

TYPES OF PLASTIC, THEIR CHARACTERISTICS... AND WHY THEY MAY BE DANGEROUS TO YOUR HEALTH!

The easiest way for a consumer to identify the type of plastic used in a product is to find the resin identification code (also known as the material container code), which is usually molded, formed or imprinted in or close to the centre on the bottom of the container.

This system of coding was developed in 1988 by The Society of the Plastics Industry (SPI) [www.plasticsindustry.org], which is the Washington, D.C.-based trade association representing the U.S. plastics industry. The intent was to provide plastic recyclers – which urged the industry to develop such a system – with a consistent national system to facilitate recycling of post-consumer plastics through the normal channels for collecting recyclable materials from household waste. The coding system is voluntary for plastic manufacturers, but its use has become relatively standard on plastic products sold in the U.S. and internationally. In Canada, the system is in use and is endorsed by the Canadian Plastics Industry Association (CPIA) [www.cpia.ca], which provides details on the system through its Environment, Health & Safety strategic unit [www.plastics.ca] and its Environment and Plastics Industry Council (EPIC) [www.cpia.ca/epic/].

The purpose of the coding system is to make it easier for plastics to be recycled, but the codes also provide consumers with a simple, handy technique for identifying the type of plastic resin used to make a particular product. In accordance with SPI guidelines, the code is deliberately placed in an inconspicuous location on the product because the industry intent is not to influence the consumer's buying decision, just to facilitate recycling of the product.

Knowing the code for a particular plastic product, consumers can then inform themselves of the characteristics and potential environmental and health effects associated with usage of that particular type of plastic. Helping consumers in this daunting task is one of the fundamental goals of Life Without Plastic.

The table below is a starting point in this information gathering process. For us, this is a continuous process, as this section of our we. Below we provide information we have gathered and reviewed so far, and we welcome your comments and suggestions for any further additions. For example, please send us any plastic-related references you may have, such as peer-reviewed scientific articles (abstracts or full-length versions) relating to the effects of plastics and plastic additives on the environment and health. We cannot guarantee we will use information you provide us, but we will certainly review and consider it. Thank you in advance.

Based on the information provided below, you may wish to carefully consider your usage of all plastic products, and especially when food or drink come into contact with those coded 1, 3, 6 and 7 (polycarbonate), all of which contain chemicals that have been shown in peer-reviewed scientific journals to display disturbing potential environmental and/or health effects. Many of the personal food and drink-oriented products with these codes can be replaced by non-plastic alternatives offered by Life Without Plastic.

**TABLE OF COMMON PLASTIC RESINS AND THEIR CHARACTERISTICS ORGANIZED ACCORDING TO
THE SOCIETY OF THE PLASTICS INDUSTRY (SPI) RESIN IDENTIFICATION (OR MATERIAL CONTAINER) CODE ***

CODE & SYMBOL	NAME (chemical & acronym/common)	PROPERTIES (largely as described by the plastics industry)	PRODUCT APPLICATIONS	RECYCLED PRODUCTS**	POTENTIALLY LEACHING CHEMICALS	POTENTIAL HEALTH EFFECTS OF LEACHED CHEMICALS	REFERENCES & LINKS
 PETE	Polyethylene Terephthalate (PET or PETE)	Clarity, strength / toughness, barrier to gas and moisture, resistance to heat.	Plastic soft drink and water bottles, beer bottles, mouthwash bottles, peanut butter and salad dressing containers, ovenable film, ovenable pre-prepared food trays.	Fibre (polyester), tote bags, food and beverage containers, bottles, clothing, fleece wear, furniture, carpet, luggage.	<i>Antimony trioxide</i> is a catalyst regularly used in the production of PET plastic resin. It remains in the plastic and can leach out into food or drink. It has been shown to leach into water stored in PET water bottles.	Workers exposed to antimony trioxide for long periods of time have shown signs of chronic toxicity, including respiratory tract and skin irritation. Antimony trioxide is known to pass into breast milk and to traverse the placenta. Exposed female workers have exhibited a higher incidence than usual of menstrual problems and of late-term miscarriages; their children tended to develop slower than usual during the first	Shotyk, W., Krachler, M., Chen, B. (2006). <i>Contamination of Canadian and European bottled waters with antimony from PET containers</i> . J. Environ. Monit., 8:288 – 292. This recent study by a group of geochemists compared concentrations of antimony in water bottled in PET with concentrations in

						twelve months of life.	groundwater and in natural water bottled both in polypropylene and glass. They concluded that antimony is leaching from PET. While the ground water contained approximately 2 parts per trillion (ppt) of antimony, freshly bottled water averaged 160 ppt. Samples left in bottles up to six months had levels as high as 630 ppt. (Available online at: http://www.rsc.org/publishing/journals/EM/article.asp?doi=b517844b)
	High Density Polyethylene (HDPE)	Stiffness, strength / toughness, resistance to chemicals and	Milk, water, juice, cosmetic, shampoo, dish and laundry detergent bottles; trash and retail bags, yogurt and	Liquid laundry detergent, shampoo, conditioner, motor oil bottles; pipes,	[Research ongoing]	[Research ongoing]	[Research ongoing]

		moisture, permeability to gas, ease of processing, ease of forming.	margarine tubs, cereal box liners.	buckets, crates, flower pots, garden edging, film and sheet, recycling bins, benches, pens, dog houses, vitamin bottles, floor tiles, picnic tables, plastic lumber, mailbox posts, fencing.			
	Polyvinyl Chloride (V or Vinyl or PVC)	Versatility, ease of blending, strength / toughness, resistance to grease/oil, resistance to chemicals, clarity.	Toys, clear food and non-food packaging, shampoo bottles, medical tubing, wire and cable insulation, film and sheet; construction products such as pipes, fittings, siding, flooring, carpet backing, window frames.	Packaging, binders, decking, paneling, gutters, mud flaps, film and sheet, flooring, cassette trays, electrical boxes, cables, speed bumps, traffic cones, garden hose, mats.	<i>Di(2-ethylhexyl) phthalate (DEHP)</i> is the most common plasticizer additive for PVC, and <i>butyl benzyl phthalate (BBzP)</i> is a plasticizer for vinyl tile, carpet tiles, and artificial leather and is also used in certain adhesives.	DEHP and BBzP are endocrine disruptors mimicking the female hormone estrogen (see http://www.ourstolenfuture.org/Basics/chemlist.htm) and have been linked to asthma and allergic symptoms in children. Also, according to some medical studies, the plasticizers added to PVC may cause certain types of cancer (cholangiocarcinoma, angiosarcoma, brain cancer).	Bornehag, C-G., et al., (2004) <i>The Association between Asthma and Allergic Symptoms in Children and Phthalates in House Dust: A Nested Case-Control Study</i> . Environ. Health Perspect., 112(14):1393-1397. This joint Swedish-Danish research study found a very strong link between allergies

in children and the phthalates DEHP and BBzP, commonly used in PVC.

(Available online at:

<http://www.ehponline.org/members/2004/7187/7187.html>).

Since 1999, the European Union has banned the use of DEHP, BBzP and four other phthalates as softeners in plastic toys intended to be placed in the mouth by children under three years old.

(See

<http://www.eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:344:0040:0043:EN:PDF>)

	<p>Low Density Polyethylene (LDPE)</p>	<p>Ease of processing, barrier to moisture, strength / toughness, flexibility, ease of sealing.</p>	<p>Dry cleaning, bread, and frozen food bags; squeezable bottles (i.e., honey, mustard).</p>	<p>Shipping envelopes, garbage can liners, floor tile, furniture, film and sheet, compost bins, paneling, trash cans, landscape timber, plastic lumber.</p>	<p>[Research ongoing]</p>	<p>[Research ongoing]</p>	<p>[Research ongoing]</p>
	<p>Polypropylene (PP)</p>	<p>Strength / toughness, resistance to chemicals, resistance to heat, barrier to moisture, versatility, resistance to grease/oil.</p>	<p>Ketchup bottles, yogurt containers and margarine tubs, medicine bottles.</p>	<p>Automobile battery cases, signal lights, battery cables, brooms and brushes, ice scrapers, oil funnels, landscape borders, bicycle racks, rakes, bins, pallets, sheeting, trays.</p>	<p>[Research ongoing]</p>	<p>[Research ongoing]</p>	<p>[Research ongoing]</p>
	<p>Polystyrene (PS)</p>	<p>Versatility, insulation, clarity, easily foamed ("styrofoam").</p>	<p>Compact disc cases, food-service applications, grocery store meat trays, egg cartons, aspirin bottles, cups, plates, cutlery.</p>	<p>Thermometres, light switch plates, thermal insulation, egg cartons, vents, desk trays, rulers, license plate frames, foam packaging and plates, cups, utensils, carry-out containers.</p>	<p><i>Styrene</i> migrates from polystyrene containers into the container's contents, especially when oily foods are heated in such containers.</p>	<p>Styrene is an endocrine-disruptor (see http://www.ourstolenfuture.org/Basics/chemlist.htm) mimicking the female hormone estrogen, and thus has the potential to cause serious reproductive and</p>	<p>Ohyama, K., et al. (2001). <i>Certain Styrene Oligomers Have Proliferative Activity on MCF-7 Human Breast Tumor Cells and Binding Affinity for Human Estrogen</i></p>

						developmental problems.	<i>Receptor [alpha]</i> . Environ. Health Perspect. 109:699-703 (Available online at: http://www.ehponline.org/members/2001/109p699-703ohyama/ohyama-full.html)
	<p>Other (<i>This code is a catch-all indicating the product in question is made with a resin other than the above six, or is made of more than one resin used in combination</i>) (may indicate the presence of: polycarbonate, acrylonitrile styrene (AS) / styrene acrylonitrile (SAN), acrylonitrile</p>	<p>Dependent on resin or combination of resins.</p>	<p>Often indicates the presence of <i>polycarbonate</i>: a hard, clear plastic used to make baby bottles, water pitchers, Nalgene brand water bottles, three and five-gallon reusable water bottles, food containers, some citrus juice and ketchup bottles, compact discs, cell phones, automobile parts, computers. Two other types of plastic that fall under code 7 are <i>acrylonitrile styrene (AS)</i> or <i>styrene acrylonitrile (SAN)</i>, and <i>acrylonitrile butadiene styrene (ABS)</i>. Both AS/SAN and ABS are</p>	<p>Custom products, bottles, plastic lumber.</p>	<p><i>Bisphenol A</i>: Polycarbonate is created by linking together in a chain molecules of bisphenol A, an endocrine disrupter that mimics the female hormone estrogen (see http://www.ourstolenfuture.org/Basics/chemlist.htm). Bisphenol A is also a component of resins used to line metal food cans.</p>	<p>A seminal 1997 study by researchers in the Endocrine Disruptors Group at the University of Missouri-Columbia showed that low environmental exposure of mice to bisphenol A causes prostate hyperplasia (excessive growth of prostate tissue, a pre-condition of cancer). Since then, numerous studies by the same researchers and others have shown that low-level exposure to bisphenol A causes decreased sperm production in</p>	<p>Seminal study: Nagel, S.C., vom Saal, F.S., Thayer, K.A., Dhar, M.G., Boechler, M. and Welshons, W.V. (1997). <i>Relative binding affinity-serum modified access (RBA-SMA) assay predicts the relative in vivo bioactivity of the xenoestrogens bisphenol A and octylphenol</i>. Environ. Health Perspect. 105:70-76.</p>

	<p>butadiene styrene (ABS), nylon or acrylic)</p>		<p>higher quality plastics with increased strength, rigidity, toughness and temperature and chemical resistance. AS/SAN is used in mixing bowls, thermos casing, dishes, cutlery, coffee filters, toothbrushes, outer covers (printers, calculators, lamps), battery housing. The incorporation of butadiene during the manufacture of AS/SAN, produces ABS, which makes it an even tougher plastic. ABS is used in LEGO toys, pipes, golf club heads, automotive parts, protective head gear. Our research on risks associated with AS/SAN, ABS, nylon and acrylic is ongoing.</p>			<p>males, accelerated rate of growth, sex reversal in frogs, early onset of puberty, chromosome damage in female ovaries and a variety of behavioural changes.</p>	<p>(Available online at: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1469837). Other key studies by vom Saal and others listed at: http://endocrinedisruptors.missouri.edu/vomsaal/vomsaalpubs.html.</p> <p>See also the following review indicating serious flaws in industry-funded research on Bisphenol A: http://www.ourstolenfuture.org/newscience/oncomponents/bisphenola/2006/2006-0101vomsaalandwelshons/2006-0101vomsaalandwelshons.html.</p>
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* Much of the information in the first five columns (Code & Symbol, Name, Properties, Product Applications, Recycled Products) is from the websites of plastics

industry organizations (SPI, APC and CPIA).

** The percentage of recycled plastic content in these products will range from 10-100 per cent.