

A to Z Chemicals of Concern

Aluminium salts in antiperspirants including aluminium chloride, aluminium chlorohydrate, and aluminium zirconium chlorohydrate complexes. They are metalloestrogens capable of interfering with oestrogen action and under certain conditions stimulate responses associated with natural oestrogen. Limited scientific evidence suggests aluminium in antiperspirants may be associated with increased breast cancer risk.

Benzophenones are UV filters found in sunscreens and some personal care products, where they may be added to prolong shelf-life of products such as face creams. They may also be used in biocides and cleaning products. They are oestrogen mimics and accumulate in breast tissue. Some nations and states (for example Hawaii) have banned certain benzophenones (e.g. benzophenone-3) due to its environmental toxicity.

Benzyl benzoate is used as a fragrance ingredient in various cosmetic and personal care products such as hair products, moisturiser, body wash and lipstick. It is also used as a solvent in perfumes. It has shown to be an estrogen mimic in breast cancer cells.

Benzyl salicylate is mainly used as a fragrance ingredient in a range of cosmetics and personal care products such as shampoos, moisturisers and lipsticks and in air fresheners and cleaning products. It is an oestrogen mimic.

Bisphenol A (BPA) and other **bisphenols** are found in polycarbonate plastics, white dental fillings, lenses, computer casings, can linings and some till receipts. BPA is classified as a substance of very high concern because of its reproductive toxicity and endocrine disrupting properties which cause probable serious effects to human health. It increases mammary cancer risk in animals and many in vitro studies demonstrate it is an oestrogen mimic which affects breast cancer multiplication and migration. It is now being phased out of everyday products although is still permitted in food contact materials. Bisphenol substitutes (BPAF, BPZ, BPB, BPS, BPF, BPAP) are also oestrogenic and are likely to be similarly harmful.

Butylated hydroxytoluene (BHT) and **Butylated hydroxyanisole (BHA)** are preservatives (anti-oxidants) used to prevent product deterioration. They are found in many types of cosmetics such as lipsticks and eye shadow, personal care products such as shampoo and may be used as food additives. They affect oestrogen biosynthesis and are anti-androgenic and anti-oestrogenic. BHA is a suspected carcinogen.

Chlorpyrifos is an organophosphate insecticide commonly used in agriculture to control various pests (e.g. aphids, flies) that affect cereals, fruit and vegetables and is a common residue in food (especially citrus fruit). It affects the nervous system and is an oestrogenic EDC which has been linked to breast cancer in vitro and mammary cancer in rodent studies.

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In the UK, chlorpyrifos is not authorised for use and there are no longer products containing chlorpyrifos as the active ingredient registered for use as a biocide or pesticide. This is an important example of how a chemical that was once deemed safe to use has now been banned by the UK government.

Cyclosiloxanes including decamethylcyclopentasiloxane (D5); octamethylcyclotetrasiloxane (D4), dodecamethylcyclohexasiloxane (D6) (also known as cyclomethicones) are used as solvent carriers, and conditioning and spreading agents and are found in personal care products such as face creams, deodorants and hair care products. They are also used in silicone production. They are weakly oestrogenic and anti-oestrogenic. D4 and D5 cause DNA damage, and D4 is suspected of being a reproductive toxicant. In the UK D4 and D5 have been banned from wash off cosmetics and there is a proposal to extend this to include D6. There is also a proposal for the ban to apply to leave-on cosmetics.

Deltamethrin is a pyrethroid insecticide used mostly in agriculture to control various pests. It is classified by the World Health Organisation (WHO) as a moderately dangerous insecticide. Deltamethrin has been shown to accumulate in fat tissue adjacent to breast tumours in female dogs and has also previously demonstrated oestrogenic and antiandrogenic activity.

2,4-dichlorophenoxyacetic acid (2,4-D) is a herbicide used to control weeds, often in aquatic environments. 2,4-D may have endocrine disrupting effects at high doses. It has also been shown to increase breast cancer risk in certain populations.

Diethyl phthalate (DEP) is used as a solvent and fixative in fragrances and may be used as an alcohol denaturant in cosmetics and personal care products such as colour cosmetics, hairspray, lotions and perfumes. It is also used as a plasticiser in a variety of plastic products. It is an oestrogen mimic which has been associated with mammary cancer in rodents and limited studies suggest it may increase breast cancer risk.

2-ethylhexyl salicylate is a UV filter used in sunscreens to protect against UV light and in face creams to protect products from UV light damage. It is an EDC which is anti-oestrogenic and anti-androgenic.

Flame retardants, specifically, brominated, chlorinated or organophosphorus flame retardants (known as “organic” flame retardants), are used in TVs, furniture, computers, carpets, polyurethane foam and paints, to make products less flammable. Several are EDCs with potential links to breast cancer. Many are suspected of being carcinogenic, toxic, persistent and bioaccumulative.

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Several brominated flame retardants are now restricted however replacements are also likely to be harmful. Examples include tetrabromobisphenol A, tris(1,3-dichloro-2-propyl) phosphate and 2,2-bis(bromomethyl)-1,3-propanediol.

Formaldehyde and **formaldehyde-releasing preservatives** are used as antimicrobial agents. Formaldehyde is used in nail products and formaldehyde-releasing preservatives (e.g. DMDM hydantoin, imidazolidinyl urea) are used in personal care products such as shampoos, soaps and hair dyes. At high concentration formaldehyde is a carcinogen. At low concentrations there is some evidence it increases risk of breast cancer and mammary tumours in rodents.

Glyphosate is classified by the International Agency for Research on Cancer (IARC) as probably carcinogenic to humans and is weakly oestrogenic at high concentrations. It is an organophosphate herbicide used to control weeds. Although it is unlikely to be oestrogenic at environmentally relevant concentrations there is some evidence that low concentrations of glyphosate may affect DNA repair pathways and cause cellular damage in breast cells.

Heavy metals including lead, cadmium, antimony and mercury may act as endocrine disruptors by mimicking oestrogen in the body. For this reason, they are known as metalloestrogens.

Heavy metals may be present in certain types of plastic bottles or take away boxes, where they can leach into food or drink, or in plastic pots containing skin care products, where they leach into products applied to skin. They are also by-products of combustion and may contaminate the environment. Exposure to certain heavy metals has also been shown to accelerate breast cancer progression.

Homosalate is a UV filter used in sunscreen and in skin care products to protect these products from deterioration from UV damage. It is an EDC which affects male and female sex hormones and acts as an oestrogen mimic. It can increase breast cell proliferation, migration and invasion in vitro.

Lilial (2-(4-tert-butylbenzyl)propionaldehyde) is used as a fragrance in cleaning products, hair care products and cosmetics such as lipstick and nail polish. It is oestrogenic and may be genotoxic (damage DNA) and may cause developmental toxicity.

Malathion is classified by the International Agency for Research on Cancer (IARC) as probably carcinogenic to humans and, is oestrogenic. Past exposure may potentially increase breast cancer risk. It is an organophosphate insecticide primarily used in agriculture to control pests (mainly mosquitoes) that affect cereal, fruit and vegetable crops. It is also present in shampoos used for the treatment of head lice and mites.

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Methyl salicylate is a fragrance ingredient and denaturant (used to denature alcohol) in personal care products such as mouth wash, body powder and moisturisers and in cleaning products and biocides. It can act as an oestrogen mimic and there is limited evidence it may cause reproductive toxicity.

Methylisothiazolinone (MIT) & Methylchloroisothiazolinone (CMIT) are used as preservatives in cosmetics, personal care products, detergents and soaps. They are EDCs that affect oestrogen, androgen and glucocorticoid hormones, are allergenic and may cause DNA damage.

4-Methylbenzylidene camphor is a UV filter and fragrance. It is used in sunscreen and in skin creams and lotions to protect products from UV damage or as a fragrance. It has oestrogenic, anti-oestrogenic and anti-androgenic activity, can increase proliferation, migration and invasion of human breast cancer cells in vitro. Animal studies suggest it may act as a developmental toxicant.

Octinoxate (2-ethylhexyl-4-methoxycinnamate) is a UV filter used in sunscreen, and in cosmetics and personal care products to protect these from deterioration from UV damage. It is an oestrogen mimic which also affects androgen, thyroid and progesterone hormones and shows developmental toxicity in animals. Several states have banned octinoxate, due to its environmental toxicity.

Octocrylene is a UV filter used in sunscreen. It may also be used in cosmetics and personal care products to protect these from deterioration from UV damage. Octocrylene can break down to form benzophenone, a carcinogen and suspected endocrine disruptor. Several states have banned octocrylene, due to its environmental toxicity.

Padimate O is a UV filter used in sunscreen, and in skin and hair care products to protect these from deterioration from UV damage. It is an oestrogen mimic and also affects androgens.

Parabens such as methylparaben, propylparaben and ethylparaben are preservatives found in cosmetics and personal care products, and occasionally in certain processed foods such as confectionery, dry meat products, cereal or potato-based snacks and coated nuts, where they are listed as E214, E217, E218 and E219. They have been measured in breast tissue, breast milk and placental tissue. High concentrations of parabens mimic the actions of oestrogen and may be linked to breast cancer.

Parfum or **perfume** refers to fragrance ingredients used in cosmetics products, and sometimes include phthalates or synthetic musks (see relevant listings below).

Per- and poly fluoroalkyl substances (PFAS) e.g. PFOA and PFOS are synthetic chemicals used to make non-stick, waterproof and grease resistant materials

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including cookware, some food packaging, and water-resistant coatings on clothing, furniture and carpets. They release toxic fluorochemicals upon heating and over time. They are environmental pollutants, bioaccumulative and are EDCs that have been linked to cancers and possibly to breast cancer.

P-phenylenediamine is an oxidation reagent used to fix colour in hair dyes. It is oestrogenic and there is evidence it causes DNA damage and limited evidence it may increase breast cancer risk.

Phthalates are mainly used as plasticisers and also in fragrances (see diethyl phthalate). They are found in polyvinyl chloride (PVC) products such as flooring and window frames, rubbers, inks, paints. Many phthalates are EDCs and some are oestrogen mimics which may be linked to breast cancer. Some are toxic to human reproductive, developmental and immune systems. Several are banned for use in the EU.

Polycyclic aromatic hydrocarbons (PAHs) are a group of compounds produced from the incomplete combustion of fossil fuels, which then get released into the atmosphere. Examples include benz(a)pyrene and 7,12-dimethylbenz(a)anthracene (DMBA).

PAHs are classified as human carcinogens (in the lungs). PAHs may also be ingested following grilled meat consumption. PAHs are also found in items made from rubber such as tyres, gym flooring and artificial turf. Studies have consistently shown that PAH exposure adversely affects breast tissue, and many studies suggest it may increase the risk of breast cancer.

Synthetic musks such as galaxolide, tonalide, musk xylene and musk ketone are often used to fragrance cosmetics, perfumes, aftershaves and laundry detergents. They are EDCs which affect oestrogen and progesterone, with possible links to breast cancer. All are bioaccumulative and some are carcinogenic.

Triclosan and (less commonly) **triclocarban** are used in personal care products such as toothpaste, deodorants, soaps and liquid washes to prevent growth of bacteria and fungi. They may be incorporated to consumer items such as clothes, toys and chopping boards. Both are EDCs which interfere with steroid biosynthesis and are bioaccumulative. Triclosan increases oestrogen biosynthesis. They also promote antibiotic resistance.

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References

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