

DETOX Program
Hazardous Substances Fact Sheet

Chlorophenols

Content

1	Background.....	3
2	Definition.....	3
3	Legal Aspects.....	3
4	Hazardous Properties and Exposure.....	4
4.1	Hazardous Properties.....	4
4.2	Exposure.....	45
5	Sources for Chlorophenols in production of textiles.....	5
6	Alternative and Substitute Substances.....	56

1 Background

Chlorophenols are a group of chemicals being used as an intermediate for the synthesis of dyestuffs, polymers and biocides for the textiles industry. In some chemical preparations they may still be present as impurities.

Some chlorophenols are used as biocides, fungicides and preservatives, e.g. for formulations that are based on water or organic materials such as starch based sizing agents. They can act as a fungicide or pesticide to prevent molding or damages caused by insects during transport and storage of textile and leather material. The use of chlorophenols is restricted by legislation in many countries.

Some chlorophenols are highly toxic and suspect to cause cancers. Chlorophenols can enter the environment through industrial discharges and particularly be found in industrial charged soils but also water and sediments.

2 Definition

Chlorophenols are a group of substances with 1 to 5 chlorine atoms bonded to the carbons in the benzene ring of the phenol molecule including all isomers of mono-, di-, tri-, tetra- and penta-chlorophenol. Some important components of the group are:

CAS Number	Name
87-86-5	Pentachlorophenol (PCP)
25167-83-3	Tetrachlorophenol (TeCP)
25167-82-2	Trichlorophenol (TriCP)
4901-51-3	2,3,4,5-Tetrachlorophenol
58-90-2	2,3,4,6-Tetrachlorophenol
935-95-5	2,3,5,6-Tetrachlorophenol

3 Legal Aspects

Since 1991, all pentachlorophenol (PCP)-containing products sold and used in the EU have been imported (EU production was banned under Directive 76/769/EEC). Today, REACH prohibits the marketing and use of PCP and its salts and esters in products in a concentration equal to or greater than 0.1% in the EU.¹

Suppliers of the REWE Group must ensure 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 are met. A comprehensive list with international regulation for individual hazardous substances can be found on the website of the American Apparel & Footwear Association (AAFA).²

¹ COMMISSION REGULATION (EC) Regulation 1907/2006 (REACH), Annex XVII

² <https://www.wewear.org/rsl/> https://www.wewear.org/assets/1/7/RSL_v16_final_UPLOAD.pdf

4 Hazardous Properties and Exposure

4.1 Hazardous Properties

Some chlorophenols are highly toxic by inhalation or skin contact. Chlorophenols like PCP may cause cancer. Dermal exposure to chlorophenol fungicides increases the risks of non-Hodgkin's lymphoma, multiple myeloma and kidney cancer³. Both nasal and nasopharyngeal cancers were significantly associated with chlorophenol exposure in occupational sites⁴.

Several chlorophenols are persistent and bioaccumulative, properties that increase their hazard potential. Some chlorophenols are highly toxic to aquatic organisms and causing long-term adverse effects in the aquatic environment⁵. Chlorophenols can form highly toxic chlorinated dibenzodioxins under conditions of heat or when incinerated.

PCP can be taken as an example: Pentachlorophenol is very toxic. Acute inhalation results in neurological, blood and liver effects just as eye irritation. Chronic (long-term) exposure to pentachlorophenol by inhalation lead to chronic effects on the respiratory tract, blood, kidney, liver, immune system, eyes, nose, and skin. The US-EPA has classified pentachlorophenol as a Group B2, "probable human carcinogen"⁶. PCP is highly toxic to aquatic organisms.

The hazard statements from a safety data sheet for pentachlorophenol (PCP) reflect the spectrum of harmful properties of this substance⁷:

Name	Statement
H301	Toxic if swallowed.
H311	Toxic in contact with skin.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H330	Fatal if inhaled.
H335	May cause respiratory irritation.
H351	Suspected of causing cancer.
H410	Very toxic to aquatic life with long lasting effects.

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

³ WorksafeBC 2005. Cancer and Occupational Exposure to Pentachlorophenol and Tetrachlorophenol. Online available: http://www.worksafebc.com/contact_us/research/research_results/res_60_10_190.asp

⁴ Department of Environmental and Occupational Health, Rollins School of Public Health, Emory University, Atlanta, Georgia, et al. 2000. Occupational exposure to chlorophenol and the risk of nasal and nasopharyngeal cancers among U.S. men aged 30 to 60. Online available: [http://onlinelibrary.wiley.com/doi/10.1002/\(SICI\)1097-0274\(200005\)37:5%3C532::AID-AJIM9%3E3.0.CO;2-A/abstract;jsessionid=8908913F43F06ED641238D648A58743Dresults/res_60_10_190.asp](http://onlinelibrary.wiley.com/doi/10.1002/(SICI)1097-0274(200005)37:5%3C532::AID-AJIM9%3E3.0.CO;2-A/abstract;jsessionid=8908913F43F06ED641238D648A58743Dresults/res_60_10_190.asp)

⁴ Department of Environmental and Occupational Health, Rollins School of Public Health, Emory University, Atlanta, Georgia, et al. 2000. Occupational exposure to chlorophenol and the risk of nasal and nasopharyngeal cancers among U.S. men aged 30 to 60. Online available: [http://onlinelibrary.wiley.com/doi/10.1002/\(SICI\)1097-0274\(200005\)37:5%3C532::AID-AJIM9%3E3.0.CO;2-A/abstract;jsessionid=8908913F43F06ED641238D648A58743D.f02t03](http://onlinelibrary.wiley.com/doi/10.1002/(SICI)1097-0274(200005)37:5%3C532::AID-AJIM9%3E3.0.CO;2-A/abstract;jsessionid=8908913F43F06ED641238D648A58743D.f02t03)

⁵ ZDHC, undated. Chlorophenols. Online available: <http://www.roadmaptozero.com/df.php?file=pdf/Chlorophenols.pdf>

⁶ EPA 2000. Pentachlorophenol. Online available: <http://www.epa.gov/ttnatw01/hlthef/pentachl.html>

⁷ <http://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=en&language=de&productNumber=P2604&brand=ALDRICH&PageToGoToURL=http%3A%2F%2Fwww.sigmaaldrich.com%2Fcatalog%2Fsearch%3Fterm%3DPentachlorophenol%26interface%3DProduct%2520Name%26N%3D0%2B%26mode%3Dmode%2520matchpartialmax%26lang%3Dde%26region%3DDE%26focus%3DproductN%3D0%2520220003048%2520219853286%2520219853101>

Inhalation and skin contacts are the most likely route of exposure at work places⁸. All chemical preparations and materials containing chlorophenols may pose a health hazard.

b) Environment

Chlorophenols may be emitted into the environment at chemical factories or facilities where chlorophenols are used in production processes of chemical compounds and formulations, as biocides, or from final products (e.g. laundry of textiles).⁹ In many surface waters like lakes and rivers chlorophenols were detected¹⁰. They have been found in groundwater¹¹ and drinking water as well¹².

c) Consumers

Contaminated food, skin contacts with products containing chlorophenols and of inhalation of polluted air are important ways of intake.¹³ Pentachlorophenol (PCP) has been detected in drinking water and food. Pentachlorophenol and its breakdown products were repeatedly detected in blood, urine, and tissues.¹⁴

5 Sources for chlorophenols in production of textiles

a) Processing chemicals used in the factory

Chlorophenols are used as pesticides and preservatives in textiles, packaging materials and leather materials to prevent mold spots or damages through insects. Raw materials which are treated accordingly may also be a source of chlorophenols. Preservatives in print pastes and in chemical formulations based on natural components are a further potential area of application.

b) Contamination

Chlorophenols are important intermediate chemicals in the production of a broad range of other chemical formulations used in the textile industry including dyestuff synthesis. Therefore they can be present as impurities in chemical formulations like dyestuffs. Also contaminated water can be a source for pollution.

6 Alternatives 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.

⁸ U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, Public Health Service Agency for Toxic Substances and Disease Registry 1999. Public Health Statement for Chlorophenols. Online available: <http://www.atsdr.cdc.gov/phs/phs.asp?id=939&tid=195>

⁹ OSPAR Commission 2004. Pentachlorophenol. Online available: http://www.ospar.org/documents/dbase/publications/p00138/p00138_bd%20on%20pentachlorophenol.pdf

¹⁰ U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, Public Health Service Agency for Toxic Substances and Disease Registry 1999. Public Health Statement for Chlorophenols. Online available: <http://www.atsdr.cdc.gov/phs/phs.asp?id=939&tid=195>

¹¹ Kimmo T., Jaakko A. Puhakka 1994. Bioremediation of chlorophenol contaminated ground water. Online available: <http://www.tandfonline.com/doi/abs/10.1080/09593339409385489?journalCode=tent20>

¹² WHO 2003. Chlorophenols in Drinking-water. Online available: http://www.who.int/water_sanitation_health/dwq/chemicals/chlorophenols.pdf

¹³ U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, Public Health Service Agency for Toxic Substances and Disease Registry 1999. Public Health Statement for Chlorophenols. Online available: <http://www.atsdr.cdc.gov/phs/phs.asp?id=939&tid=195>

¹⁴ EPA 2000. Pentachlorophenol. Online available: <http://www.epa.gov/ttnatw01/hlthef/pentachl.html>

Safer chlorophenol alternatives listed by ZDHC¹⁵:

- Biocide, preservative and mold control products that do not contain chlorophenols, for example Zinc-2-pyridinethiol-N-oxide and 2,2'-dihydroxy-5,5'-dichlorodiphenylmethane-ester
- Proper management to prevent conditions that allow mold to grow can minimize the need for preservative chemicals.

In order to minimize environmental and health effects and to use resources efficiently the use of best available technology (BAT¹⁶) in textiles industry is a standard requirement.

Diligent selection of chemical products such as dyestuffs and auxiliaries that are declared to be free from chlorophenols is essential for proper chemical management under the DETOX Program.

The Chemsec Textile Guide offers access to a list of hazardous and safer chemicals and should be taken into account for the selection and purchase of chemical products¹⁷.

¹⁵ ZDHC, undated. Chlorophenols. Online available: <http://www.roadmaptozero.com/df.php?file=pdf/Chlorophenols.pdf>

¹⁶ European Commission: Integrated Pollution Prevention and Control (IPPC) Reference Document on Best Available Techniques for the Textiles Industry July 2003

¹⁷ <http://textileguide.chemsec.org/find/textiles-come-with-a-toxic-footprint/>