

Environmental pollutants

Intolerances to environmental pollutants can be caused by toxicity, but can also be a result of allergies.

Allergic intolerances are mostly based on the existence of specific T lymphocytes (type IV sensitisation) that can be detected using the **lymphocyte transformation test (LTT)**. Particularly with the toxic and in some cases carcinogenic substances indicated here, preference should be given to laboratory methods rather than testing on the skin (epicutaneous test).

The testable xenobiotics currently standardised in the LTT are explained in this collection of substances.

Formaldehyde

Formaldehyde is an aldehyde and is a toxic, colourless, flammable gas with a strong acrid odour. The aqueous solution of formaldehyde (37 %) is an important commercial product marketed under the name Formalin.

Formaldehyde is a chemical with an exceptionally wide range of uses and is found in many products in everyday use. The following are possible sources of formaldehyde:

- bonded products made from wood materials, cork tiles and similar materials (adhesives containing formaldehyde)
- insulation and foaming material (urea-formaldehyde foams)
- paints, dyes, varnishes, parquet sealants (formaldehyde in the preservative or bonding agent)
- glass and rock wool, fibre mats (formaldehyde-containing bonding agent)
- textiles and textile floorings (finishing with urea-formaldehyde resins)
- cleaning and care products and disinfectants (Formalin)
- cosmetics, e.g., mouth washes or nail hardeners
- tobacco smoke and emissions from gas cookers

Formaldehyde is used as a preservative in shampoos and shower products but also in medicinal products (toxoid vaccines).

Type IV allergies to formaldehyde/Formalin are not rare. The frequency of sensitisation is 1.7 % for women and 1.3 % for men in Germany. Type I sensitisations (confirmation by detection of specific IgE using RAST) are very rare on the other hand.

Permethrin

Permethrin is a pyrethroid. Pyrethroids are synthetic compounds with a structure derived from that of pyrethrins (naturally occurring in chrysanthemum) but which are more stable. Permethrin is a yellowish-brown, water insoluble, odourless powder.

Permethrin is used as an insecticide in wood preservatives and in wool carpets. Insecticides are intended to protect treated materials from moth and beetle damage. Pyrethroids

started replacing lindane for the protection of plants, wood and textile and indoor pest control from about the start of the 1980s onwards.

Permethrin is also used for external application against head lice as well as body lice (liquid preparation).

The use of permethrin in closed rooms is currently under discussion as a health hazard. There have been very few studies of its role as a contact allergy to date.

PCB

PCB is the abbreviation for polychlorinated biphenyl. This is the name given to a group of 209 organochlorine compounds that have the same basic structure – a chlorinated biphenyl ring. Commercial PCB products are usually difficult-to-separate mixtures with a chlorine content of about 30–60 %. PCB is barely soluble in water but are readily soluble in fatty tissue. This is why they accumulate in the fatty tissue. They are barely biodegradable, and have suspected half lives of between 10 and 100 years.

PCB is characterised less by acute toxicity than by a high health risk with permanent exposure. For these reasons PCB is also one of the 'dirty dozen' (POP) – a range of environmental toxins that are particularly resistant to degradation and spread around the world which are now illegal internationally.

An historical example of poisoning by PCB is Yusho disease which appeared in Japan between 1968 and 1975 and was caused by rice oil contaminated with PCBs.

Before the health and environmental hazards caused by PCB became fully apparent, it was widely used because of their useful properties.

In the 1960s and 1970s in particular, a range of building materials were used which generated quantities of PCB in indoor environments that could be harmful to health. PCB was produced on an industrial scale in Germany up to 1982. They were used as insulating liquids in transformers and capacitors, as plasticisers in plastics (jointing compounds, ceiling linings, cable sheathing, etc.), as flame retardants in wall paints, varnishes and adhesives as well as in hydraulic oils. In buildings PCB is predominantly present in paints and adhesives, caulking compounds for all types of joints, plastics with plasticisers, old lamp capacitors and formwork residues on concrete structural components. Since 1989 the manufacture, sale and use of PCB is forbidden apart from a few exceptions. In addition to lamp capacitors containing PCB which had to be removed and disposed of across the board from public buildings in the 1990s, the jointing compounds used in the past are often a major source of PCB. The worst affected are panelised buildings erected between 1955 and 1975 such as schools, kindergartens, administrative buildings as well as apartment blocks. Exposure to harmful levels of PCBs in private single and multiple family homes from this period cannot be ruled out.

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PCP

Pentachlorophenol is a member of the group of organochlorine pesticides and is a potent toxin for microorganisms (fungicide), plants (herbicide), insects (insecticide) and fish. PCP is or was used as a wood preservative, leather and textile preservative and disinfectant. In Germany the use of PCP is practically forbidden. However, the use of PCP in imported products cannot be ruled out.

The following in particular are possible sources of PCP:

- wood surfaces on wall cladding, wooden beams, doors, wainscoting, flooring, windows, furniture;
- roof trusses, framework and other wood constructions;
- textiles such as leatherwear, leather furniture, awnings, tents;
- adhesives; paints and varnishes as well as mineral oils.

CHC (chlorinated hydrocarbons)

CHC is the abbreviation for organic chemical compounds that contain one or more chlorine atoms. CHC have become very important for industry as starting products for plastics (e.g., vinyl chloride to manufacture PVC), as synthetic solvents (e.g., trichloroethane, trichloroethylene, dichloromethane), as pesticides (e.g., chlordane, lindane, DDT) and much more. Their danger is derived from their very high chemical stability which prevents their being rapidly degraded to harmless substances, their good fat solubility which favours good uptake and storage in living organisms as well as their high toxicity. Following a decision made by the professional association many years ago, CHC are no longer allowed to be used in detergents and cleaning agents in the printing industry.

PAH mixture

PAH is the abbreviation for polycyclic aromatic hydrocarbons, a group of substances containing several hundred individual compounds (predominantly benzo-a-pyrenes). Their chemical structure is characterised by at least three aromatic rings fused together. PAH forms when organic materials are heated or burnt in low oxygen levels (incomplete combustion).

Crude oil naturally contains PAH. It is also present in vegetables and smoked, grilled and roasted meat products, however.

Considerable quantities of PAH are present in cigarette smoke. Passive smoking is also a significant source of these substances.

Another major source in homes is open fireplaces.

PAH-containing tar ointments are still in use today.

PAH is used industrially predominantly in bitumen and bituminous coal tar products and in the manufacture of other chemicals. PAH in buildings is found primarily in:

- adhesives and paints containing tar and pitch under-wood parquetry and wood flooring
- bitumen products, asphalt floor coverings
- bituminous liner sheets and roofing felt

1,6-Diisocyanatohexane

1,6-Diisocyanatohexane (synonym: 1,6-hexamethylene diisocyanate, HMDI) is known under the trade names Desmodur H or Desmodur N. Isocyanates are a widely used

intermediate product in the chemical industry. Isocyanates are used in the plastics industry in particular in varnishes, elastomers, foams, adhesives, etc. HMDI-containing preparations are also used as two-component adhesion promoters to improve the bond strength of PVC plastisol coatings on synthetic fibres made from polyester, polyamide and aramid fibres.

Phthalic acid anhydride

Phthalic acid anhydride is present in some surface coatings such as alkyd resin varnishes, clear varnishes, parquetry sealants, panels and laminates. It is derived from phthalic acid, the esters of which are the phthalates. The high boiling point of 285°C also allows its use in water soluble varnishes without declaration. It irritates the mucous membranes. There is a MAC value for workplaces of 1 mg/m³.

Phthalic acid anhydride can lead to sensitisation of the mucous membranes (anhydride asthma) but is not carcinogenic. The high allergic potential is also the critical reason to carry out possible tests for this substance. In the EU safety data sheet, special mention is made of the risk of sensitisation through inhalation and skin contact.

Dichlofluamid

Dichlofluamid was introduced in 1964 as an active substance in plant protection agents and wood preservatives. Although it is less toxic, it may harm the health of allergic patients due to its sensitising action. Tests on its longterm behaviour have not been conducted. Practical experience is available primarily from kindergartens in which the allergy symptoms of children abated significantly after wood surfaces containing large amounts of dichlofluamid were decontaminated.

Dichlofluamid is used as a foliar fungicide (fungicide to treat plant leaves). It has a protective effect and controls scab in apples and pears, true and false mildew and other harmful fungi in the cultivation of grapes, potatoes, fruit, hops, vegetables and ornamental plants. It is also used as the active substance against fungal infestation in wood preservatives. It is one of the most commonly used substances to offer blue stain protection in solvent-containing preparations. It is also used in varnishes and other paints. There are currently no restrictions on its use in Germany. Skin contact or inhalation of dusts should be strictly avoided.

Lindane

Lindane is a product comprising about 99 % of the isomer of hexachlorocyclohexane (HCH, a monocyclic chlorinated hydrocarbon with the empirical formula C₆H₆Cl₆). Lindane is a widely used contact insecticide. It has been used since about 1945 in homes and gardens (against ants, cockroaches, fleas, mites, lice, e.g., Ameisenfrei®), to protect textiles (e.g., Rinal Mottenhexe® for moth control in clothes cupboards), in veterinary medicine (e.g., Dermakulin®) and for external use in humans (e.g., Jacutin®). It was found in most wood preservatives up to the middle of the 1980s in a concentration of 0.5 % to 2 %.

Lindane is now only used as a plant protection agent for a specific indication in the forestry industry. Wood preservatives that were tested by the German Institute for Consumer Health Protection and Veterinary Medicine (Bundesinstitut für gesundheitlichen Verbraucherschutz und Veterinärme-

dizin, BGWV) as part of the mark of conformity procedure in the German Institute for Building Technology (Deutsches Institut für Bautechnik) and in the RAL quality seal procedure for wood preservatives conducted by the Gütegemeinschaft Holzschutzmittel e. V. (Wood Preservative Quality Association) in Frankfurt were found to no longer contain Lindane. In human medicine it continues to be used as an active agent in powders, gels and ointments to treat mites (e.g., itch mites), head and felt lice (e.g., used in the treatment of scabies with Jacutin®; this contains 0.3 g Lindane in 100 g). The only alternatives available for medical treatments are other insecticides that are just as harmful.

Latex

Latex is the coagulated and purified milky white sap produced by many species of plants in the Euphorbiaceae and Moraceae families. The most important source is *Hevea brasiliensis* (rubber tree) which provides about 95 % of the global harvest of natural rubber. This is then mixed with various accelerants, binding agents and dyes during the manufacturing process of a wide range of items for daily use. Vulcanisation produces rubber.

A range of useful items that contain latex: bed mattresses, bras, rubber balls, rubber bands, wellingtons, rubber sheets, cleaning gloves, condoms, air balloons, air mattresses, erasers, rubber boats, pacifiers, ski masks and swimming goggles, sock elastic, hot water bottles.

In the medical sector it is used for: surgical and examination gloves, balloon catheters, ventilation masks, ventilation tubes, blood pressure monitor cuffs, finger stalls, rubber

sheets, rubber dam (dentistry), plasters, wound drainage systems, dental wedges.

In some patients with a latex sensitisation, the result is intolerance to certain types of fruit which is due to cross-reactivity between latex and fruit allergens (latex-fruit syndrome). In patients intolerant to the following, a latex allergy should be considered as the origin: avocado, kiwi and banana, as well as pineapple, chestnuts, potato, orange, tomato, melon, mango, peach, fig, grapes, passion fruit and paw paw. Cross-reactions to weeping fig, also known as *Ficus benjamina*, have also been described.

BTX

BTX is the abbreviation for the aromatic hydrocarbons benzene, toluene and xylene. These are organic compounds which have a molecular structure derived from benzene. Aromatics are extracted almost exclusively from coal and crude oil using thermal or catalytic processes (coking plants, refineries). They are one of the most widely used chemical raw materials and by weight make up to 30 % of all plastics, up to 60 % of all synthetic rubber products and up to 70 % of all chemical fibres. As solvents they are extensively used in paints, varnishes and adhesives, for example. Benzene, toluene and xylene are also present in outdoor air primarily as a result of exhaust emissions. More than 90 % of the benzene content of the air can be traced back to vehicle emissions. A critical reduction in benzene emissions was achieved by using regulated three-way catalytic converters. As a result, benzene concentrations in the air have been falling for some years.