

THE HEALTH RISKS OF USING PLASTIC FOR FOOD STORAGE AND OTHER EVERYDAY ITEMS

I. Introduction

Plastic is the general term used to describe the many different combinations of plastic polymers consumed daily around the globe. Plastic was brought into widespread use only in the 1950s but has now become indispensable in the daily lives of millions of people around the globe. Since its initial marketing and introduction into household use, consumers have been wary of the effects that this synthetic material could have on their health. In response to these concerns, several studies in the past few decades have shown the harmful effects of certain types and combinations of plastics. In fact, a 2011 study done by Yang Chun et al found that “almost all commercially available plastic products...leached chemicals having reliably detectable estrogenic activity” . Unfortunately, these studies have not prompted most governments to legislate stringent regulations, which would protect consumers from the harmful chemicals released by many plastics. Therefore, the tedious and time consuming task of informing oneself of the health risks involved in the daily use of (or rather, attempt at daily avoidance of) the hundreds of potentially harmful plastic items that have invaded our daily lives, from teething rings and disposable diapers to plastic stir sticks and cling wrap, has fallen to consumers and/or natural health counselors. The following information, including how to identify “safer” plastics, should prove helpful in addressing this considerable task.

What is plastic made from?

The main ingredient of most plastic, or plastic polymers is distilled crude oil. Other substances, which may be added to different plastics in varying amounts, include salt, cellulose, coal and natural gas. Plastics are made through the processes of polymerization or poly condensation, the production process being dependent on the desired qualities for each product, including malleability, durability, and desired weight.

How is plastic harmful?

Crude oil, or petroleum, is a yellow-to-black liquid, which occurs naturally and is made up of a mixture of hydrocarbons. Exposure to crude oil, such as spending time near oil refineries, can cause negative health effects such as headaches and disturbances to the circulatory, respiratory or integumentary systems. This toxic substance, alone or in combination with other substances, should obviously never be ingested. Why then, do supermarkets sell hundreds of thousands of food products packaged in combinations of solid forms of crude oil mixed with other toxins?

Many companies claim that the health risks of the toxins being transferred to foods are minimal or non-existent, while others use “safer” forms of plastic for the products they sell. In reality, exposure to sunlight, heating, or acidity (i.e. acidic foods such as tomatoes) can all cause leaching, a process by which toxins are transferred from the plastic to the food product it encases. Next, the food is ingested.

II. Plastic additives and their impact on health

Not only is petroleum itself a toxin if inhaled or ingested, but the many substances added to plastics to produce desired characteristics are toxic as well. Plasticizers are used to increase malleability; examples include **adipates** and **phthalates**. Other plastics contain **alkyphenols** which are **xenoestrogens** (mimic and interfere with estrogen function in the body). Also, monomers used to produce certain plastics, can become trapped in plastic items. One example is **vinyl chloride**, the precursor to **PVC**, which is a known human carcinogen.

Other known toxins found in plastics are: **BPA** (Bisphenol A), now often replaced by **BPS** (Bisphenol S) which produces many of the same health effects, **TBBPA** (Tetrabromobisphenol A), and **PBDE** (Polybrominated diphenyl ethers). Plastic can also

contain **toxic metals**. Still other plastic products, such as disposable diapers, can contain **dioxins**.

BPA - BPA, a plasticizing agent, is an endocrine disruptor and perhaps the most commonly known toxin that has demonstrated leaching from plastic products. Research has shown many potential negative health effects from this toxin. According to a 2012 study by Jennifer T. Wolstenholme et al, "**Exposure to BPA during development may affect brain organization and behavior**, perhaps as a consequence of its actions as a steroid hormone agonist/antagonist and/or an epigenetic modifier. Here we show that BPA produces transgenerational alterations in genes and behavior."

A 2002 study by Kenji Moriama et al showed that **BPA can disrupt thyroid action**. A 2006 study has linked low-level exposure to BPA with insulin resistance "which can lead to inflammation and heart disease". A more recent 2012 study found a positive link between BPA and obesity, abdominal obesity, and insulin resistance.

BPS - Bisphenol S has replaced Bisphenol A in many products. However, it is also an endocrine disruptor and has shown many of the same negative effects as BPA. Many consumer products that are labeled "BPA free" contain BPS; therefore the label "BPA free" does not necessarily mean that products are safe to use.

PHTHALATES - Phthalates are a type of plasticizer. They are endocrine disruptors and have been linked to breast cancer, disrupted endocrine function, preterm birth and birth defects. They may also lead to liver and kidney ailments, a higher risk of cancers and worsen asthma symptoms. The European Union has banned the use of phthalates in toys.

ADIPATES - According to the United States Environmental Protection Agency "Some people who drink water containing di(2-ethylhexyl) adipate well in excess of the maximum contaminant level (MCL) for many years could experience toxic effects such as weight loss, liver enlargement, or possible reproductive difficulties."

ALKYPHENOLS are **XENOESTROGENS** which mimic and interfere with the functioning of the body's own estrogens, including promoting the early onset of puberty and causing malfunction of the reproductive system.

PVC / VINYL CHLORIDE - Many studies have linked vinyl chloride to liver damage and cancer of the liver. People who are exposed to vinyl chloride in the workplace have experienced the following symptoms or illnesses: dizziness, nausea, headache, fatal respiratory failure, birth defects, brain and lung tumours and liver toxicity. Those who handle PVC frequently have shown various skin problems ranging from thickening of the skin to blistering. Most PVC products contain phthalates as a plasticizer. As stated above, phthalates are endocrine disruptors and can cause endocrine malfunction.

TBBPA - Tetrabrombisphenol A is an endocrine disruptor and an immunotoxicant, which means it can decrease the development or function of immune cells. TBBPA has been shown to interfere with thyroid function as it can mimic thyroxin. Experiments in zebrafish have shown TBBPA to be more toxic than BPA.

PBDE - Polybrominated diphenyl ethers are compounds used as a flame retardant. A 2010 study by A. Williams linked PBDE exposure with impairment to the development of the nervous system. PDBEs have also been shown to negatively effect estrogen and thyroid hormones as well as fetal development.

TOXIC METALS - Antimony is one toxic metal that has been found to leach from PET bottles, particularly those containing acidic fruit juices. Low doses of antimony can cause headaches, dizziness and depression. Larger doses can cause damage to the kidneys and liver and can lead in death.

DIOXINS - Dioxins are by-products, formed during the creation of a variety of products including different types of plastic. They are very toxic substances and can cause a variety

of health problems, including harming the immune system and interfering with hormones. Animal studies have shown them to be carcinogens.

Other toxins - Some polymers, when heated, break down into other toxic substances. Many of them release chemicals that produce estrogenic activity. Therefore, even the “safer” plastics can be toxic when heated or in contact with acidic substances.

Estrogenic disruptors account for many of the above toxins. How do they affect the function of our bodies?

BPA, BPS, TBBPA, phthalates, alkylphenols, adipates are all xenoestrogens, a type of xenohormone which mimics estrogen. They may act as false messengers, sending the wrong messages through the endocrine system, causing malfunction. Many studies have shown that negative effects of xenoestrogens can cause a wide variety of endocrine related problems, in particular breast cancer, women’s health issues, gynecomastia in men, precocious puberty, infertility, fetal development, and obesity. Please see the chart below for more information.

AILMENTS THAT HAVE BEEN LINKED TO PLASTIC USE

Below are examples of some specific ailments, which have been linked to plastic use.

AILMENT	ADDITIONAL INFO
Breast cancer	Many plastics contain BPA and phthalates, which are endocrine disruptors. According to www.breastcancer.org , “because estrogen can make hormone-receptor-positive breast cancer develop and grow, many women choose to limit their exposure to these chemicals that can act like estrogen.”
Women’s health issues, such as: endometriosis, fibroids, painful menstrual periods, heavy and prolonged periods, bleeding between periods, cystic breast disease, menopausal and PMS symptoms	These health issues are all linked to high estrogen levels. BPA, phthalates and PCBs are xenoestrogens, which can be released from plastic containers into food and drinks. These xenoestrogens mimic and interfere with the functioning of the body’s own estrogens.
Precocious puberty /early periods	Xenoestrogens from plastic containers accumulate in the body and raise estrogen levels, which can result in an early onset of menstruation in young girls.
Infertility	Too much estrogen in a woman’s body can make it more difficult to conceive. Ingesting xenoestrogens from plastics can therefore pose risks to fertility.
Fetal development	Exposure to phthalates has been linked to birth defects. BPA can affect fetal brain development. A 2012 study found that “pregnant women with high levels of BPA in their urine were more likely to have daughters who showed signs of hyperactivity, anxiety, and depression.” (breastcancer.org)
Thyroid malfunction	High estrogen depresses thyroid levels by interfering with thyroxine.
Obesity (inability to lose weight)	A 2012 study by Raquel Chamorro-García et al has shown that BADGE (Bisphenol A Diglycidyl Ether) may “cause stem cells to become fat cells”. According to Chamorro-García “exposure to these kinds of chemicals can reprogram your metabolism and make it more likely for you to store calories instead of passing them through.” Men may store extra fat in their breast tissues (gynecomastia) due to too much estrogen circulating in the body.





III. Identifying different types of plastic




Below is a list of the different types of plastics used in food storage or other household needs, categorized by their “resin identification code” .

The Resin Identification Code was created in 1988 by the SPI (Society for the Plastics Industry) in response to consumer concerns about how the toxic ingredients in plastic were affecting the environment and individuals. Originally, the symbol used was a triangle with “chasing arrows” ; however this created confusion in that it led some consumers to believe that this symbol indicated that the particular product could be recycled. According to the SPI, the arrows are gradually being replaced by solid triangles as of 2013.

The SPI website stipulates regulations for manufacturers using the RICs. One is that the code should be “inconspicuous at the point of purchase so it does not influence the consumer's buying decision.” This clearly illustrates that the SPI does not want consumers to make informed buying decisions based on potential toxicity of the product at hand.

RESIN IDENTIFICATION CODES and THEIR COMMON USES

Symbol	COMMONLY FOUND IN
	<p>PET / PETE (Polyethylene terephthalate) water bottles, soda bottles, peanut butter jars, plastic ketchup bottles, trays for food, salad trays, medicine jars, peanut butter jars, combs, bean bags, and rope.</p> <p>RISKS: PET bottles should not be reused as this can increase the risk of bacteria developing inside them or leaching. When heated or exposed to acidic substances, PET can leach phthalates, the toxic metal antimony, and may leach other carcinogens.</p> <p>THIS PLASTIC IS RELATIVELY SAFE IF KEPT AWAY FROM HEAT OR SUNLIGHT SHOULD NOT BE REUSED.</p>
	<p>HDPE (High-density polyethylene) milk jugs, milk bottles, detergent and oil bottles, toys, some plastic bags, bleach, cleaners, most shampoo bottles.</p> <p>RISKS: HDPE bottles can be reused as HDPE plastic has been shown to withstand sunlight, hot temperatures and freezing. HDPE can be recycled.</p> <p>THIS PLASTIC IS RELATIVELY SAFE</p>
	<p>PVC (Polyvinyl chloride)(soft and flexible) food wrapping, meat wrap, cooking oil bottles, teething rings, children’s and pets’ toys, mattress covers, pipes, fittings, window and door frames (rigid PVC), thermal insulation (PVC foam), and blister packaging.</p> <p>RISKS: PVC should be avoided because of the numerous toxins it can leach. PVC may contain phthalates; when PVC is manufactured, dioxins are released. PVC should not be reused and less than 1% is actually recycled.</p> <p>THIS PLASTIC SHOULD BE AVOIDED</p>
	<p>LDPE (low-density polyethylene) shrink wraps, dry cleaner garment bags, squeezable bottles, bread packaging, plastic grocery/carrier bags, bin liners, packaging films</p> <p>RISKS: This plastic has not been shown to leach harmful chemicals.</p> <p>THIS PLASTIC IS RELATIVELY SAFE</p>
	<p>PP (Polypropylene) disposable diapers, pails, plastic bottle tops, margarine and yogurt containers, potato chip bags, straws, packing tape, rope, margarine tubs, microwaveable meal trays, fibres ,and filaments for carpets, wall coverings and vehicle upholstery.</p>

	<p>RISKS: PP can degrade when exposed to heat and UV rays. Not much leaching has been found from PP though Canadian research (2008) found leaching of oleamide and quaternary ammonium biocides-anti-bacterial agents but the health effects are yet unknown.</p> <p>THIS PLASTIC IS RELATIVELY SAFE IF KEPT AWAY FROM HEAT OR SUNLIGHT</p>
	<p>PS (Polystyrene)/Styrofoam disposable styrofoam drinking cups, take-out “clamshell” food containers, egg cartons, plastic picnic cutlery, foam packaging, “peanut” foam chips used to fill shipping boxes, yoghurt pots, foam hamburger boxes and egg cartons, plastic cutlery, protective packaging for electronic goods and toys, rigid foam insulation and underlay sheeting for laminate flooring.</p> <p>RISKS: “Polystyrene may leach styrene, a possible human carcinogen, into food products. Chemicals present in polystyrene have been linked with human health and reproductive system dysfunction.” (Earth Easy)</p> <p>THIS PLASTIC SHOULD BE AVOIDED</p>
	<p>OTHER, often PC - includes plastic with BPA baby bottles, sippy cups, plastic food containers, water cooler bottles, car parts, or any other plastics that do not fall into the above categories. The new generation of bio plastics is also currently marked #7. They may have the initials PLA on the bottom.</p> <p>RISKS: BPA from PC containers may leach into food or drinks. Other unknown plastics have unknown effects.</p> <p>THIS PLASTIC SHOULD BE AVOIDED</p>

An “R” prefix on a plastic item means it is made of recycled resin, e.g. RPETE. Please note that some products do not appear to be made of plastic, but have an inner plastic lining (which often contains BPA). Examples include **canned food, Tetra Paks, non-stick cookware, and even some metal water bottles.**

IV. Recommendations

Avoid plastic, Tetra Paks and canned food as much as possible for health and environmental reasons. If you decide to buy products packaged in plastic, look for #1, #2, #4 or #5. Avoid #3, #6 and #7 or any plastic that has a no symbol at all. Even if a label says “BPA free”, it might still contain other toxins.

In order to minimize the risk of leaching, those concerned should store plastic drink or food containers at room temperature and avoid storing fatty foods such as meat or cheese in plastic wrap or plastic containers. Discard plastic that has been scratched, avoid washing plastic items in the dishwasher, and never microwave food in plastic containers or drink hot drinks from disposable plastic cups. Even if a container says microwave safe, that does not guarantee that toxins won't leach into the food; it only means that the plastic won't melt. Always wash children's toys before use, with soap or vinegar and water. Many cash register receipts contain BPA; wash hands after handling them.

ALTERNATIVES TO COMMONLY USED PLASTIC PRODUCTS

Check packages to determine actual plastic used on each item. If there is no symbol or number, the manufacturer should be contacted.

Product	Type of plastic or additives commonly used	Possible health effects	Suggested Alternatives
Bottled water or soda	PET plastic (#1); PET can leach phthalates and the toxic metal antimony when exposed to heat or sunlight	In small doses, antimony can cause headaches, dizziness or depression. Larger doses can damage the liver and kidneys. Phthalates have been linked to breast cancer, disrupted endocrine function, preterm birth and birth defects	Fill a glass with tap water or bring water from home in stainless steel bottles which are BPA, BPS, and phthalate and lead free, such as Kleen Kanteen.
Water coolers	Other, #7, potentially leach BPA and other toxins	BPA may affect brain organization and behavior; interferes with hormone function.	Plastic free water cooler (e.g. Quench) or tap water (w/filter if preferred)
Some metal water bottles	Aluminum lined with a plastic coating containing BPA	Aluminum has been linked with Alzheimers' s and kidney disease	Stainless steel water bottles which explicitly state they are BPA and BPS free, do not contain phthalates, lead or aluminum
Juice or milk in Tetra paks	Lined with LDPE or PET(#1); plastic or aluminum, possibly BPA	PET can leach estrogenic substances leading to endocrine problems. Aluminum has been linked with Alzheimers' s and kidney disease.	Glass bottles *a trial project in Brazil is using bio plastic from sugar cane for Tetra paks.
Milk jugs	HDPE (#2)	This plastic is relatively safe.	Glass bottles
Oil bottles	HDPE (#2)	This plastic is relatively safe, but oil should be kept in dark bottles to avoid oxidation.	Dark glass bottles
Food in cans/tins	Lined with PC (polycarbonate),which contains BPA. (Canned tomatoes are particularly risky as their acidity can promote leaching.)	BPA may affect brain organization and behavior; interferes with hormone function.	Glass containers, dry or fresh foods, e.g. dried beans, fresh fish, fresh soup, fresh tomatoes or tomatoes in glass jars. Some companies use BPA free tins.
Grains or other foods stored in plastic bags	LDPE (#4) or PVC (#3) PVC usually contains phthalates.	LDPE has not been shown to leach toxins; Phthalates have been linked to breast cancer, disrupted endocrine function, preterm birth and birth defects	Buy in bulk, filling own cloth or mesh bags, or transfer immediately after purchase to glass or ceramic storage container.
Frozen vegetables	LDPE (#4)	LDPE has not been shown to leach toxins	Buy vegetables fresh, dried, or preserved in glass if you want to avoid this plastic.
Fresh fruit/vegetables packaged in plastic	PVC (#3) or LDPE (#4) PVC usually contains phthalates.	LDPE has not been shown to leach toxins; Phthalates have been linked to breast cancer, disrupted endocrine function, preterm birth and birth defects	Bring mesh bags and choose organic fruit and vegetables that are not in packaging. Some vegetable bags are biodegradable.

Meat or cheese wrapped in plastic	PVC (#3) PVC usually contains phthalates.	Phthalates have been linked to breast cancer, disrupted endocrine function, preterm birth and birth defects	Take your own container to shop to have cheese placed in Or cut off the layer of cheese which the plastic covered and transfer to another container
Plastic food storage containers	LDPE (#4)	LDPE has not been shown to leach toxins, but food should never be microwaved in them to reduce risk of leaching.	Stainless steel or glass containers
Pots and pans with non-stick coatings	PTFE (Teflon) can release up to 15 different toxins upon heating	Teflon has been linked to thyroid disease, chronic fatigue and cancer. Teflon fumes have been shown to kill birds.	Use cookware made from: Cast iron Ceramic Stainless steel
Baby bottles	PC (#7) usually contains BPA (now banned in baby bottles in some countries) PP, (#5) - releases phthalates Silicone- releases phthalates PA (polyamide) - can contain BPA PES (Polyethersulphone) - relatively safe	BPA is an endocrine disruptor, linked thyroid malfunction and obesity, may affect brain organization. Phthalates have been linked to breast cancer, disrupted endocrine function, preterm birth and birth defects.	Glass or stainless steel baby bottles (e.g. Pura brand)
Baby pacifiers	HDPE (#2) PC - usually contains BPA Silicone - releases phthalates	BPA is an endocrine disruptor, linked thyroid malfunction and obesity, may affect brain organization. Phthalates have been linked to breast cancer, disrupted endocrine function, preterm birth and birth defects	Natural rubber pacifiers (e.g. Natursutten brand)
Plastic toys- teethers, rubber duckies, beach balls, and bath books.	HDPE (#2) PVC (#3) usually contains phthalates	Phthalates have been linked to breast cancer, disrupted endocrine function, preterm birth and birth defects	Buy lead free wooden or organic cotton toys, or look for the CE marking on toys IKEA has completely phased out PVC in favour of PP (#5)
Yo yo balls (toy)- have a strong chemical smell	Possibly phthalates	Phthalates, have been linked to breast cancer, disrupted endocrine function, preterm birth and birth defects	Wooden yo-yo
Diapers	PP (#5) Dioxins -in small amounts, created when wood pulp is bleached - variety of plastics, adhesives, glues and lubricants xylene, ethyl benzene, styrene and isopropylene can be emitted by some diapers	Dioxins have been linked with cancer, though there are no studies linking diaper usage to cancer Xylene and ethyl benzene are suspected endocrine, neurological and respiratory toxins; Styrene has been linked to cancer Isopropylene is a neurotoxin.	Cloth diapers or eco-diapers that don't contain harmful ingredients

Plastic straws	PP (#5) HDPE (#2) Formerly were made with PS (#6)	Relatively safe	Reusable stainless steel or silicone straws
Vaseline/Petroleum jelly	Petroleum sludge, contains hydrocarbons	Hydrocarbons have been found in women with breast cancer.	Coconut oil or other natural oil based commercial lip balms
Shower curtains	PVC (#3) - can contain phthalates.	Exposure to phthalates can result in endocrine problems.	Cotton with nylon liner
Mattress protector	PVC (#3) - can contain phthalates. Polyurethane	Phthalates have been linked to breast cancer, disrupted endocrine function, preterm birth and birth defects.	Choose Vinyl, PVC and Phthalate Free options
Flooring	PVC (#3)- can contain phthalates.	Phthalates have been linked to breast cancer, disrupted endocrine function, preterm birth and birth defects.	Linoleum, cork, bamboo or wood flooring

V. Conclusion

Many studies have shown that the use of plastics to store food or drinks poses health risks, in particular plastics that contain xenoestrogens, which disrupt endocrine function in the body. People who are experiencing health issues related to obesity, thyroid malfunction, and women's health issues in particular, should be strongly advised to refrain from storing food or drinks in plastic containers as much as possible. Couples unable to conceive should be advised to avoid food and beverages contained in plastics due their effects on fertility. Expectant mothers should be particularly cautious of plastic use due to the risks to the developing fetus; baby bottles, food containers, teething rings and toys should be verified to make sure they don't contain BPA, BPS, phthalates, lead or other toxins. Any other individuals who are committed to a healthy lifestyle with minimal exposure to toxins should also choose better alternatives to plastic.

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ADDITIONAL RESOURCES FOR READING OR VIEWING

The Clean Bin Project - video documenting a year in the life of a couple who tries to live without creating any non-biodegradable waste; avoiding plastic proved a big challenge.
<http://cleanbinproject.com/>

My Plastic Free Life - website documenting one woman's challenge to live without plastic. <http://myplasticfreelife.com/>

Life without plastic - website for purchasing plastic free alternatives to common household items. <http://lifewithoutplastic.com/>

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