Convention
  → 4th COP (2009) : PBDEs are listed in the Annex as substances to be controlled.
  → 6th COP (2013) : Decided to add HBCDs in the Annex.

- The Basel Convention provides the information for BFRs, including technical guidelines for treating waste containing BRFs.

- In the EU, BFRs including HBCDs are restricted for use in accordance with WEEE Directive and RoHS, etc.

- As a party to these Convention, Korea tried to manage the waste containing BFRs according to the guideline of Basel Convention, RoHS, WEEE and ELV Directive.

- Management plan for HBCD including regulatory Levels and test method will be established Shortly.

Objectives of Study

Purpose

Perspective on Management of HBCD waste in Korea

Regulations for BFRs in Korea

- Regulations for waste-containing BFRs in Korea
- Regulations for baby products

Status of Waste contaminated with HBCD in Korea

- Usage of HBCD in Korea
- HBCD-containing Waste in Korea

Perspective on Management of HBCD in Korea

- Regulatory Levels of HBCD in Korea
- Test Method of HBCD in waste

II. Regulations for BFRs in Korea

Regulations for BFRs in Korea (Republic of)

Regulation	Department	Major content	Note
Chemical control act	Ministry of Environment	- Designation of hazardous substances - Pollutant Release and Transfer Register (PRTR) system	- Included 6 types of BRFs - Only Deca-BDE is managed in PRTR.
Act on Registration, Evaluation, etc. of Chemicals (AREC)	Ministry of Environment	- Designation of hazardous substances	- Included 6 types of BRFs
Persistent Pollutants Control Act	Ministry of Environment	- Designation of persistent organic pollutants	- Included 6 types of BRFs
Act on Resource Circulation of Electrical and Electronic Equipment and Vehicles	Ministry of Environment	- Restriction on the use of hazardous substances in electrical and electronic products	- 27 types of e-waste - Included 6 types of BRFs (PBBs, PBDEs)
Electrical Appliances Consumer Products Safety Control Act	Ministry of Trade, Industry and Energy	- Types of products subject to safety control	- Conducted hazard assessment according to AREC

Type of BFRs in Korean Regulations

Regulation	Target chemical substance (Cas. No.)
Chemical control act (6 types)	Octabromodiphenyl oxide (32536-52-0), Pentabromodiphenyl oxide (32534-81-9), 1,2-Dibromoethane(106-93-4), Polybrominated biphenyls; PBBs (59536-65-1), Tris(2,3-dibromopropyl)phosphate(126-72-7), 2,3-Dibromo-1-propanol(96-13-9)
Act on Registration, Evaluation, etc. of Chemicals (6 types)	
Persistent Pollutants Control Act (6 types)	Tetrabromodiphenyl ether (-), Pentabromodiphenyl ether (32534-81-9), Hexabromodiphenyl ether (-), Heptabromodiphenyl ether (-), Hexabromobiphenyl (-), Hexabromocyclododecane; HBCD (-)
Act on Resource Circulation of Electrical and Electronic Equipment and Vehicles (2 types)	Polybrominated biphenyls; PBBs (67774-32-7), Polybrominated diphenylethers; PBDEs (-)
Electrical Appliances Consumer Products Safety Control Act (4 types)	Polybrominated diphenylethers; PBDEs (-), 1,2-Dibromoethane (106-93-4), Tris(2,3-dibromopropyl) phosphate (126-72-7), Polybrominated biphenyls; PBBs (59536-65-1)
Special Act on the Safety of Products for Children (4 types)	
Food Sanitation Act	-

Regulations for baby products

- Baby may be sensitively affected by products contained chemical substances such as HBCD.
- The regulations for baby products containing brominated flame retardants (BFRs) are as follows.

List of BFR in Risk Assessment of Environmental Health Act

Hazardous substances	CAS No.
Polybrominated diphenylethers (PBDEs)	-
1,2-Dibromoethane	106-93-4
Tris(2,3-dibromopropyl) phosphate	126-72-7
Polybrominated biphenyls (PBBs)	59536-65-1

Standards for containers (Table ware, Baby bottle, etc.)

Hazardous substances	Standard (ppm)
Bisphenol A	0.6
Di-(2-ethylhexyl) phthalate (DEHP)	1.5
Di-n-butyl phetalate (DBP)	0.3
Benzylbutyl phethalate (BBP)	30

* Ref. article 7(1) of the Food sanitation act, 2016.

In Korea, HBCD needs to be added in the Act

III. Status of Waste contaminated with HBCD in Korea

The Status of Use for BFRs in Korea (2013)

- According to the result of the Korea Chemical Management Association in 2013, 17 kinds of BRFs were used in Korea.

- HBCD has 16 isomers. Two of them were used in Korea such as CAS No. 3194-55-6 and CAS No. 25637-99-4.

- Identification of HBCD

CAS No.	Identification of HBCD
3194-55-6	This number refers to 1,2,5,6,9,10-HBCD and is thus the most correct one from a chemical point of view
25637-99-4	This number refers to HBCD (without specifying the bromine positions) and is used by some industry for the commercial substance

Ref. European Chemical Agency, Member state committee support document for identification of HBCD and all major diastereoisomers identified as a substance of very high concern, 2008.

The Amount of Use for BFRs in Korea (2013)

Substance group	Substance	Generative name	CAS No.	Import[1] [ton]	Export [ton]	Usage (Final product] [ton]	Stock (ton)
PBDE	Decabromodiphenyl oxide	Deca-BDE, DBDPO	1163-19-5	1,938	127	1,405	406
HBCD (2 types)	1,2,5,6,9,10-Hexabromocyclododecane	HBCD	3194-55-6	1,927	701	1,226	0
	Hexabromocyclododecane	HBCD	25637-99-4	639	197	309	133
TBBPA	Tetrabromobisphenol	TBBPA	79-94-7	28,103	5,680	21,245	1,178
Others[2] (13 types)		-	-	38,530	26,095	12,435	0
Total (17 types)				40,433	32,800	36,621	1,252

1) Includes imports of raw material for synthesis of BFRs
2) CAS No. of others : 84852-53-9, 26265-08-7, 25713-60-4, 40039-93-8, 68928-70-1, 88497-56-7, 135229-48-0, 3278-89-5, 158725-44-1, 21850-44-2, 71342-77-3, 32588-76-4, 52434-90-9

* Ref. Korea Chemical Management Association, Study on the detailed status of the brominated flame retardant in Korea, 2015.

The amount of HBCD usage

Large Category	Medium Category	Details	Quantity (ton)	Ratio (%)
Building materials	Insulator	Extruded polystyrene foam	1,412	92.0
		Text product, R&D, etc.	0.3	0.0
Vehicle	Fabric	Car sheet, Door trim	97	6.3
Other uses	Other products	Packing material	16.8	1.1
		Lubricant	0.03	0.0
		The others, R&D	0.002	0.0
Textile products	Curtain	Blind, roll screen	8.6	0.6
Electrical and electronic product	Component	Home appliance	1.1	0.1
Total	-	-	1,536	100.0

* Ref. Korea Chemical Management Association, Study on the detailed status of the brominated flame retardant in Korea, 2015.

The Number of Company used HBCD in Korea (2013)

Industrial Code in Korea	Business classification	Importer	Intermediate manufacture	Final product	Total
13	Textile products manufacturing ;; except clothing	-	-	7	7
20	Manufacture of chemicals and chemical products ; except medicine	3	4	2	6
22	Plastics and rubber products Manufacturing	2	7	79	88
25	Fabricated Metal Product Manufacturing ; except machine, furniture	-	-	7	7
28	Electrical equipment Manufacturing	-	-	1	1
46	Wholesale trade agents and brokers	10	1	1	30
74	Facilities management and landscape services	-	-	1	1
96	Other personal service	2	-	-	2
Total		17	12	98	142

* Ref. Korea Chemical Management Association, Study on the detailed status of the brominated flame retardant in Korea, 2015.

The Content of HBCD in the Building Materials in Korea

Type	Number of sample	HBCDs (mg/kg)		
		Average±Standard deviation	Median	Range
Insulator	21	2,854.7±3,933.7	499.4	N.D. ~ 16,021.3
Paint	3	2.4±2.1	1.5	0.4 ~ 5.3
Walls &ceiling finishes materials	4	11.1±6.3	9.7	4.0 ~ 21.1
Glue	1	0.8±0.0	0.8	0.8
Wall paper	2	0.5±0.5	4.5	N.D. ~ 0.9
Decorative synthetic resin	2	2.1±2.1	2.1	N.D. ~ 4.1
Resist	1	N/D	N.D.	N.D.
Street furniture	2	13.2±1.2	13.2	1.2 ~ 25.2
Recycled materials	9	2,556.3±6,022.5	26.3	0.0 ~ 19,499.3

* N.D. : Not Detected.

* Ref. Ministry of Environment, Survey on BFRs among Building Materials, 2015.

The Content of HBCD in the Automobile Waste in Korea

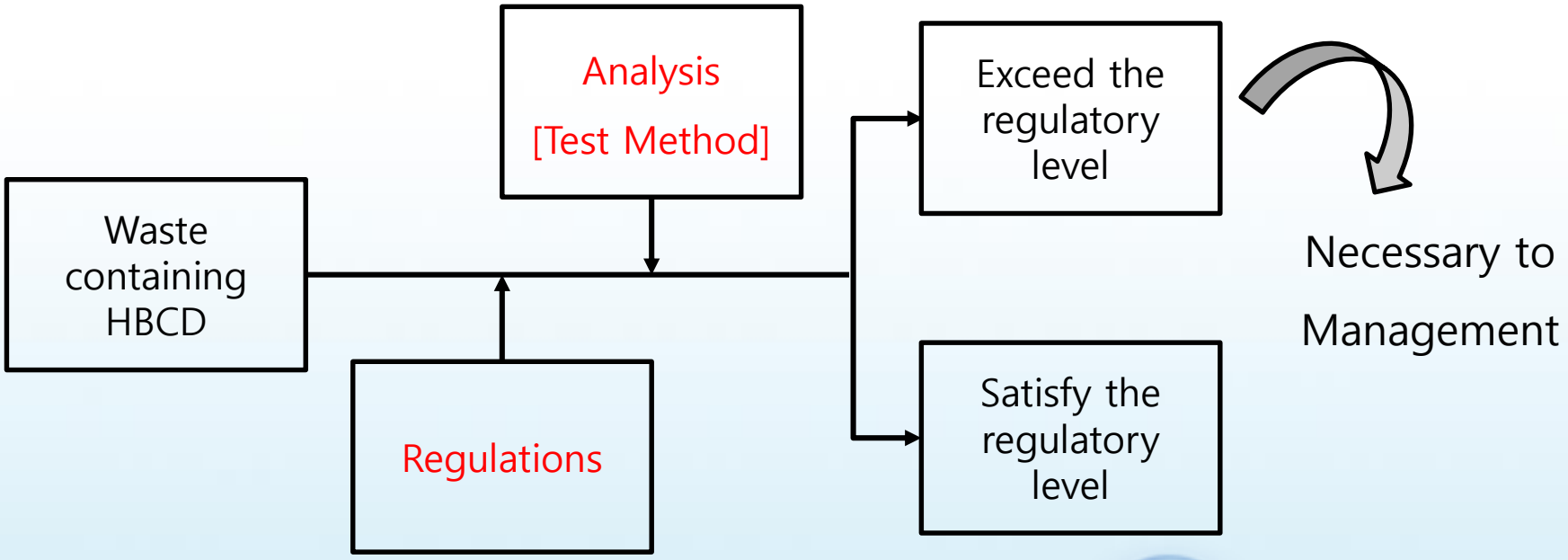
Type		Range of HBCDs (mg/kg)
Part of cars	ceiling (fiber)	N.D.
	Floor (fiber)	N.D.
ELV	ASR	N.D. ~ 167.34
	Sheet form	N.D. ~ 15.35
	Car seat	N.D. ~ 14.84
	Bumper crusher etc. (synthetic resin)	N.D.

* N.D. : Not Detected.

* Ref. National Institute of Environmental Research, Research of proposal content standard for the waste containing new POPs (II), 2016.

IV. Perspective on Management of HBCD in Korea

Tools for the Management of HBCD-containing Waste

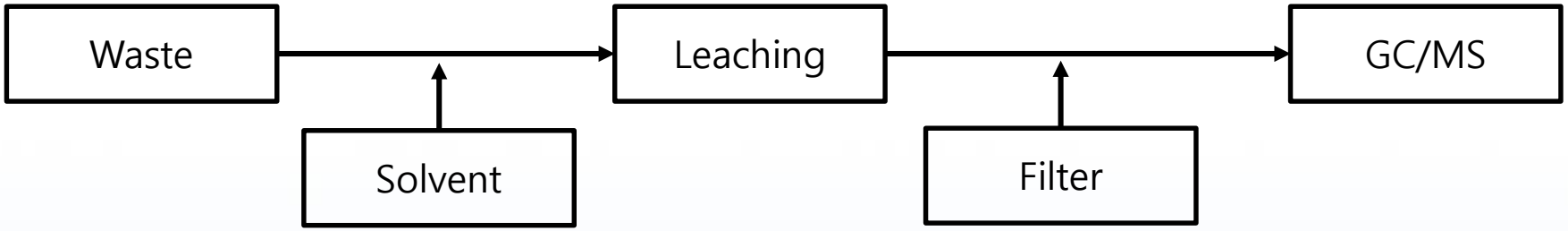


- Regulatory level for HBCD are not established in Korea.
- In Korea, the official test method for HBCD is not legally prescribed.

Regulatory Level of HBCD

Country or Organization	Regulatory Level	Reference
Basel Convention	Provisional definitions of low POP content : 100 or 1,000 mg/kg	Basel Convention COP-13 http://www.basel.int/
Stockholm Convention	Management standards for products : 100mg/kg	Stockholm convention, chm.pops.int, 2015
EU	Presence of no more than 100 mg/kg as an unintentional trace contaminant in substances, mixtures, articles or flame-retarded parts of articles. This is subject to review by the Commission by March 22, 2019	EU Directive 2016/293
EU	Low POP Centration Limits (LPCL) : 100 mg/kg	BIPRO, Study on waste-related issues of newly listed POPs and candidate POPs, 2011
Korea	Content in Product: 100 mg/kg (Draft) Lower concentration limit : 100 mg/kg (Draft) Upper concentration limit : 1,000 mg/kg (Draft)	National Institute of Environmental Research, Research of proposal content standard for the waste containing new POPs (II), 2016.

General Test Method for HBCD



Test Method of HBCD in Research conducted in Korea

Type of waste	Leaching	Solvent	Filter	Reference
Polymer substance	Soxhlet	n-hexane	Syringe filter	KS M 1072 (Determination of TBBPA and HBCD in polymer materials, 2016
Small appliances	Soxhlet, sonicator	Toluene	Multilayer silica gel	National Institute of Environmental Research, Survey on POPs (BFRs) in Waste of Electrical and Electronic Products, 2012
Plastic parts of household appliances	Soxhlet	Toluene	Syringe Filter	Song, M.H., et al., Case Study on Determination of the Level of New RoHS II Substances in Domestic Electronic and Electrical Equipment, Clean Technology, 17(2), 2011
Building materials	Soxhlet, Ultrasonic extraction	Dichloromethane, Toluene, etc.	Syringe filter	Ministry of Environment, Survey on BFRs among Building Materials, 2015

Need for an official test method of HBCD

Summary

01

- In Korea (Republic of), BFRs are managed by Regulations, but the regulations governing HBCD are insufficient.
- In particular, regulations for baby products were necessary because baby can be sensitive to chemicals such as HBCD.

02

- In Korea, two types of HBCD (CAS No. 3194-55-6 and 25637-99-4) are used. In 2013, 1,536 tons of HBCD were used in final products.
- HBCD is mainly used in building materials and vehicles.

03

- In Korea, there is no regulation for HBCD, but NIER recommends 100 mg/kg (draft) in waste.
- In this regulation (draft), insulator, recycled building materials among the waste generated from building materials and vehicle are exceeded the regulation (draft).
- It is necessary to establish management plan of HBCD.
- Also, the official test method for HBCD is not established, so it needs to be set up.

Thank you for Your Attention

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