The Problem with Plastics

Plastics are everywhere – in our food packaging, clothing, personal care products, and even the air we breathe. Research shows that plastics, the chemicals they contain, and the microscopic fragments they break down into can enter our bodies and harm our health. The good news is that you can take simple, powerful steps to reduce your exposure to plastics and protect your health.

Plastics, Plasticizers, and Microplastics: Where They're Found and Their Health Risks

Plastics, plasticizers, and microplastics are three types of chemicals that are linked together:

- **Plastics** are ever-present in our environment. Over time, they break down in response to heat, light exposure, washing, and wear and tear. They can then leach into our food, water, and living and working spaces, likely harming our health.
- **Plasticizers** are chemicals added to plastics to make them flexible, durable, or transparent.
- **Microplastics** are tiny pieces of plastic that range in size from 1 nanometer (nm) to 5 millimeters (mm). For reference, a human hair is about 80,000 nm wide.[1] They are either intentionally manufactured or result from plastic degradation. Microplastics may also absorb other chemicals, making them carriers of other toxins.[2]

Both plasticizers and microplastics can make their way into our bodies, and like plastics themselves, they are linked to a growing number of health concerns.[3,4]

There are many types of plastics, plasticizers, and microplastics produced today.[5,6] However, some of these substances are more thoroughly researched for their harmful health effects than others and are commonly found in everyday products. By focusing on these specific substances, we can take meaningful steps to reduce our exposure.

The following table highlights the key plastics, plasticizers, and microplastics you should know about, where they are found, and their associated health risks.

Plastic Chemical Type	Where It is Found and Examples	Potential Harmful Health Effects
Plastics		
Polyvinyl chloride (PVC)	A strong plastic used in pipes, flooring, and medical equipment. PVC pipes may leach plastics into drinking water.[7] PVC is indicated by the number 3 in the plastic recycling code.	PVC particles are linked to cardiovascular disease and harmful effects on sperm health.[8,9] PVC often contains phthalates, which are associated with harmful health effects.[10] See the "Plasticizers" and "Phthalates" sections below for more information. PVC may also release lead, a toxic metal linked to lowered IQ, behavior problems, and impaired growth in children.[11,12]
Polystyrene (PS)	A hard and brittle plastic used in disposable plastic cups and utensils. PS is indicated by the number 6 in the plastic recycling code.	Polystyrene is linked to liver and kidney cell inflammation and damage to the large intestine.[13,14]
Polycarbonate (PC)	An impact-resistant plastic used in products like bulletproof glass, safety helmets, clear plastic baby bottles, and hard water bottles (such as Nalgene® bottles). PC is indicated by the number 7 in the plastic recycling code.	Polycarbonate particles are tied to harmful effects on sperm health.[9] Bisphenol A (BPA) found in polycarbonate plastic also is linked to adverse health effects. See "Plasticizers" and "Bisphenol A" below for more information about the health effects of BPA.
Polyethylene terephthalate (PET/PETE)	A lightweight plastic used for plastic bottles, clothing and industrial uses. PET/PETE is indicated by the number 1 in the plastic recycling code.	PET particles are linked to gut inflammation.[15] PET bottles may contain phthalates.[16] See "Plasticizers" and "Phthalates" below for more information about the health effects of phthalates.
Polyethylene (PE) **Low-density polyethylene (LDPE)** **High-density polyethylene (HDPE)**	PE is a versatile plastic used in food packaging and many household items. LDPE and HDPE are types of PE. LDPE is a lightweight, flexible plastic used for products like plastic wrap and bags for bread and frozen food.[17] It is a significant source of microplastics.[18] LDPE is indicated by the number 4 in the plastic recycling code. HDPE is a strong, impact-resistant plastic used for products like shampoo bottles, pipes, plastic lumber, and jugs for milk, water, and detergent. HDPE is indicated by the number 2 in the plastic recycling code.	While HDPE is considered less toxic than other plastics, PE particles are linked to increased harmful gut bacteria and reduced butyrate, a protective compound in the gut.[19] PE is also connected to reduced sperm health.[9] LDPE is associated with increased oxidative stress, an imbalance between harmful free radicals and the body's ability to neutralize them.[20]
Polypropylene (PP)	A semi-rigid plastic used to make products ranging from food containers to auto parts. PP is indicated by the number 5 in the plastic recycling code.	PP particles are linked to inflammation.[21]
Polylactic acid (PLA)	A "green" plastic, often marketed as biodegradable, made from corn, sugar cane, and sugar beets. Used in food containers, compost bags, and upholstery fabrics. PLA products are often commercially compostable. They are indicated by the number 7 in the plastic recycling code.	Linked to intestinal damage and inflammation.[22]

Plastic Chemical Type	Where It is Found and Examples	Potential Harmful Health Effects
Plasticizers		
Bisphenol A (BPA)	A chemical used in hard plastic products, including polycarbonate plastics, like water bottles and food containers, the lining of canned foods, and thermal paper receipts.[23,24]	BPA is connected to obesity, type 2 diabetes, polycystic ovary syndrome (PCOS), and cardiovascular disease.[25,26]
Bisphenol analogues (chemicals related to BPA)	Found in many "BPA-free" products.[27] Includes bisphenol S (BPS), bisphenol F (BPF), and bisphenol E (BPE).[28] Found in "BPA-free" products like water bottles and canned foods.[29]	Exposure to BPS during pregnancy is associated with increased anxiety, aggression, and sleep issues in children 2 years later.[30] Bisphenol analogues are linked to fertility problems and hormone imbalances.[27] "BPA-free" products are not necessarily better or safer than BPA-containing products.
Phthalates	Found in plastics like PVC, children's toys, some oral medications, and personal care products like makeup and lotion.[31-33]	Phthalates are connected to obesity, metabolic syndrome, diabetes, miscarriage, early puberty in girls, reduced sperm health, and endometriosis.[26,34-36]
Microplastics		
Primary Microplastics	Small plastic pieces that can be intentionally manufactured, such as microbeads in personal care products like face scrubs and toothpaste, as well as microfibers shed from polyester clothing and other fabrics.[37-39] Primary microplastics can flow into waterways and eventually be absorbed by the body through water and food.[40] Airborne microplastics can be inhaled.[41]	Microplastics are linked to impaired fetal growth, harmful effects on sperm health, and an increased risk of cardiovascular events like heart attacks and strokes.[8,9,42] Nanoplastics are linked to hormonal imbalances, reduced fertility, damage to the gut lining, gut inflammation, and increased harmful gut bacteria.[43,44]
Secondary Microplastics	Tiny pieces of plastic from the breakdown of larger plastic products, such as the plastic liner of disposable coffee cups, plastic water bottles, car tires, medical tubing, and even contact lenses. Secondary microplastics are also found in indoor dust.[45-50]	
Nanoplastics	A subtype of microplastic that also results from the breakdown of plastic products. They range in size from 1 nm to 1 μm.[51] Occur in drinking water that sits in plastic pipes, seafood, and plastic tea bags.[52] They can be inhaled and absorbed through the skin.[53]	

How to Reduce Your Exposure to Plastics, Plasticizers, and Microplastics

Plastics, plasticizers, and microplastics are everywhere, but there are steps you can take to reduce your exposure. Here are some effective ways to make a difference. We suggest trying a couple of initial changes and building from there.

Reduce Food Exposures

- **Minimize processed foods.** Eating processed food is linked to increased phthalate exposure due to contamination from packaging and processing methods.[34-36,54,55] Instead, focus on eating fresh, whole foods.
- **Limit your intake of takeout/fast food.** Some takeout and fast-food containers have polystyrene, a plastic that can leach into food.[13,14,56,57]
- **Avoid plastic food storage containers.** They may release phthalates into food.[34-36,58,59] Use glass, ceramic, or stainless-steel containers for reheating and storing food.
- **Avoid microwaving food in plastic.** This can leach plastics like polypropylene into food.[21,60] Microwave food in glass or ceramic containers instead.
- **Try to limit your intake of canned foods.** The linings of most canned foods contain BPA and BPA alternatives that can leach into the food inside the can.[25,26,28,30,61-63] Some food manufacturers sell canned foods with a BPA- and BPS-free lining.[64]
- **Be careful about eating farmed fish.** Studies suggest that farmed fish have more microplastics and PCBs than wild-caught fish.[65,66] However, not all farmed fish are the same. There are an increasing number of sustainable and ethical options for farmed fish. Do your research before purchasing farmed fish to ensure you choose a high-quality option. For example, look for farmed seafood with certification from the Monterey Bay Aquarium Seafood Watch or the Aquaculture Stewardship Council, both of which ensure farmed seafood is produced responsibly.[67,68]
- **Avoid using plastic wrap to package food.** Plastic wrap can release chemicals such as phthalates and microplastics, which might end up migrating into your food.[9,34-36,42-45,69,70] Try using beeswax wrap or glass food storage containers with reusable lids.
- **Use wood cooking utensils instead of plastic.** Plastic cooking utensils are associated with an increased release of microplastics into food.[42-45,71]
- **Use a wood cutting board instead of a plastic cutting board.** Plastic cutting boards may transfer microplastics into food.[42-45,72]

Reduce Beverage Exposures

- **Use stainless-steel or glass water bottles instead of plastic water bottles.** Plastic water bottles are linked to elevated BPA and microplastics in water.[24-26,42-45,73] Beware of "BPA-free" water bottles because these containers may still leach potentially harmful BPA-like chemicals.[74,75]
- **Bring a reusable stainless-steel mug to the coffee shop.** Disposable coffee cups are lined in plastic, which can leach into hot liquids such as coffee and tea.[45,76] Drinking coffee or tea from your own reusable stainless-steel mug may help you avoid these contaminants.

- **Choose loose-leaf tea or tea in biodegradable paper teabags.** Research links plastic teabags to microplastic release into tea.[52,77]
- **If you use plastic water bottles, avoid washing them in hot water.** When polycarbonate plastic, commonly used in reusable plastic water bottles, is washed in water at a temperature of 176° F/ 80° C (the point when water starts to steam) and above, BPA release increases.[78,79] Hand wash polycarbonate plastic items using warm water instead.

Reduce Personal Care Product Exposures

- **Look for personal care products labeled "phthalate-free."** Phthalates are common in personal care products.[34-36,80,81] Personal care products include any items used to support hygiene and beauty, including makeup, shampoo, conditioner, toothpaste, and deodorant.
- **Choose personal care products without plastic microbeads.** Beat the Microbead is a helpful resource for choosing microbead-free personal care products.[82]
- **Try a safe cosmetics database.** To locate safe personal care products free of chemicals like phthalates in the U.S., consider using something like the EWG's cosmetics database or Cosmetic Ingredient Review.[83,84]
- **Choose clothing made with natural materials like cotton, wool, silk, and bamboo, when possible, instead of synthetic materials.** Synthetic fabrics may release microplastics.[39]

Reduce Household and Workplace Exposures

- **Use filtered, reverse osmosis, or distilled water for drinking and cooking.**[85] Tap water and well water often contain contaminants such as phthalates and microplastics.[86,87] The EWG's Tap Water Database provides information about common water contaminants in the U.S.[88] In Europe, the European Environment Agency can help you identify possible water contaminants.[89] If you live outside of the U.S. and Europe, look into local at-home water testing options. Once you know what's in your drinking water, you can get a water filter to help remove contaminants.
- **Consider using an air purifier with a HEPA filter at home.** The filter may help remove phthalates from the indoor environment.[90,91]
- **Avoid products with PVC when possible.**[8-11] PVC is used in common household products including shower curtains, flooring, and wall coverings. Look for products labeled "PVC-free."
- **Choose furniture upholstery and carpet made of natural materials such as cotton, wool, and linen in your home.** Synthetic furniture fabric and carpets are a source of microplastics.[92] Examples of synthetic fabrics include polyester, acrylic, nylon, and microfiber.
- **Regularly replace the filters on air conditioning units and ventilation systems.** Filters in these units can accumulate microplastics from circulating air.[41,93]

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