



Tupperware photo by Linda; Lego photo by Patrick Lauke; Barbie photo by Charlotte Powell



From canned vegetables to last night's leftovers, plastic—and its attendant environmental nightmare—is everywhere. Writer **Marla Rose** investigates our most omnipresent product, from its vegetable-based beginnings to its compostable future.

The Plastic Conundrum

PLASTIC AND I GO WAY BACK. I'D GUESS THAT THE SAME IS true for you. Some singular moments in my life made possible by plastic include when my first boyfriend, a plucky five-year-old charmer named Larry, presented me with my inaugural piece of jewelry, a necklace with a little pink plastic heart pendant, still in its crinkly bag from the grocery store novelty machine. Larry gave it to me as we swung side-by-side on the backyard swing set with black seats of soft plastic, perfectly molded to the contours of our little Toughies-clad bottoms. I also fondly recall the first two-wheel bike I learned to ride, which was mauve with a plastic sparkly banana seat, and took me hither and yon around our cul-de-sac. Years after my beloved Schwinn was retired, a driver's license miraculously, perhaps unjudiciously, came forth from the machine at the DMV—I had failed three times previous, so this rectangle of warm plastic was deeply appreciated—and some years after that, I luxuriated in the interior of my first new car, filled with that beloved New

Car Smell, which is, essentially, plastic off-gassing. Come to think of it, this very article was produced thanks to my computer and its many plastic components.

When it was first presented in an early form at the Great International Exhibition of 1862 by Alexander Parkes, a very productive English metallurgist and chemist, the protoplastic that was created to do anything rubber could do, but better and less expensively, was called Parkeskin. Later that decade, John Wesley Hyatt, the son of a blacksmith from Albany, NY, saw a newspaper advertisement placed by Phelan and Collender—the largest billiards supplier in the United States—that offered a “handsome fortune” to any inventor who could come up with a synthetic replacement for the ivory-tusk-carved billiard balls that were in diminishing supply. While he never did create the perfect billiard-ball replacement, Hyatt succeeded in producing the first malleable plastic mass on one of his father's blacksmithing machines. Celluloid, combining cellulose

(raw vegetable matter) with the suffix *-oid*, meaning “like” or “akin to,” became the name for the new material Hyatt rolled out. It was the first thermoplastic, a moldable mass that retains its shape after the heat and pressure forming it have been removed. Little did Hyatt know how profoundly wide-reaching his ingenious little creation would go, far surpassing his original ambitions: This material could be easily dyed, molded, cut, stamped, and formed into an astonishing variety of shapes and sizes, making it the perfect match for the upcoming Machine Age. When Leo Baekeland, a Belgian-born industrial chemist, invented Bakelite in 1907, he ushered plastic out of its natural origins (the early experiments were made with a doughy mixture of pulped paper or cotton with camphor). Bakelite, the result of a condensation reaction between carbolic acid and formaldehyde, was the first chemically based, synthetic plastic.

contribute to our perception of plastic as being so utterly synthetic and machine-made. Plastic is the perfect product for a throwaway, consumer-driven culture that values convenience and affordability over almost everything else. Plastic bags, numbering in the trillions, are perhaps the appropriate symbol of our culture and likely the most ubiquitous man-made products on the planet. Given plastic bags’ easy disposability, out of sight means out of mind.

The Uglies

If the enormous heap of trash continually piling up on our planet weren’t unsettling enough, we also have cause to be concerned about the health effects of the plastics that seem to be wrapped around every food item we purchase, whether it’s a sandwich on the run or a head of broccoli. According to Stephen Lester, science director at the Center for Health, Environment and Justice (CHEJ) in

around in order to avoid buying bottled water are a better environmental choice than disposable bottles, but they may carry risks: A 2009 study from the Harvard School of Public Health found that research participants who drank from polycarbonate bottles—the very popular hard-plastic drinking and baby bottles—had a two-thirds increase of the chemical BPA in their urine after a week. BPA, which is also found in the resin lining of many food and beverage cans, mimics the hormone estrogen—the substance was conceived in 1891 as a synthetic form of estrogen, no less—and has been linked to cardiovascular disease and diabetes. Further, there is concern that BPA may also be an endocrine disruptor, which can cause the early onset of sexual maturation (a suspected risk factor for breast cancer) and is most harmful in the stages of early development, for example, at the age when many babies drink from bottles. The FDA, which approved polycarbonate to be regulated as a food additive in the 1960s, now advises that there are some causes for concern regarding the effect of BPA on the brain, behavior, and prostate gland of fetuses, infants, and children. Sonya Lunder, senior analyst with the Environmental Working Group, says, “BPA exposure is serious. One of its major sources is cans. BPA is in 95 percent of all Americans’ bodies. It’s of concern to us, and it should be to everyone, because it affects fetuses and children, as well as healthy adults. Food manufacturing needs to get more up-to-date technologies that do not include BPA or other harmful chemicals.”

The other frightening plastic products are phthalates. Phthalates are a group of chemicals used to make PVC soft, flexible, and clear, and they can be found in shower curtains, vinyl flooring, toys (think of teething rings), perfumes, and cosmetics. Phthalates are thought to be endocrine disruptors and are especially of concern to children with their vulnerable, rapidly evolving development and high consumption of food and drink relative to their weight. The European Union has banned the phthalates DEHP, DBP, DINP, DIDP, DNOP, and BBP from toys since 2006, and as of 2008, nine other countries have as well. China, responsible for producing about 85 percent of the world’s toys, now has two manufacturing systems: one for the markets that ban phthalates and another for the markets that do not have a ban, including the US. According to the CHEJ, early studies

“When one tugs at a single thing in nature, he finds it attached to the rest of the world.” —John Muir

Despite its omnipresence in our consumer culture, it is obvious that we have a complicated relationship with plastic. Associated with the cheap and mass-produced, plastic is synonymous with disposability, and to use the word to describe someone is to describe an artificial, inauthentic person, the human equivalent of AstroTurf. The very qualities that have made it so perfect for mass production—its protean nature and ability to be reliably molded with heat and pressure into the desired results—

Falls Church, Va., pervasive plastic wrap is not so innocent because chemical migration, also known as leaching, can occur. This leaching is more likely to occur with fatty food, such as meat or cheese, and increases in proportion to the time that the food is in contact with the plastic wrap and cooking temperature. Avocado, with its higher fat content, is also susceptible to chemical leaching. Lester explains, “The use of plastic wrap to store or package food can result in components present in the plastic leaching out into the food. These components can include plasticizers, colorants, and stabilizers, especially when the wrapped food is heated.” He goes on to say, “The plasticizers are used to increase the wrap’s flexibility. Perhaps the most common plasticizer is DEHA, which is present in polyvinyl chloride (PVC) film wrap. DEHA is a suspected carcinogen and is associated with limited developmental and reproductive toxicity.”

The two components of plastic that seem to be the most worrisome for human health are bisphenol-A (BPA) and additives used in the synthesis of plastics called phthalates, also known as “plasticizers.” Those clear, plastic reusable water bottles many carry



In the US, 92 billion disposable bags are used every year.



suggest that a number of chemicals released by PVC, including dioxin, lead, and mercury, have been linked to or shown to cause learning and developmental disabilities. The concerns for public health don't end there. As the annual 7 billion pounds of discarded PVC break down in landfills, toxic chemicals leach into the groundwater. And, with more than 8,400 landfill fires reported every year in the US, the burning of flexible plastic waste contributes to dioxin pollution. Landfills are primarily found in low-income communities with a higher concentration of African-American and Latino populations.

The Chemical Soup

For those of us who are concerned with both our health *and* environmental protection, plastic—and all its considerable baggage—is worrisome. Since the 1980s, the bottled-water industry has done a remarkable marketing job, making water from a tap seem tainted and dangerous, and its products, with names and images conjuring pristine landscapes with waterfalls and geysers, seem much more pure and trustworthy. In reality, the General Accountability Office reported in July 2009 that there were fewer regulations for bottled water than tap. Today, consumers purchase more than 50 billion water bottles a year—that's 1,500 disposable bottles bought every second in the US—made possible with more than 17 million gallons of crude oil. *National Geographic* estimates that more than 85 million plastic bottles are used every three minutes and also offers a tidy visual aid to help us understand that the chemical composition of those bottles is in direct opposition to the images of unspoiled natural beauty on the label: Imagine a water bottle filled a quarter of the way with oil. That is approximately how much petroleum product is required to manufacture the average bottle. Petroleum Springs or AquaOil probably wouldn't generate such refreshingly pure imagery or consumer trust.

How did we come to be wading in this chemical soup? Substantial blame can be assigned to a very ineffectual vehicle for regulation called the Toxic Substances Control Act (TSCA), which, when passed in 1976, declared 62,000 chemicals already on the market safe with little or no data to support this *carte blanche* approval. Fewer than 200 of the chemicals given clearance by TSCA have been required to be tested and



The Plastic Zone

Known as the Plastic Vortex or the Great Pacific Garbage Patch, this giant mass is trapped in a whirlpool between two gyres in the Pacific Ocean, roughly halfway between the US and Japan. A gyre is a current system that pulls water from one part of the ocean and sends it somewhere else; the North American Subtropical Gyre is formed by four large clockwise-turning currents. A giant heap of debris, much of it discarded, single-use plastic bottles and bags, floats there. All those little bits and pieces pulled in by the gyre are estimated by Oceanic Defense to be twice the size of Texas and growing daily. Project Karsei, a non-profit organization dedicated to studying marine pollution, estimates that more than 60 percent of the Plastic Vortex comes from land-based sources due to poor waste-management practices. Other significant debris sources are cruise ships: One typical, 3,000-person ocean liner will generate more than eight tons of solid waste weekly—as much as a mid-sized city—and since no standards are enforced for waters three miles or more out from shore, discharges are largely unmonitored and unregulated. Those ubiquitous, forgettable plastic bags that end up in the oceans kill marine life: The Blue Ocean Society for Marine Conservation estimates that more than a million birds and 100,000 marine mammals and sea turtles die from eating plastic—many are thought to mistake loose, floating bags for jellyfish—or getting entangled in it every year. Plastic can also harm human health as particulates decompose, never to truly break down, and are ingested from small organisms to larger fish in the ocean's food chain, ultimately to be consumed by those who eat the fish as the cycle expands.

only five chemicals have been banned or restricted. Since the passage of TSCA, 20,000 more chemicals have been approved and the burden of proving that these chemicals are unsafe rests almost entirely on the government, as opposed to the burden of proving their safety falling to the companies that produce and use them, through rigorous, third-party testing. Using toothless TSCA regulations, the Environmental Protection Agency (EPA) does not even have the authority to completely ban asbestos, a known carcinogen responsible for at least 10,000

deaths per year. Today, many environmental- and consumer-health organizations assert that the TSCA favors business over safety: Companies creating the chemicals will voluntarily provide the EPA with some data on their product, but the information is not required to be complete or timely. Given the wide latitude that TSCA allows industry, thousands of chemicals are considered trade secrets and given confidentiality protection.

Thankfully, this free ride appears to be near its end. New legislation introduced by Senator Frank R. Lautenberg (D-NJ) and



Fifty billion plastic bottles are used each year in the US, most of which are not recycled.

Plastic Facts

Just how bad is that bottle of water? Here's a rundown of some of plastic's staggering stats.

- ❖ Plastic production in the US alone requires 200,000 barrels of oil per day.
- ❖ Though no one has a firm number, it's estimated that plastic bottles will break down in landfills after 100 to 1,000 years.
- ❖ In the US, 2.5 million plastic bottles are thrown away every hour.
- ❖ Enough plastic wrap is produced in the US each year to wrap the entire state of Texas.
- ❖ More than 100,000 mammals die each year from ingesting plastic bags.

Representative Bobby Rush (D-Ill.) called the Kid-Safe Chemicals Act is intended to finally reform the antiquated TSCA, give the EPA some enforcement control, require more

your Congressperson, signing petitions—that all helps. We need people on the ground to support the Kid-Safe Chemicals Act in order to bring about real changes,” says Lunder.

China, responsible for producing about 85 percent of the world's toys, now has two manufacturing systems: one for the markets that ban phthalates and another for the markets that do not have a ban, including the US.

rigorous testing, as well as place the burden of proof on the chemical manufacturers. “People need to get out there and talk to family members, talk to friends, and build a momentum for supporting a safer, better-regulated chemical industry. Calling or writing

While this strengthened act would be a giant step forward, passage will take years to take effect and improve lives. What can concerned consumers do in the meantime?

The Light at the End of the Plastic Tunnel

While certain plastics are considered to be safer, all should be kept out of the microwave and dishwasher. Plastics with numbers 1, 2, 4, and 5 at the bottom surrounded by a triangle of arrows are thought to be safer choices because they are manufactured with fewer toxic additives and are non-chlorinated. Plastic products with the numbers 3 (PVC), 6 (polystyrene), and 7 (usually BPA), also surrounded by arrows, are considered less safe and consumers are advised to avoid these. Even the safer plastics remain environmental hazards, though.

Supporting green technology is one

solution. There are new, smart technologies underway as companies race to develop sustainable replacements for plastic. IBM researchers, for example, recently announced newly developed plant-based catalysts to create plastic polymers that can be recycled numerous times and be used in many different kinds of applications. Typically, conventional plastic can only be recycled once before the polymer begins to degrade and it gets sent to landfill. Other signs of hope: Scientists at the Imperial College of London have developed a novel kind of plastic from sugars found in fast-growing trees and grasses that can completely biodegrade in a compost heap in just a matter of months without requiring special conditions. Forward-thinking entrepreneurs are developing replacements for plastic, using everything from corn, potatoes, tapioca, and even algae as consumer demand grows.

Throwing your support behind progressive environmental initiatives helps, such as the five-cent plastic and paper bag tax in Washington, DC, which has already reduced the number of bags given out from 22.5 million to 3 million since it was adopted in January. While reducing waste, the tax has also generated revenue: \$150,000 will be used for cleaning up the Anacostia River. Internationally, Ireland has seen plastic bag use cut by more than 90 percent with its 15-cent tax and the millions of dollars

One-tenth of all trash in the US gets recycled.





Fifty-six tons of trash are created per person per year in the US.

The Portable Future

Loosening plastic's grip on our lives is easier these days with so many great, sustainable products. Consider food storage, for example, the domain where Tupperware and its famous burp once reigned supreme. Today, conscientious consumers have many other options. Here are a few of our favorite plastic-free finds.

BioBag

Sending your religiously separated plastic to be recycled or composted in plastic bags just doesn't make sense. Find compostable bags for your trash, recycling, and compost.

biobagusa.com

Earth Renewable Technologies

Creates alternatives to plastic storage containers using plant-based polymers. Find out which products they make and which are available in your area.

earthrenewable.com

Life Without Plastic

Offers many varieties of stainless steel containers that are re-heatable, airtight, and attractive.

lifewithoutplastic.com

The Soft Landing

Has dozens of varieties of BPA-, PVC-, and phthalate-free products, from bottles and lunch gear to dog toys and baby teethers.

thesoftlanding.com

To-Go Ware

Sells beautiful, leak-proof stainless steel tiffins, two-to-three tiered carriers, and recycled-cotton bags to make it a very convenient, stylish transportation unit for lunch or leftovers.

to-goware.com



in euros raised will similarly be spent on environmental projects. China, long derided for its carbon emissions and lax environmental standards, banned plastic bags in 2008 and now saves 37 million barrels of oil per year. In the US, San Francisco was the first large city to ban plastic bags, and other cities are introducing legislation designed to loosen plastic's grip on the everyday shopping experience. Research your community and any plastic-bag initiatives you can support. A good place to start is by contacting local environmental organizations.

Last, and most powerfully, the personal is the political. Go through your home and find where you can cut back on wasteful packaging. For example, making your own natural cleaning products not only cuts down on costs and chemicals you breathe in, but also means that you are not throwing away as many plastic jugs and bottles. There are many great resources for making your own cleaning products online. Second, cooking more whole, minimally or unprocessed foods means eating more healthfully and reducing many of those cans and plastic-wrapped boxes. Third, bring your own reusable bags whenever you go shopping. There are many varieties that fold up into neat little bundles designed to easily be carried in a purse, commuter bag, or even a pocket. Remember to keep these handy in your car or bike, and always have one or more with you. It will quickly become ingrained

if you make it easy for yourself. For those of us who buy bulk goods like rice and rolled oats, most grocery stores allow shoppers to bring in their own containers, like glass jars—remember to have them pre-weighed by a cashier and have their weight subtracted after the bulk goods have been added. This way, you are not paying more for using a heavier container. Finally, make a habit of bringing a reusable water bottle (or a mug) along with you. Truly, once you commit to incorporating these changes into your life, they will become second nature.

On any given day, I can sit in the sunroom of our house and watch a white plastic bag swoop over the fence into our yard. The bags that wander into my life probably came from a drug store or convenience store, used once to grab something on the run and discarded, never to be thought of again. From infancy, with its baby bottles and disposable diapers, to old age, with its medical equipment and bottles of pills, Mr. Baekeland's invention seems to tightly cling to our collective experience like, well, plastic wrap. While breaking free of plastic entirely may not yet be possible, we can minimize its effects on our health and the environment when we are committed to change and mindful of our consumption habits. **VN**

Marla Rose is a writer and mother who scrupulously avoids plastics in the Chicago area.