**Cooperative Extension Service**
College of Tropical Agriculture and Human Resources
University of Hawai'i at Mānoa

**Food Safety and Technology**
**May 2008**
**FST-29**

# Bisphenol A

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Bisphenol A, also called BPA, is an organic compound that is a key monomer used in the production of the polycarbonate plastic or epoxy resins used in some food packaging materials. Polycarbonate plastic and epoxy resins are also used in products such as cell phones, computers, household appliances, bicycle helmets, and flooring. BPA is receiving increased scrutiny because of studies that reported its role in causing cancer, tumors, and developmental and hormonal changes in humans.

## Functions

BPA prevents corrosion in cans, and when used in epoxy coatings, it prevents the contamination of the food in the can. BPA increases the heat resistance and durability of bottles. Products using BPA include reusable plastic food and beverage containers, baby bottles, tableware, microwave oven ware, and linings for cans used for food. It has been used in consumer products for over 40 years.

## Types of plastics

There are seven types of plastics used in packaging. In 1988, the Society of Plastics Industries, Inc. (SPI) introduced a voluntary coding system, called the SPI Resin Identification Codes, to identify the type of plastic used to make the container. These are the numbers found, for example, on the bottom of plastic bottles. Numbers 1–6 identify particular resins, while 7 is the catch-all "other." Types 3 and 7 may contain BPA. In many states, these ID codes are used to inform the consumer which packaging can be recycled.

| *Type* | *Plastic* |
|---|---|
| 1 | polyethylene terephthalate (PET) |
| 2 | high density polyethylene (HDPE) |
| 3 | polyvinyl chloride (vinyl) |
| 4 | low density polyethylene (LDPE) |
| 5 | polypropylene (PP) |
| 6 | polystyrene (PS) |
| 7 | other |

## Safety and controversy

Food packaging is important in protecting foods from disease-causing microorganisms and other contaminants. The Office of Food Additive Safety (OFAS) of the FDA's Center for Food Safety and Applied Nutrition (CFSAN) is the regulatory body that oversees all food-contact substances, including plastic packaging materials, to ensure their safety. Manufacturers are required to provide detailed safety tests, such as toxicological, chemical, and environmental tests, before they are approved for safe use.

As a component in food packaging, BPA has been extensively tested and recognized as safe by the U.S. Food and Drug Administration (FDA). The preponderance of evidence indicates that FDA-regulated products with BPA are safe and that exposure levels from BPA food contact materials are well below those that may cause health effects in infants and children.

In 1998, the U.S. Environmental Protection Agency (EPA) established an oral reference dose (RfD) of 50 µg/kg/day, or 50 parts per billion (ppb) per day. RfD is

Published by the College of Tropical Agriculture and Human Resources (CTAHR) and issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Andrew G. Hashimoto, Director/Dean, Cooperative Extension Service/CTAHR, University of Hawai'i at Mānoa, Honolulu, Hawai'i 96822.

an "estimate of daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime." This RfD is much higher than the actual exposure levels to BPA. The amount of BPA that migrates to food packaged in plastic containers or cans is also extremely low and is much less than this RfD. FDA has found no evidence or data to restrict or institute regulatory limits on the amounts of BPA used. Due to the recent concerns about BPA, however, FDA has created a task force to review emerging research, conduct a risk assessment on BPA, and develop recommendations for FDA-regulated products that contain BPA.

Other regulatory agencies worldwide have also recognized the safe use of BPA and support current research findings that it does not accumulate in the body and that the small amounts ingested from daily exposure are rapidly excreted. These agencies include the European Commission's Scientific Committee on Food, the European Food Safety Authority (EFSA), and the U.K. Food Standards Agency.

Scientific bodies continue to review the scientific literature on BPA. In January 2006, the German Federal Institute for Risk Assessment announced that they did not find published research results on the health effects of BPA consistent, leaving them with considerable reservations about the studies' conclusions. EFSA echoed their assessment.

In 2007, the National Institute of Advanced Industrial Science and Technology of Japan concluded that current exposure levels of BPA do not lead to unacceptable risks to human health and that a ban on BPA is unnecessary.

Also in 2007, after reviewing extensive scientific evidence collected since 2002, the EFSA's Scientific Panel on Food Additives, Flavourings, Processing Aids, and Materials in Contact with Food called for a permanent setting of a Tolerable Daily Intake (TDI) level at 50 μg/kg/day, or 50 ppb/day, replacing the previous temporary recommended level. EFSA stated that this TDI is still above "people's dietary exposure to BPA including that of infants and children," demonstrating their confidence in the safety of the TDI level of BPA. Note that EFSA's TDI and the U.S. EPA's safe level of BPA exposure are the same.

In 2000, the National Institute of Health's National Toxicology Program (NTP) reviewed available scientific data, including several large multigenerational rat studies, to evaluate any possible low-dose health effects of BPA. At that time, NTP concluded that there was no evidence for a low-dose health effect of BPA. In 2007, a scientific review panel of the NTP again studied available data. The panel stated in their 2008 draft report (the final report has not yet been released) that there is

- minimal risk associated with low-dose effect
- a possible association between BPA at current human exposure levels and neurobehavioral effects for pregnant women and infants and children
- negligible concern for resulting fetal or neonatal mortality, birth defects, or reduced birth weight and growth in the offspring of pregnant women exposed to BPA
- negligible concern for adverse effects from BPA exposure in adults.

In 2008, Health Canada completed a risk assessment of BPA with industry and other stakeholders and concluded that human exposures are less than the levels deemed to be potentially unsafe. Health Canada, however, considered the margin of safety to be too low for formula-fed newborns and infants and will propose strategies to reduce the amount of their BPA exposure.

## The resulting reactions

There are many criticisms of the experimental designs and interpretations of research results in BPA exposure studies. Low-dose toxicity studies are heavily criticized, especially when BPA is injected into experimental animals. Humans typically ingest BPA and metabolize it in the liver. Even the sources of funding for some studies were implicated as influencing the final results.

Due to these recent events, Wal-Mart announced that it was discontinuing sales in Canada of food containers, water and baby bottles, "sippy" cups, and pacifiers containing BPA. By early 2009, it will also phase out in the United States all baby bottles with BPA. Nalgene stated that it will stop using BPA in its products. Toys-R-Us will stop selling baby bottles with BPA. Patagonia Inc. stopped selling polycarbonate bottles in 2005 and many retailers are doing the same today. Baby bottles are no longer sold by Whole Foods Market (since 2006) or by Mountain Equipment Co-op (since 2007).

On the legislative front, ten U.S. states have legislation affecting the use of BPA, including California, Maryland, Connecticut, and New Jersey. There is also pending legislation that would ban BPA nationwide from products for infants.

On the other hand, other scientific organizations and trade associations support the safety of BPA. These include the American Chemistry Council, the International Food Information Council, and the Grocery Manufacturers Association.

## Putting risk in perspective

Sound science critically depends on the reproducibility of results and consistency of the observations reported by various scientists. The large body of scientific evidence continues to support that FDA-regulated products containing BPA currently on the market are safe to everyone. Exposures to BPA from food contact materials, including those for infants and children, remain much below those that may cause harmful health effects. At this time, FDA is not recommending that consumers discontinue the use of products containing BPA. FDA is, however, advising concerned consumers that alternatives to polycarbonate baby bottles, such as glass bottles, exist.

## Resources

(Sites accessed May 23, 2008.)

Environmental Protection Agency (EPA). 09/26/1988. Bisphenol A (CASRN-80-05-7) http://www.epa.gov/NCEA/iris/subst/0356.htm (accessed May 23, 2008).

European Commission Health and Consumer Protection Directorate-General. May 3, 2002. Opinion of the Scientific Committee on Food on bisphenol A. SCF/CS/PM/3936 Final. http://ec.europa.eu/food/fs/sc/scf/out128_en.pdf.

European Food Safety Authority (EFSA). November 29, 2006. Opinion of the Scientific Panel on Food Additives, Flavourings, Processing Aids and Materials in Contact with Food (AFC) related to 2,2 bis(4-hydroxyphenyl)propane. http://www.efsa.europa.eu/EFSA/efsa_locale-1178620753812_1178620772817.htm.

European Food Safety Authority (EFSA). January 29, 2007. Bisphenol A (BPA) frequently asked questions. http://www.efsa.europa.eu/EFSA/efsa_locale-1178620753812_BisphenolAFAQs.htm.

Food and Drug Administration (FDA). Bisphenol, an overview and message for consumers. http://www.fda.gov/oc/opacom/hottopics/bpa.html.

Grocery Manufacturers Association. 2008. Bisphenol A—A guide for consumers, policymakers, and the media. GMA Science Policy Paper. Washington, DC. http://www.gmabrands.com/publications/SciPol_Bisphenol.pdf.

Melnick, R., et al. April 2002. Summary of the National Toxicology Program's report of the endocrine disruptors low-dose peer review. Environmental Health Perspectives 110(4): 427–431. http://www.jstor.org/pss/3455224 (abstract).

National Toxicology Program, Center for the Evaluation of Risks to Human Reproduction. August 6–8, 2007. Draft meeting summary of the expert evaluation of bisphenol A. http://cerhr.niehs.nih.gov/chemicals/bisphenol/draftBPA_MtgSumm080807.pdf.

Research Center for Chemical Risk Management, National Institute of Advanced Industrial Science and Technology. November 2007. Bisphenol; A risk assessment document (AIST Risk Assessment Document Series no. 4) summary. http://unit.aist.go.jp/crm/mainmenu/BPA_Summary_English.pdf.

U.K. Food Standards Agency Committee on Toxicity of Chemicals in Food, Consumer Products, and the Environment. Statement on a survey of bisphenol A in canned foods. http://www.foodstandards.gov.uk/multimedia/pdfs/bisphenols.pdf.