

## ARE PLASTIC BOTTLES OF WATER SAFE FOR DRINKING? .... NOT REALLY

Plastic bottles PET and similar, are made from petroleum. Most plastics are made of long chains of hydrocarbon molecules, built from simpler building blocks called monomers. Some plastics then have chemicals added to give them a characteristic such as flexibility or colour. New evidence that PET drink bottles can leach substances into the contents that mimic the sex hormone estrogen – phthalates and antimony – has put PET bottles in the crosshairs also of scientists worried about their health safety.

According to the U.S. Center for Disease Control, [antimony can cause acute and chronic health issues](#), such as diarrhea, vomiting, and stomach ulcers. ("Most antimony oxide produced is added to textiles and *plastics* to prevent their catching on fire.") each from plastic increase by thousandfold when the water content in a bottle is exposed to the sun. A study carried out by the University of Missouri states that PET-bottled water triggered a 78 percent increase in the growth of the breast cancer cells when compared with control water. A Columbia University research also has reported that excessive exposure to endocrine disruptors/phthalates might increase a child's future risk of developing asthma. "Eighty percent increased risk of developing asthma between age of five and 11, if their mothers were exposed to high levels of phthalates during pregnancy," it was noted. Moderator Dr. Mamta Jain said that plastics and their additives are not just around us, they are virtually inside every one of us, present in blood and urine in measurable amounts due to the leach in plastic. It was noted that even the safest of safe claimed plastic leaches dangerous chemicals, which disrupts the entire body. The 'single use' water bottles that you typically buy at milk bars, service stations and the like are usually made from polyethylene terephthalate (abbreviated to PET or PETE), an inexpensive and lightweight plastic. Its recycling code (the number in the centre of the triangle of arrows found on most plastics) is 1. "PET is not one of the plastics that one would think has a propensity to cause a problem," says Moore. Moore agrees with the US FDA, which says that PET bottles are safe for use and reuse so long as they are washed properly with detergent and water to remove bacteria.

The safety of using PET bottles was questioned after a student research project hit the headlines. The 2001 study found traces of a phthalate — a potentially harmful 'plasticizer' used to make some plastics more flexible — in water from PET bottles, but the research hadn't been verified.

Moore says PET has never contained phthalates and the public's association between the two could be based on the plastic's name.

And while some preliminary studies have suggested water from PET bottles can contain as-yet-unidentified substances with 'estrogenic' properties (which disrupt the body's normal hormone regulation), Moore says no rigorous scientific review has backed these.

A substance called antimony is used in PET production and it can leach into the water in PET bottles. However, this doesn't pose much of a risk, says Moore.

"Antimony is not in the same league as lead or mercury toxicologically so the likelihood of harm is low," says Moore.

A [University of Texas study](#) published last month in *Environmental Health Perspectives* confirms that hormone-disrupting chemicals leach from almost *all* plastics, even BPA-free plastics.

### **BPA is not the only chemical with Estrogenic Activity**

BPA concerns us because it has Estrogenic Activity (EA), meaning it mimics the hormone estrogen in the body. According to the study authors, chemicals with EA have been linked to all kinds of health

problems, including *early puberty in females, reduced sperm counts, altered functions of reproductive organs, obesity, altered sex-specific behaviors, and increased rates of some breast, ovarian, testicular, and prostate cancers.*

Theorizing that BPA was not the only EA chemical, the authors of the study tested 455 everyday products of all different kinds of plastic from various retail sources to determine if they had estrogenic effects. Products included food wrap, deli containers, hard or flexible packaging, plastic bags, baby bottles, and reusable plastic water bottles. Most of these products were BPA-free. But what other chemicals were in them? Just like you and I, the researchers didn't know. We are, after all, talking about the plastics industry and their secrets.

*The exact chemical composition of almost any commercially available plastic part is proprietary and not known. A single part may consist of 5-30 chemicals, and a plastic item containing many parts (e.g., a baby bottle) may consist of 100 or more chemicals, almost all of which can leach from the product, especially when stressed.*

So, to test the products they had gathered, the researchers first extracted chemicals from the various plastic products using different solvents to mimic the types of foods/beverages the plastics might contain, and then they exposed those extracted plastic chemicals to **MCF-7 cells**, a type of human breast cancer cell that is receptive to estrogen. If the cells multiplied in the presence of the leached plastic chemicals, the researchers knew those chemicals were estrogenic and therefore potentially harmful to humans.

Their finding? **Almost all of the plastic products tested leached EA chemicals.**

*Almost all commercially available plastic products we sampled, independent of the type of resin, product, or retail source, leached chemicals having reliably-detectable EA, including those advertised as BPA-free. In some cases, BPA-free products released chemicals having more EA than BPA-containing products.*

### **Stressed Out Plastic is Even Worse**

Realizing that plastics are more likely to leach chemicals when exposed to various stressors like heat or light, the researchers also tested the products after subjecting them to UV radiation (mimicking the effect of sunlight), wet heat (as in a dishwasher), and microwave radiation. As you might expect, there was more leaching of EA from stressed plastic products than from unstressed ones. In fact, in some cases, products with no detectable EA levels when unstressed were found to release EA chemicals after being roughed up a bit. Wouldn't you?

**The Point:** it's not enough for a company to test its products in an unstressed environment. Only by exposing plastic products to the kinds of stressors it will be subjected to in real life can we know for sure whether it will leach EA chemicals or not.

### **Bio-Based Plastics Like PLA are Not Exempt**

PLA is a kind of compostable plastic made from starch, usually corn. It's generally touted by its manufacturers as safe simply because it doesn't come from petroleum. So, guess what. 71% of all the PLA samples tested were found to leach EA chemicals as well.

**The Point:** just because a plastic is made from plants doesn't make it safe.

### **It's in the Additives**

The researchers also tested "barefoot" polymers, meaning pellets of the basic plastic before any other chemicals have been added to it. And while a few of these barefoot plastics (#2, #4, and #5) did not leach EA chemicals by themselves, nearly all commercial products made from these plastics did. It's those darned secret additives!

**The Point:** it's not enough for a company to tell you that a certain type of plastic (#2, #4, #5) is safe. Without knowing what additives are in it, we don't know what could be leaching out.

### **Some BPA Replacements are WORSE than BPA**

The researchers tested baby bottles made from PES (polyether sulfone), a new plastic being used to

replace BPA in hard plastic bottles. Among others, Born Free brand bottles are made from PES. What did they find? Some PES baby bottles released more EA chemicals than those with BPA in them! The researchers also tested water bottles made from PETG, a copolyester like the new Eastman Tritan which has replaced BPA water bottles. Again, EA chemicals were found to leach from those bottles as well.

As for our good old #1 PET disposable water/soda bottles? Big time EA leaching.

**The Point:** be skeptical of new plastics being developed to replace harmful ones. And remain skeptical of old plastics too.

### **Are There Any Safe Plastics?**

One of the study researchers works for a company called [PlastiPure](#), which is working to develop EA-free plastics. To do that, the company hopes to create an EA-free supply chain, requiring that all the chemicals that are added to plastics be certified EA-free as well. Their [WaterGeeks](#) plastic water bottle is advertised as EA-free.

I had a conversation with Brent Meikle from PlastiPure last year. I asked why go to all the trouble to develop a "safe" plastic bottle when they could just promote stainless steel or glass instead. Brent's feeling was that it was not practical to expect everyone to switch to stainless steel bottles, especially those involved in sports, and that plastics are here to stay, so they should be safe.

Whether or not the new EA-free plastics are safe or whether they will turn out to have other harmful health effects, the fact remains that like all petroleum-based plastics, they are not biodegradable and will cause harm to the environment when not handled properly. I hope that PlastiPure will continue to focus on making durable plastic products rather than single-use disposables.

As for me, I'm going to stick to my stainless steel travel mug and water bottle. No plastic water bottles for me. But as for my plastic lid? If it has to be plastic, I'd rather it were EA-free.

**The Point:** we can only act on the information we have at the moment. Ask questions. Remain skeptical. But keep an open mind.

### **Using your own bottle**

But what if you've decided not to buy bottled water, but to use a refillable water bottle to cut down on the plastic sent to landfill?

Polycarbonate has been commonly used to make the sturdy reusable water bottles that many of us use. Polycarbonate is one of the plastics classed as 'other' in the recycling scheme. It has a recycling code of 7, but not all bottles stamped with a 7 are made from polycarbonate.

Polycarbonate is made of a monomer called bisphenol A (BPA). As the plastic breaks down over time, BPA is released into the water held in polycarbonate bottles, particularly when the bottle is heated or repeatedly washed.

"If you have a bottle made of polycarbonate, on first use there probably isn't much depolymerisation but as you use it again and again — especially if things are warm or hot — then there's a high likelihood that there will be a breakdown of the plastic to release the monomer," says Moore.

But just because there is some BPA in the water, it doesn't necessarily mean it's dangerous, says Moore. Research in animals has found BPA can cause a range of conditions — such as cancer, diabetes, obesity and reproductive and developmental disorders. Some studies suggest that young animals metabolize BPA less efficiently than adults.

"But there's nothing much in the way of identified effects in humans — virtually all of the effects have been established in relatively higher levels of exposure in animal models. The level of exposure is probably not sufficient to cause these effects [in people]. But people who are feeding young children are saying 'I'd rather not take the chance', which is fair enough."

PET and BPA plastics are the most common types of containers for water and other drinks. Both PET

plastics and BPA plastics have been shown to leach over time. PET plastics tend to leach when exposed to realistic though extreme conditions, such as exposure to sunlight, heat and storage time. The Harvard School of Public Health has shown that exposure to BPA can interfere with reproductive development in animals. It has also been linked with cardiovascular disease and diabetes in humans.

### **Safe Alternatives to Reusing Plastic Bottles**

Stainless steel bottles are considered the safest alternative to plastic bottles. They are durable and do not leach. Glass is another safe alternative but less practical due to its breakable nature.