

Polymers Leaching Harmful Chemicals

Introduction

Polymers are made from chemicals that form polymer chains, and additives that enhance the polymer's properties. It has been found that under certain conditions, some chemicals escape, or leach from polymers and contaminate other substances in contact with them.

There is conflicting evidence about the health effects of chemicals that have leached from polymers, however the debate has highlighted possible health risks and has initiated remedial action by some manufacturers and governments such as Canada and Japan.

Chemicals of particular concern are bisphenol A (BPA) and phthalates.

Bisphenol A (BPA)

Bisphenol A (BPA) is a chemical used in the production of polycarbonate (PC) and epoxy resins and is an additive used in other polymers, e.g. polyvinyl chloride (PVC). It has been found to leach from plastics, especially when exposed to high temperatures.

Bisphenol A has been linked to birth defects, miscarriage, cancers, early onset of puberty and brain and mental problems.

The European Union Risk Assessment Report on Bisphenol A states that:

"The products that are likely to have the potential for the highest exposure of consumers to BPA are those that are used in applications which involve direct contact with foodstuff. These include food and beverage containers which have epoxy resin internal coatings, and polycarbonate tableware and bottles, such as those used for infant formula milk. Exposure to BPA arising from use of these products is determined by the migration of BPA from the polymer into the food with which it is in contact, under the particular conditions of use. Migration of BPA from these products into food or beverages stored in them may occur if conditions are created which allow hydrolysis of the polymer during food or beverage storage or if there is residual monomer in the polymer. Consumption of the food or beverage will then result in ingestion of BPA."

European Union Risk Assessment Report, 4,4'-ISOPROPYLIDENEDIPHENOL (BISPHENOL-A) CAS No: 80-05-7, February 2010, p.243

Bisphenol A has been found in:

- polycarbonate baby bottles, cups and dishes
- drinks bottles
- water coolers
- epoxy lining of most food cans
- paints, sealants, adhesives and fillers
- sports equipment
- medical devices,
- dental fillings
- eyeglass lenses
- bicycle helmets
- CDs and DVDs
- household electronics

Surveys have found Bisphenol A in the urine of most of the people sampled; it was detected in the blood of pregnant women and in the breast milk of lactating women.

Canada has banned the use of Bisphenol A in plastic baby bottles and infant formula containers. Japan has replaced epoxy coatings in cans used for food products with PET.

Phthalates

Phthalates are mixed with polymers because they make plastics soft and pliable. They are used in many applications including food containers, PVC food wrap, children's toys, packaging, cosmetics and wood finishes. Phthalates leach easily from polymers, especially when in contact with fatty foods like cheese and meat or acidic foods like fruit juices and vinegar etc., because they are not chemically bound in, they are just mixed in.

Some phthalates are believed to be hormone disruptors and carcinogens, i.e. they cause cancer. Exposure to phthalates is through many sources including:

- baby bottles, baby foods and infant formula (they can leach into the contents of packages containing phthalates)
- children's toys when chewed etc.
- microwaving foods in plastic containers
- TV dinners in plastic trays with plastic film
- boil in the bag foods
- the lining of canned foods
- bottled water and fruit juices
- plastic film food wrap contamination of cheese and meat etc.
- leaching from medical supplies, IV bags etc.

Di(2-ethylhexyl) phthalate (DEHP) is a plasticiser which is used mainly for making PVC soft and pliable.

The European Union Risk Assessment Report on bis(2-ethylhexyl)phthalate (DEHP) CAS No: 117-81-7, Final Report, 2008, § 5.3.1.2, p.521 states that with regard to workers:

"There is a need for limiting the risks ... because of:

concerns for testicular effects, fertility, toxicity to kidneys, on repeated exposure and developmental toxicity as a consequence of inhalation and dermal exposure during production, processing and industrial end-use of preparations or materials containing DEHP"

With regard to consumers, the European Union Risk Assessment Report states:

"There is a need for limiting the risks ... because of:

- concerns for children with regard to testicular effects, fertility, and toxicity to kidneys, on repeated exposure as a consequence of oral exposure from toys and child-care articles, and multiple routes of exposure.
- concerns for children undergoing long-term blood transfusion and neonates undergoing transfusions with regard to testicular toxicity and fertility, as a consequence of exposure from materials in medical equipment containing DEHP.
- concerns for adults undergoing long-term haemodialysis with regard to repeated dose toxicity to kidney and testis, fertility, and developmental toxicity, as a consequence of exposure from materials in medical equipment containing DEHP."

With regard to humans exposed via the environment, the European Union Risk Assessment Report states:

"There is a need for limiting the risks ... because of:

- concerns for children with regard to testicular effects, fertility, and toxicity to kidneys, on repeated exposure as a consequence of exposure via food locally near sites processing polymers with DEHP, or sites producing sealants and/or adhesives, paints and lacquers or printing inks with DEHP. The scenarios that give concern are generic scenarios based on default emission data. There is no concern for the limited number of sites that have reported measured emission data.
- concerns for children with regard to testicular toxicity, as a consequence of exposure via food grown locally near sites recycling paper or municipal sewage treatment plants. The scenarios that give concern are generic scenarios based on default emission data."

Di-'isononyl' phthalate (DINP) is mainly used as a plasticiser of PVC. Other applications include its use in rubbers, inks and pigments, adhesives, sealants, paints and lacquers and lubricants.

Tests indicate that it has less harmful effects on workers, consumers and the environment than DEHP and is being used as a safer alternative plasticiser in some polymers.

The European Union Risk Assessment Report on di-'isononyl' phthalate (DINP) states:

"As DINP is not chemically bound to PVC, it can be released during the entire cycle of life of end products that are used by consumers. In addition, the release intensity is not expected to be linear over time. New products would be expected to give a higher exposure than products in which DINP has reached a steady-state release from product matrix to medium. DINP is not available to consumers as such.

The consumers may be exposed to DINP in two ways:

- use of end products
- via food and food-related products.

End products containing DINP which are used outdoors do not lead to significant exposure; they are:

- building materials: insulation materials, roof coatings,
- car undercoating.

End products containing DINP which lead to consumer exposure are:

- building materials: flexible floor covering, wallpapers, windows frames, cables, paints,
- varnishes, epoxy and vinyl glues, joints and other materials used during the do-it-yourself,
- car and public transport interior,
- clothes especially rainwear and clothes in artificial leather or in fleecy materials,
- gloves,
- shoes in synthetic leather,
- seats and furniture covered with artificial leather,
- handbags, school bags in artificial leather,
- coated fabrics.

For children 0-3 years old, PVC toys and teething rings are an additional source of DINP. Consumer exposure may also occur through food and drinking because of contamination from packaging and processing equipment containing DINP. Food and drink may also be contaminated via the environment."

European Union Risk Assessment Report, 1,2-BENZENEDICARBOXYLIC ACID, DI-C8-10-BRANCHED ALKYL ESTERS, C9-RICH AND DI-'ISONONYL' PHTHALATE (DINP) p.127 § 4.1.1.3.1

Commonly used products in D&T

Tensol 70 is a two-pack adhesive containing dimethyl phthalate; see COSHH Regs, part 1.001

Epoxy Resins and adhesives may contain Bisphenol A, see COSHH Regs, part 1.005

Other adhesives contain chemicals that may be highly flammable, produce harmful vapours, or are harmful when in contact with the skin; see **COSHH Regs, particularly part 1.055, HAZARDS OF MATERIALS.**

Summary

This brief description is intended to highlight the fact that under certain conditions, chemicals may leach from polymers and:

- chemicals leached from polymers may be harmful to human health, plants, animals and the environment
- chemicals leached from plastic packaging can contaminate the packaged product
- harmful chemicals have been found to leach from a wide range of plastic products including infant toys and feeding bottles
- tests have shown that most of the people sampled have chemicals in their bodies that have come from polymers.