DETOX Program

Hazardous Substances Fact Sheet

Phthalates

Content

1 Background

Phthalates are a group of chemicals most commonly used in PVC-based products and other plastics. These hard polymers become soft and flexible when plasticisers as phthalates are added[1]. Phthalates are often used in high concentrations and can make up to 60% of the softened material. They are used in artificial leather, rubber/latex, waterproof coatings, printing plastisols, dyes etc.
There are numerous phthalates and they show different harmful effects on health. Some have an effect on the hormonal system, others on the liver. DEHP, a common softener, was classified by the European Union as “toxic for reproduction”. Many phthalates have a potential to bioaccumulate in food and in the human body.

Phthalates are used as polymer-plasticizers because they have softening and elastic effects on plastic materials, especially PVC[2]. In the apparel industry some applications are flexible plastic components (e.g., PVC), print pastes, adhesives, plastic buttons, plastic sleevings, or polymeric coatings[3]. They are also widely used in other products such as toys, flooring materials, electrical products, shower curtains, packaging or shoes.[4]

2 Definition

Most phthalates with known hazardous properties belong to the group of ortho-phthalates (esters of o-phthalic acid). Some of them are dimethylphthalate (DMP), diethylphthalate (DEP), diisobutylphthalate (DIBP), n-butylbenzylphthalate (BBP), di-2-(ethyl-hexyl-)phthalate (DEHP), di-n-octylphthalate (DOP), diisononylphthalate (DINP) and diisodecylphthalate (DIDP)[5]. Phthalates typically are chemically rather stable liquids that do not dissolve well in water but easily dissolve in many polymers.

3 Legal Aspects

The EU Directive 2005/84/EC took effect in 2007 and set the limits of 6 phthalates in toys and childcare products. Since Annex XVII of REACH came into force in 2009, the Directive 2005/84/EC was replaced by REACH regulation. All of the following 6 substances have been added to the REACH Restriction List[6]:

- Di-2-ethylhexyl phthalate(DEHP)
- Dibutyl phthalate (DBP)
- Benzylbutyl phthalate(BBP)
- Diisononyl phthalate (DINP)
- Di-n-octyl phthalate (DNOP)
- Diisodecyl phthalate (DIDP)

[1] http://www.greenpeace.org/international/en/campaigns/detox/fashion/about/eleven-flagship-hazardous-chemicals/#a1
[2] Chemical Inspection and Regulation Services (CIRS), undated. Phthalates Testing | EU Directive 2005/84/EC. Online available: http://www.cirs-reach.com/Testing/Phthalates_Testing.html
[3] ZDHC: MRSL 2014 http://www.roadmaptozero.com/df.php?file=pdf/MRSL.pdf
[4] Chemical Inspection and Regulation Services (CIRS), undated. Phthalates Testing | EU Directive 2005/84/EC. Online available: http://www.cirs-reach.com/Testing/Phthalates_Testing.html
[5] http://umweltlexikon.katalyse.de/phthalsaeureester/
[6] http://www.cirs-reach.com/Testing/Phthalates_Testing.html

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).[7]

4 Hazardous Properties and Exposure

4.1 Hazardous Properties

Various phthalates show different harmful effects on health – examples are effects on the endocrine (hormonal) system, or liver defects.[8] Studies have shown that men's sperm reduction over the past few decades may be related to the use of phthalates as softeners.[9] Several phthalates are listed as "substance of very high concern" by the EU[10]. One of them is DEHP (Bis(2-ethylhexyl) phthalate), which is reprotoxic and can damage fertility and the unborn child, e.g. as it interferes with development of the testes in early life of male children.[11] It is also suspected that DEHP can cause cancer5. The phthalate DBP (Dibutyl phthalate) is classified as "toxic to reproduction" as well.[12] Several phthalates were detected in human body tissue like the liver and fatty tissue in significant concentrations5. Laboratory tests indicated that DEHP also shows potential to bioaccumulate in water organisms.[13]

Example of hazard statements for one of the most common phthalates, DEHP (Bis (2-ethylhexyl-phthalate) taken from a safety data sheet[14]:

- H360FD May damage fertility. May damage the unborn child.
- EU Directive 67/548/EEC: Labeling: "Danger"

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

Exposure of workers can occur either in a facility that produces phthalates or in the various formulating and production facilities where phthalates are applied. Also people working with plasticized products and materials that contain phthalates are likely to be

[7] https://www.wewear.org/rsl/ https://www.wewear.org/assets/1/7/RSL_v16_final_UPLOAD.pdf
[8] German Federal Institute for Risk Assessment 2013. Plasticiser DEHP is ingested mainly through food. Online available: http://www.bfr.bund.de/en/press_information/2013/13/plasticiser_dehp_is_ingested_mainly_through_food-186815.html
[9] Chemical Inspection and Regulation Services (CIRS), undated. Phthalates Testing | EU Directive 2005/84/EC. Online available: http://www.cirs-reach.com/Testing/Phthalates_Testing.html
[10] European Chemicals Agency (ECHA) 2015. Candidate List of substances of very high concern for Authorisation. (last updated: 15/06/2015) Online available: http://echa.europa.eu/web/guest/candidate-list-table
[11] European Commission 2013. 9. EXPOSURE ASSESSMENT - bis(2-ethylhexyl) phthalate (DEHP). Online available: http://echa.europa.eu/documents/10162/0991d6a1-3a58-4b12-80bc-51f0b9269351
[12] Greenpeace, undated. Eleven hazardous chemicals which should be eliminated. Online available: http://www.greenpeace.org/international/en/campaigns/detox/fashion/about/eleven-flagship-hazardous-chemicals/#a1
[13] Greenfacts, undated. Diethylhexyl phthalate. Online available: http://www.greenfacts.org/en/dehp-dietylhexyl-phthalate/l-2/3-effects-environment.htm
[14] http://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=DE&language=de&productNumber=D201154&brand=ALDRICH&PageToGoToURL=http%3A%2F%2Fwww.sigmaaldrich.com%2Fcatalog%2Fsearch%3Fterm%3DDioctyl%2Bphthalate%26interface%3DProduct%2520Name%26N%3D0%2B%26mode%3Dmode%2520matchpartialmax%26lang%3Dde%26region%3DDE%26focus%3DproductN%3D0%2520220003048%2520219853286%2520219853101

exposed. The most likely route of workers intake of DEHP is through inhalation and dermal contact.[15]

b) Environment

Phthalates are released into the environment during production, transport, storage, their use in products and their disposal. As they are not tightly bound to the plastic-polymer they are constantly released from plasticized materials into the air or connecting materials[16, 17]. The production and application of plasticized materials in apparel and shoe industry can cause significant emissions of phthalates. They enter the air as vapor or bound to particles, and are deposited with rain and dust into soil and into the oceans, globally[18]. Significant amounts are also directly released into the aquatic environment through industrial and household discharges.[19] As the emissions of phthalates were among the highest chemical emissions for decades, they are ubiquitous nowadays and can be found almost everywhere, from homes, agriculture land to remote parts of the planet.

c) Consumers

Phthalates leach (migrate) out of many consumer products as Vinyl-floors and wall coverings, shower curtains, apparel and shoe products, electronics, toys etc.[20]. Human and environmental exposure is rather high, long lasting and widespread. Besides products, food that is containing phthalates is a major source of exposure. Children often have a higher relative daily intake than adults.[21] Phthalates were repeatedly detected in blood, urine and other body liquids of humans.

5 Sources for Phthalates in production of textiles

a) Processing chemicals used in the factory

Phthalates may be present in processing chemicals, e.g. dyes and printing plastisols.

b) Raw materials used in the factory

Materials and pre-products for waterproof coatings, latex rubber or artificial leather that are bought by a factory and used in production may contain Phthalates and should be controlled.

c) Contamination

- Chemical impurities or unknown additives in processing chemicals
- Incoming processing water of a factory
- Storage in contact with other materials that emit phthalates

[15] European Commission 2013. 9. EXPOSURE ASSESSMENT - bis(2-ethylhexyl) phthalate (DEHP). Online available: http://echa.europa.eu/documents/10162/0991d6a1-3a58-4b12-80bc-51f0b9269351
[16] Center for Health, Environment, & Justice (CHEJ), undated. PVC Factsheet. Online available: http://www.chej.org/pvcfactsheets/The_Poison_Plastic.html
[17] Greenfacts, undated. 3.1 When is DEHP released? Online http://www.greenfacts.org/en/dehp-dietylhexyl-phthalate/l-3/3-effects-environment.htm#1p0
[18] Greenfacts, undated. Diethylhexyl phthalate. Online available: http://www.greenfacts.org/en/dehp-dietylhexyl-phthalate/l-2/3-effects-environment.htm or http://www.kemi.se/Documents/Publikationer/Trycksaker/Rapporter/Rapport7-14-Ftalatuppdraget.pdf
[19] European Commission 2013. 9. EXPOSURE ASSESSMENT - bis(2-ethylhexyl) phthalate (DEHP). Online available: http://echa.europa.eu/documents/10162/0991d6a1-3a58-4b12-80bc-51f0b9269351
[20] International Coatings, undated. Phthalates And Why It's Impacting Textile Screen Printing. Online available: https://internationalcoatings.wordpress.com/2009/10/01/phthalates-and-why-its-impacting-textile-screen-printing/
[21] German Federal Institute for Risk Assessment 2013. Plasticiser DEHP is ingested mainly through food. Online available: http://www.bfr.bund.de/en/press_information/2013/13/plasticiser_dehp_is_ingested_mainly_through_food-186815.html

6 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.
Generally there are polymers on the market which are soft and flexible by nature and an addition of plasticizers is not necessary. There is also a broad range of alternative plasticizers available. REWE Group does not explicitly authorize these alternatives but refers to some references listed here.
The Federal German Institute for Risk Assessment (BfR) recommends to replace hazardous phthalates with substances from other substance classes as, epoxidised soybean oils, adipates, citrates, adipic polyester and cyclohexanoate[22].

The US Environmental Protection Agency (EPA)[23] and the Danish Environmental Protection Agency[24] mentioned various possible alternatives for phthalates in plasticized PVC. Six chemicals have been cited as already being used in various children's products; they are[2526]:

No.	CAS Number	Name
1	77-90-7	acetyl tri-*n*-butyl citrate (ATBC)
2	103-23-1	di(2-ethylhexyl) adipate (DEHA)
3	166412-78-8 (Europe/Asia), 47919-59-0 (USA)	diisononyl ester (DINCH) Diisononyl cyclohexane-1,2-dicarboxylate
4	122-62-3	Dioctyl sebacate (DIDS) DOS
5	3319-31-1	Trioctyl trimetallitate (TOTM)
6	6846-50-0	Trimethyl pentanyl diisobutyrate (TXIB)

Other possible phthalate substitutes also mentioned by EPA are[27],[28]:

- phosphate esters, e.g.: tris(2ethylhexyl)phosphate)
- sebacate and azelate esters (e.g., diisodecyl sebacate (DIDS), di-butyl sebacate, and di(2-ethylhexyl) azelate (DOZ))
- isosorbide esters (made from renewable resources)
- other organic esters (e.g. isobutyrate trimethylpentanediol, diethyl succinate)
- low-molecular-weight polymeric ester plasticizers that are derived from polymeric multifunctional alcohols and adipic, sebacic or glutaric acid
- polymeric rubbers and plastics
- reactive plasticizers

In order to minimize environmental and health effects and to use resources efficiently the use of best available technology (BAT[29]) in textiles industry is a standard requirement.

[22] German Federal Institute for Risk Assessment 2013. Fragen und Antworten zu Phthalat-Weichmachern. Online available: http://www.bfr.bund.de/de/fragen_und_antworten_zu_phthalat_weichmachern-186796.html#topic_186805
[23] http://www.epa.gov/oppt/existingchemicals/pubs/actionplans/phthalates_actionplan_revised_2012-03-14.pdf
[24] https://www2.mst.dk/udgiv/publications/2010/978-87-92708-00-7/pdf/978-87-92708-01-4.pdf
[25] US Environmental Protection Agency 2012. Phthalates Action Plan. Online available: http://www.epa.gov/oppt/existingchemicals/pubs/actionplans/phthalates_actionplan_revised_2012-03-14.pdf
[26] http://www.roadmaptozero.com/fileadmin/layout/media/downloads/en/Phthalate.pdf
[27] US Environmental Protection Agency 2012. Phthalates Action Plan. Online available: http://www.epa.gov/oppt/existingchemicals/pubs/actionplans/phthalates_actionplan_revised_2012-03-14.pdf
[28] US Environmental Protection Agency 2012. Phthalates Action Plan. Online available: http://www.epa.gov/oppt/existingchemicals/pubs/actionplans/phthalates_actionplan_revised_2012-03-14.pdf

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[30].

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

[30] http://textileguide.chemsec.org/find/textiles-come-with-a-toxic-footprint/