

Bisphenol A in plastics: is it making us sick?

a hazard of modern living

A consumer guide to Bisphenol A



**Friends of
the Earth
Europe**

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promoting a healthy planet for healthy people

The use of plastics has become one of the defining characteristics of modern life. An increasing number of scientific studies have made a direct link between one of the major components of most clear, shatterproof plastic articles - Bisphenol A or BPA - and a surprising number in many diseases. BPA is a known endocrine or hormone disruptor and is implicated in diseases ranging from infertility, obesity, breast and prostate cancer, to diabetes, thyroid malfunction and attention deficit syndrome.

Most of the clear, shatterproof plastics used in baby bottles, food storage containers, small kitchen appliances and hard plastic water bottles are made of plastic which contains Bisphenol A. Bisphenol A is also used in the lining of food, beer and soft drink aluminium and tin cans. Evidence of leaching of BPA has been observed for all of the above general public uses.

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Bisphenol A¹ and health

avoid plastics numbered



¹ For a more detailed insight into the issue of BPA, please see Friends of the Earth report: Blissfully unaware of BPA; Reasons why regulators should live up to their responsibilities available at http://www.foeeurope.org/safer_chemicals/Blissfully_unaware_of_BPA_report.pdf

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The endocrine system of the human body is a complex network of glands, hormones and receptors that carefully regulates many body functions, including our metabolism, immunity, behaviour, growth and development during childhood.

This very finely balanced network is involved in developmental processes of cells and organs, including the development of sexual organs. The hormones also regulate our response to disease and even influence our behaviour

The endocrine system: an essential and hypersensitive regulatory system of the human body

and relationships with each other: e.g. mother-child bonding.

The endocrine system is a messaging system: the glands secrete hormones, which act as chemical messages and are transported by the bloodstream. Hormones are received by receptors, which detect and react to specific hormones in particular cell/tissue types. This mechanism functions very much like a lock and key.

Under certain conditions, extremely small amounts of endocrine-mimicking chemicals

may disturb this endocrine network. This can be the case during pregnancy, early childhood, and in particular during the vulnerable periods of the development of the reproductive system.

Thus, while at a certain concentration Endocrine Disrupting Chemicals (EDCs) may not alter the hormone system of adults, the same concentration may have serious effects on a baby during pregnancy or during other sensitive periods, possibly leading to permanent changes to the organ functions.



how

how BPA can harm you

infertility, obesity, cancer, diabetes,
thyroid malfunction and attention deficit syndrome.



how BPA can harm you

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Scientific research has shown again and again that BPA is a known and proven² endocrine disrupting chemical (a chemical that disturbs the hormone system). A 2007 scientific review linked exposure to BPA with an increased risk of cancer of the hematopoietic system (e.g. marrow, spleen, tonsils, and lymph nodes), a significant increase in cell tumours of the testes and an alteration of the number of chromosomes in some cells and tissues (potentially leading to mutations and ultimately cancer). Additionally, early life exposure may induce or predispose humans to an increased risk of breast cancer. When exposure occurs during foetal or early childhood development, BPA may increase a person's susceptibility to cancer by affecting their genetic developmental 'programming'.

The ability of BPA to affect and/or mimic oestrogen, a key female hormone, is well documented, but BPA's effects are not just limited to the inhibition of oestrogen. BPA also has a number of direct impacts apart from the oestrogen inhibition. These include: effects on the androgen regulation system (which regulates the growth, development, and function of the male reproductive system), disruption of thyroid hormone function, diverse influences on the development and function of the central nervous system, and potentially adverse influences on the immune system.

Furthermore, recent studies have shown that BPA can alter how genes are expressed (i.e. turned on or off) and that "low-dose BPA exposure during pregnancy has multigenerational consequences; it increases the likelihood of chromosomally abnormal grandchildren." (Susiarjo et al. 2007). In humans, abnormal chromosomes may lead to miscarriages, death soon after birth or conditions such as Down's syndrome and Turner syndrome.

It is now obvious and indisputable that BPA can have adverse effects on human health even at low doses. But how exactly does BPA get from consumer goods into our blood streams?



² See the Chapel Hill Bisphenol A Expert Panel Consensus Statement 2007 where thirty-eight of the world's leading scientific experts on Bisphenol A have warned policymakers of potential adverse health effects of the widespread exposure to this chemical in *Reproductive Toxicology* 24: 131–138.

how BPA can harm you

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One of the key arguments of the chemical and plastics industry and some governments is that the amount of BPA we ingest is so incredibly small that we do not have to worry about it. It is the traditional idea that the greater the amount of a poison, the more harmful it is.

However, research into endocrine disrupting chemicals is seriously challenging traditional thinking about toxicology. New understanding about how hormones act at extremely low concentrations is putting “the dose makes

The scientific understanding about toxic chemicals is undergoing a revolution

the poison” credo into a whole new and much more sophisticated context.

Endocrine disrupting chemicals, such as Bisphenol A, can interfere with the body's hormonal system by acting like natural human hormones at concentrations much lower than those at which other toxic chemicals have an impact.³

Sometimes a low dose may be as or more harmful than a higher dose (this is known as the “low dose” effect). Industry and many governments still dispute the

“low dose” effect, but scientific evidence of its existence continues to mount, both for Bisphenol A and for other chemicals.

In addition, the amount and kind of harm the chemical may cause depends on the timing and length of exposure. Furthermore, when several different kinds of chemicals mix together in human body, they can act additively or synergistically and cause adverse effects at concentrations that are insufficient to cause harm when a chemical is by itself. This is commonly known as the “cocktail effect”.

³ Since the 1980s, scientists have been able to measure concentrations of a chemical in ‘parts per trillion’, or 1 part in 1 trillion (10¹²) – or the equivalent of one grain of sand in a sand-filled Olympic-size swimming pool of 50 x 25 meters.



where

where BPA can be found

food and drink containers, cans, compact discs, household appliances, fresh food and many other products.

where BPA can be found and how it gets into you

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Bisphenol A is one of the most commonly used industrial chemicals in the world today. BPA is a key ingredient in the production of plastic materials and makes them strong and shatterproof, resistant to temperatures between 40 and 145 degrees Celsius, and resistant to many acids and oils. It is also an ingredient in epoxy resins, a type of product that is tough and resistant to many chemicals, and adheres well to numerous surfaces. In addition, BPA is also used in a variety of minor applications, such as brake fluids, dental sealants and pesticides (please refer to Table 1 for a sample list of products containing BPA).

table 1 Examples of products containing Bisphenol A

Polycarbonate Plastics (65% of use)

Impact-resistant glazing
Street-light globes
Household appliance parts
Components of electrical/electronic devices
Compact discs
Automotive applications
Reusable bottles
Food and drink containers
Sunglasses
Refrigerator shelving
Microwave ovenware
Eating utensils

Epoxy Resins (30% of use)

Coatings
Food and beverage can linings
Electrical laminates for printed circuit boards
Composites
Adhesives
Paints
Nail polish

Other Uses (5% of use)

Pesticide formulations
Antioxidants
Flame retardants
Brake fluids
Rubber and PVC stabilisers
Water supply pipes
Dental sealants
Thermal paper additives
Water main filters
Reinforced pipes
Floorings
Electric insulators

sources: Bro-Rasmussen 2006, Weise and Szabo 2008, Endocrine/Estrogen Letter 2003.



The scientific literature showing that BPA is leached from countless consumer products, food contact materials and is released during its production into the environment is extensive (see Table 2). Whether BPA leaches out from plastics or epoxy resin coatings is related to the type of food or liquid, the temperature and heating time. Leaching rates under normal conditions of use have been measured in food containers, epoxy resins, plastics, baby bottles, take-away food containers and plastic wraps. The BPA that has leached from food containers into food products has been detected in vegetables, fish, fruit (including fresh), canned instant coffee, powdered milk and infant formula, canned milk as well as honey.

BPA has also been found to migrate from polyvinyl chloride or PVC hoses and water storage tanks, contributing to the possible contamination of drinking water. An unexpected source of BPA may be fresh fruit and vegetables grown in greenhouses, as the chemical migrates from the PVC panels used for the walls of greenhouses into the indoor atmosphere.⁴

The potential overall environmental contamination due to BPA production is considerable and largely unacknowledged. BPA has been found in freshwater, seawater, landfill leachates (the liquid that drains from landfill), air, and dust particles.

Human exposure to BPA is worldwide and pervasive. Numerous studies have found BPA in human serum, urine, amniotic fluid, follicular fluid, placental tissue, and umbilical cord blood⁵ despite the chemical being metabolized (i.e. broken down) in the human body within 6 hours.⁶



table 2 Major sources of Bisphenol A exposure

Product	How
Baby bottles	Leaching from bottle into milk increases with the temperature of the content, length of contact with the bottle and significantly after repeated use.
Polycarbonate plastic bottles	55 fold increase in leaching when filled with boiling water
Microwave plastic containers	Leaching increases with heating of containers
Polyvinyl chloride plastic wraps	Leaching observed when in contact with water, olive oil, acetic acid
Paper towels from recycled paper	Bisphenol A is used in the production of thermal paper. Different types of recycled paper contain very different levels of BPA.
Polycarbonate plastic tubing	Leaching levels greatest in river water
Canned food lining	Leaching into foods, including vegetables, fish, fruit, instant coffee, powdered milk and infant formula
Fresh food	Leaching from PVC in glass house panels via air onto fruit and vegetables

sources: as cited by Vandenberg et al. 2007, Lopez-Espinoza et al. 2007, Le et al. 2008.

⁴ See Vivacqua et al. 2003 and Sajiki et al. 2007

⁵ Vandenberg et al. 2007

⁶ See Chapel Hill Bisphenol A Expert Panel Consensus Statement 2007, as cited.



act

what you can do to reduce BPA exposure

choose safe options and engage with the retailer and producer.

what you can do to reduce BPA exposure

choose safe options for food packaging and storage

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Whenever possible: choose safe options

- Store food in glass, ceramic or stainless steel containers.
- Buy fresh local products; try to avoid fruit and vegetables grown in greenhouses.

If you need to use plastic that comes into contact with food, choose safer options where possible: Suitable plastics are those with a recycling code no.1 (Polyethylene terephthalate or PETE), no. 2 (high density poly ethylene or HDPE), recycling code no.4 (low-density polyethylene or LDPE) and no.5 (polypropylene or PP), in any case, take care to avoid polycarbonate plastics (PC) as much as possible.

Avoid plastics with recycling codes no. 3, no.6 or no.7.

No.7 (other plastics) may contain Bisphenol A and are best avoided. Additionally take care and avoid PVC (no.3) and polystyrene (no.6), as the possible residues (vinyl chloride and styrene) may also be harmful.⁷ PVC has negative environmental and health impacts during production, use and after disposal, for instance when waste is incinerated.

Avoid heating foods or drinks in plastic containers

Avoid heating all plastics, irrespective of their recycling numbers. If you need to store heated food or liquid in plastic containers, wait until the food has cooled down before transferring it.

Avoid canned food and foods grown in plastic greenhouses.

Although it is not always possible to identify fruits and vegetables grown in greenhouses, eating seasonal products can be first step and a good way to avoid food grown in greenhouses.

Caution: food wrapping:

Meats, cheeses, and other commercially-wrapped foods in delis/speciality food shops and standard food shops/supermarkets may be wrapped in PVC, which we recommend you avoid.

Some of the commercial wraps sold for home use are made from polyethylene (no.4).

Caution: unlabelled could mean unsafe

Many plastic items are unlabelled and the only way to find out what they are made of is by contacting the manufacturer. We encourage you to do so and to express your concerns.

In the absence of information: avoid using plastics where possible. The safer alternatives are glass and stainless steel.

Take care with all plastic products

- Take plastic products to recycling stations where possible.
- Ask your dentist to use dental sealants that do not contain BPA.

⁷ Mutti A, Mazzucchi A, Rustichelli P et al, 1984. "Exposure-effect and exposure-response relationships between occupational exposure to styrene and neuropsychological functions." Am. J. Ind. Med. 5: 275-286 Benignus VA, Geller AM, Boyes WK et al, 2005. "Human neurobehavioral effects of long-term exposure to styrene: a metaanalysis." Environ Health Perspectives, 113(5): 532-538.

what you can do to reduce BPA exposure

minimize baby and infant exposure

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Here are some suggestions to reduce exposure

Babies and infants are especially at risk from low dose BPA exposure. Here are some suggestions:

Feeding

- Breastfeed whenever possible for as long as possible. Breast milk is the optimal food for your baby, the World Health Organisation (WHO) recommends six months of exclusive breastfeeding and continued breastfeeding thereafter until two years or longer, so no need for infant formula and bottles.
- If you need to use infant formula, choose a powdered one, as liquid formulas have higher levels of BPA, and use glass bottles or cups for feeding.
- Use as few cans as possible, as the metal will probably be coated with epoxy resin which contains BPA.
- Do not use ready-to-eat liquid formulas in metal cans.
- Avoid liquid formulas that are in rigid and transparent plastic containers marked with “PC”.
- When expressing breast milk, use breast pumps, shields and jars and bags that are BPA free.

Baby bottles/sippy cups:

- Use glass or plastic baby bottles that are labelled “Bisphenol A-free” or made of polyethylene, polypropylene or polyamide.⁸

Teats, ‘dummies’ or pacifiers

- Choose teats/‘dummies’ or pacifiers made from silicon. They are the most durable and inert options.

Ask your local childcare centre to get rid of all polycarbonate food contact and food storage materials

Plastic Code Quick Guide

Avoid

- no.3-PVC (Polyvinyl chloride)
- no.6-PS (Poly Styrene)
- no.7- PC (Poly Carbonate)⁹

Probably Safe

- no.1-PET (Polyethylene terephthalate)
- no.2-HDPE (High-density Polyethylene)
- no.4-LDPE (Low-density Polyethylene)
- no.5-PP (Polypropylene)



⁸ National Childbirth Trust UK 2008

⁹ Number 7 is the general code for “other plastics” and may therefore include many sorts of plastics. When followed by the letter PC, it clearly indicates Poly Carbonate plastics, which contains BPA and should therefore be avoided.

what you can do to reduce BPA exposure

engage with retailers, producers and government departments

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Here are some ways

- Always read the labels. Sometimes a company declares that their product is free of BPA.
- Ask your retailer to stop using and selling polycarbonate food contact materials.
- Contact the manufacturer and ask them whether the food contact material contains BPA.
- Help ensure that endocrine disrupting chemicals, like BPA, are tightly controlled under the new European Chemicals law, REACH. To have BPA identified as a 'Substance of Very High Concern' and subject to a strict authorisation procedure which can stop certain uses from being put in the European market, write to your government (see below) to request that they nominate BPA to the so-called candidate list. Once the chemical is on the candidate list, the producers and sellers of any articles containing this substance will be obliged to inform a consumer, should they request it (see overleaf). The candidate list is expected to be published by the European Commission in October 2008. You will be able to find it then on the website of the European Chemicals Agency (www.echa.eu).
- For each EU member state, the relevant government authority can be found on pages 44-46 of the booklet Navigating REACH which can be found here:
http://www.foeeurope.org/publications/2007/Navigating_REACH_Chem_React_Sept07.pdf



what you can do to reduce BPA exposure

write to companies about its use

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Sample letter to a manufacturer:

Date

Dear Sir/Madam

In accordance with the new regulation on chemicals REACH, I am writing to ask you to inform me about the presence in the product XXX or its packaging of any chemicals from the group of "substances of very high concern" as specified by REACH.

Should any of these substances be present in the product XXX or its packaging, I wish to be informed of the name of the chemical substance(s), and any other accompanying information.

I would be grateful to receive this information within 45 days as required by REACH.

Furthermore, I am also very concerned about the presence of Bisphenol A in XXX and/or its packaging. I would therefore be grateful if you would provide me with any relevant information. Please note that should you fail to provide me with a relevant answer to these questions I would have to switch to a product that I consider safer for my health and that of my family.

I would also be grateful if you would inform me about steps you are taking to provide products intended for the same use but which do not contain such potentially hazardous chemicals.

Yours faithfully

CC: European Chemical Agency
Annankatu, 18, 00120 Helsinki, Finland.
www.echa.europa.eu



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Plastic Code Quick Guide

Avoid

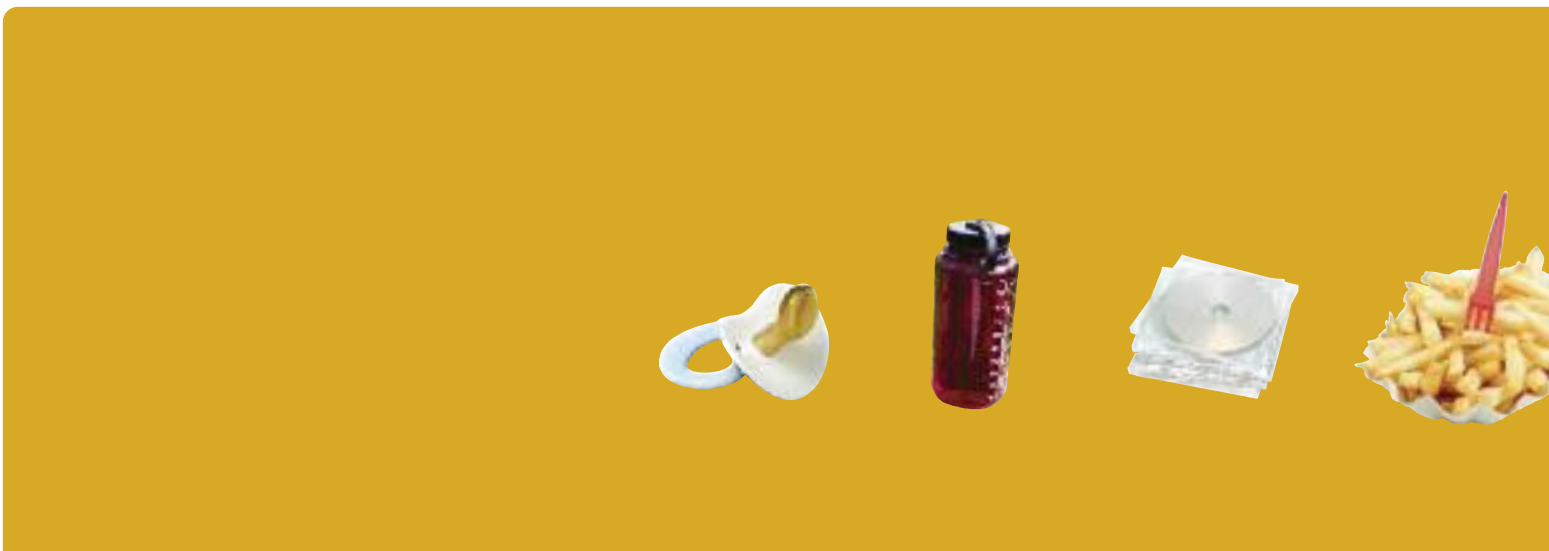
- no.3-PVC (Polyvinyl chloride)
- no.6-PS (Poly Styrene)
- no.7- PC (Poly Carbonate)⁹

Probably Safe

- no.1-PET (Polyethylene terephthalate)
- no.2-HDPE (High-density Polyethylene)
- no.4-LDPE (Low-density Polyethylene)
- no.5-PP (Polypropylene)

cut out and use as a guide when shopping.





**Friends of
the Earth
Europe**

Friends of the Earth Europe
Rue Blanche 15
1050 Brussels, Belgium
email: info@foeeurope.org
www.foeeurope.org



Health & Environment Alliance (HEAL)
28 Boulevard Charlemagne
1000 Brussels, Belgium
email: info@env-health.org
www.chemicalshealthmonitor.org

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