DETOX Program

Hazardous Substances Fact Sheet

Chlorobenzes and -toluenes

Content

1 Background

Chlorobenzenes and chlorotoluenes have been used as solvents, dyeing-carriers, biocides, and as chemical intermediates. These chemicals are persistent and bio-accumulative. They commonly affect the liver, thyroid, and the central nervous system (CNS). Hexachlorobenzene (HCB), the most toxic and persistent chemical of this group, is also a hormone disruptor. Some chlorobenzenes and –toluenes are very toxic to aquatic organisms. Occupational exposure occurs primarily through breathing the chemicals. For consumers the greatest source of exposure to these chemicals is through the diet, especially foods containing fats of animal origin. Many chlorobenzenes are legally restricted already.

Chlorobenzenes and chlorotoluenes are mainly used as intermediates in the synthesis of other chemicals and as solvents[1]: They are being used as dyeing carriers, especially for dyeing of polyester and polyester blends and polyester accessories such as buttons, or leveling agents for dyeing, printing and coating of textile and leather materials including fibers, yarns and fabrics.[2] [3] Chlorobenzenes and –toluenes may also be found in textiles and leather materials acting as leveling agents, deodorizers, fumigants, degreasers, pesticides3 and in adhesive formulations.

2 Definition

- Chlorobenzenes are a group of twelve chemical substances:

No.	CAS Number	Name
	608-93-5	Pentachlorobenzene (PCB)
	120-82-1	1,2,4-trichlorobenzene
	118-74-1	Hexachlorobenzene (HCB)
	108-90-7	Monochlorobenzene
	108-70-3	1,3,5-trichlorobenzene
	95-50-1	1,2-dichlorobenzene
	634-66-2	1,2,3,4-tetrachlorobenzene
	541-73-1	1,3-dichlorobenzene
	634-90-2	1,2,3,5-tetrachlorobenzene
	106-46-7	1,4-dichlorobenzene
	95-94-3	1,2,4,5-tetrachlorobenzene
	87-61-6	1,2,3-trichlorobenzene

- Chlorotoluenes are, for example:

No.	CAS Number	Name
	95-49-8	2-chlorotoluene
	108-41-8	3-chlorotoluene
	106-43-4	4-chlorotoluene
	32768-54-0	2,3-dichlorotoluene

[1] ZDHC, undated. Chlorobenzenes. Online available: http://www.roadmaptozero.com/df.php?file=pdf/Chlorobenzenes.pdf
[2] ZDHC, undated. Chlorobenzenes. Online available: http://www.roadmaptozero.com/df.php?file=pdf/Chlorobenzenes.pdf
[3] ZDHC: MRSL 2014

	95-73-8	2,4-dichlorotoluene

3 Legal Aspects

Within the EU PCB and HCB are classified as 'priority hazardous substances' and the listed Trichlorobenzenes as priority substance under regulations requiring measures to be taken to eliminate their pollution of surface waters. PCB and HCB are also listed as 'persistent organic pollutants' for global restriction under the Stockholm Convention and, in line with this, they are prohibited or scheduled for reduction and eventual elimination in Europe.[3]

Legislation around the world restricts the use of some chlorobenzenes in the production of apparel, footwear and accessories.[4]

Pentachlorobenzene (PCB) is listed as Persistant Organic Pollutant (POP) in the Stockholm Convention which bans its production, placing on the market and use[5].

Suppliers of the REWE Group must assure that they produce in full accordance with the legal requirements of the country where the production takes place, and the legal provisions of the European Union regarding final products. A comprehensive list with international regulation for individual hazardous substances can be found on the website of the American Apparel & Footwear Association's (AAFA).[6]

4 Hazardous Properties and Exposure

4.1 Hazardous Properties

Chlorobenzenes and –toluenes can affect the liver, thyroid, and CNS. The hazardous properties depend on the type of chlorobenzene or chlorotoluenes. Exposure to chlorobenzenes may cause the development of different types of cancer[7]. Hexachloro-benzene (HCB), the most toxic and persistent chemical of this group, is also a hormone disruptor.[8] The International Agency for Research on Cancer (IARC) classified hexachlorobenzene as "possibly carcinogenic to humans" (Group 2B)[9]. Chlorobenzenes potentially cause anesthetic effects and liver, kidney and central nervous system damage[10]. Some chlorobenzenes are toxic by inhalation or skin contact.

Chlorobenzenes are persistent and bioaccumulative in the environment. Some chlorobenzenes and chlorotoluenes can be very toxic to aquatic organisms and may cause long-term adverse effects in the aquatic environment[11,12]. Chlorobenzenes are volatile organic compounds (VOC)[13].

[4] ZDHC, undated. Chlorobenzenes. Online available: http://www.roadmaptozero.com/df.php?file=pdf/Chlorobenzenes.pdf
[5] European Commission 2012. NINTH MEETING OF THE COMPETENT AUTHORITIES FOR THE IMPLEMENTATION OF REGULATION (EC) NR 850/2004 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL ON PERSISTENT ORGANIC POLLUTANTS
[6] https://www.wewear.org/rsl/ https://www.wewear.org/assets/1/7/RSL_v16_final_UPLOAD.pdf
[7] ZDHC, undated. Chlorobenzenes. Online available: http://www.roadmaptozero.com/df.php?file=pdf/Chlorobenzenes.pdf
[8] Muthu, S.S.: Roadmap to sustainable textiles and clothing, Hong Kong, 2014
[9] IARC. HEXACHLOROBENZENE. Online available: http://monographs.iarc.fr/ENG/Monographs/vol79/mono79-18.pdf
[10] EPA, undated.Technical Factsheet on: CHLOROBENZENE http://water.epa.gov/drink/contaminants/basicinformation/historical/upload/Archived-Technical-Fact-Sheet-on-Chlorobenzene.pdf
[11] ZDHC, undated. Chlorobenzenes. Online available: http://www.roadmaptozero.com/df.php?file=pdf/Chlorobenzenes.pdf
[12] RIVM 2009. Environmental risk limits for chlorotoluenes (o-chlorotoluene, m-chlorotoluene, p-chlorotoluene) Online available: http://www.rivm.nl/en/Documents_and_publications/Scientific/Reports/2009/juli/Environmental_risk_limits_for_chlorotoluenes_o

Hazard statements from a safety data sheet for pentachlorobenzene[14]:

Classification according to Regulation (EC) No 1272/2008

- H228 Flammable solids (Category 1)
- H400 Acute aquatic toxicity (Category 1)
- H410 Chronic aquatic toxicity (Category 1)
- H302 Acute toxicity, Oral (Category 4)

The substance hexachlorobenzene (HCB)[15] can serve as an example for the effects of Chlorobenzes and -toluenes: HCB was formerly synthesized and used as a pesticide but this use is now banned in most countries. However, hexachlorobenzene is still formed as a by-product in the manufacture of other chemicals, like solvents and pesticides, and in combustion processes.

Hexachlorobenzene is a toxic, persistent, and bioaccumulative chemical that is found in a big part of the natural and urban environment, including air, water and soil. Some concentrations detected are sufficient to result in adverse health and environmental effects. Hexachlorobenzene degrades slowly in air and, consequently, undergoes long-range atmospheric transport. It is classified as "possibly carcinogenic to humans" (Group 2B)[16]. Besides being a probable ~~as~~ human carcinogen, it can cause[17]:

- changes in the hemoglobin production
- damage to the nervous system
- skin rashes
- liver damage
- developmental and reproductive disorders.

HCB is known to bioaccumulate in the fat of living organisms as a result. It is very persistent[18].

4.2 Exposure

The risk of a chemical for human health and the environment is not only determined by its toxicity but by the degree of exposure, too.

a) Workers

Occupational exposure to chlorobenzenes and chlorotoluenes occurs during its production and use in industry and agriculture.[19] Occupational exposure occurs primarily through inhalation. Increased levels of chlorobenzene were found in the air at several industrial sites during normal operations[20].

_chlorotoluene_m_chlorotoluene_p_chlorotoluene?sp=cml2bXE9ZmFsc2U7c2VhcmNoYmFzZT00Njk1MDtyaXZtcT1mYWxzZTs=&pagenr=4696

[13] Helmhotz-Zentrum für Umweltforschung Leipzig 2009. Chlorobenzene induces oxidative stress in human lung epithelial cells in vitro.

[14] MEGS. Chlorobenzene – Material Safety Data Sheet. Online available: http://www.megs.ca/MSDS/Pdf/Chlorobenzene.PDF

[15] COMMISSION FOR ENVIRONMENTAL COOPERATION, undated. Dioxins, furans and hexachlorobenzene. Online available: http://www.cec.org/Page.asp?PageID=749&SiteNodeID=1243

[16] IARC. HEXACHLOROBENZENE. Online available: http://monographs.iarc.fr/ENG/Monographs/vol79/mono79-18.pdf

[17] COMMISSION FOR ENVIRONMENTAL COOPERATION, undated. Dioxins, furans and hexachlorobenzene. Online available: http://www.cec.org/Page.asp?PageID=749&SiteNodeID=1243

[18] Persistent organic pollutant toolkit 1995. Hexachlorobenzene (HCB). Online available: http://www.popstoolkit.com/about/chemical/hcb.aspx

[19] IARC. HEXACHLOROBENZENE. Online available: http://monographs.iarc.fr/ENG/Monographs/vol79/mono79-18.pdf

[20] Agency for Toxic Substances and Disease Registry, U.S. Dept. of Health and Human Services, undated. Chlorobenzene. Online available: http://www.eco-usa.net/toxics/chlorobenzene.shtml

b) Environment

Chlorobenzenes and -toluenes enter the atmosphere from emissions connected with its use as a solvent in pesticide formulations and as an industrial solvent. The major release to air stem from the metal industry and chemical industry[21]. They can be expected to leach into the groundwater.[22] Other sources for ambient releases are from municipal landfills, waste treatment and disposal facilities.[23]

c) Consumers

For most people, the greatest source of exposure to these chemicals is diet, especially food containing fats of animal origin. People may also be exposed through contaminated air, water or soil or by living near industries that release them to the environment.[24] Humans can absorb chlorobenzenes by breathing contaminated air, by drinking contaminated water or eating food contaminated with chlorobenzene. Absorption can also occur through the skin.[25]

5 Alternative and Substitute Substances

All alternatives used as substitutes for hazardous substances must be free of hazardous properties. Some tools to identify hazardous properties of chemicals and to find safer alternatives are listed in the factsheet about hazardous substances.

- Safer alternatives to chlorobenzene listed by ZDHC are: Dyeing carriers composed of aromatic esters and substituted phenols, and also Benzyl benzoate, CAS 120-51-4, which is a good alternative dyeing carrier requiring no additional solvents for dilution[26].

In order to minimize environmental and health effects and to use resources efficiently the use of best available technology (BAT[27]) in textiles industry is a standard requirement.

Please refer to the factsheet about hazardous substances for further information on alternatives. In addition, the Chemsec Textile Guide offers access to a list of hazardous and safer surfactants and should be taken into account when a chemical inventory is prepared[28].

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[21] European Commission 2012. NINTH MEETING OF THE COMPETENT AUTHORITIES FOR THE IMPLEMENTATION OF REGULATION (EC) NR 850/2004 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL ON PERSISTENT ORGANIC POLLUTANTS

[22] EPA, undated.Technical Factsheet on: CHLOROBENZENE http://water.epa.gov/drink/contaminants/basicinformation/historical/upload/Archived-Technical-Fact-Sheet-on-Chlorobenzene.pdf

[23] New York State, undated. Uses, Sources and Potential Exposure to Toxic Air Pollutants. Online available: http://www.dec.ny.gov/chemical/89942.html

[24] COMMISSION FOR ENVIRONMENTAL COOPERATION, undated. Dioxins, furans and hexachlorobenzene. Online available: http://www.cec.org/Page.asp?PageID=749&SiteNodeID=1243

[25] Bureau of Environmental Health Assessment Section 2009. Chlorobenzene. Online available: http://www.odh.ohio.gov/~/media/ODH/ASSETS/Files/eh/HAS/chlorobenzene.ashx

[26] ZDHC, undated. Chlorobenzenes. Online available: http://www.roadmaptozero.com/df.php?file=pdf/Chlorobenzenes.pdf

[27] European Commission: Integrated Pollution Prevention and Control (IPPC) Reference Document on Best Available Techniques for the Textiles Industry July 2003

[28] ChemSec, undated. Textiles come with a toxic footprint. http://textileguide.chemsec.org/find/textiles-come-with-a-toxic-footprint/