



The Future of Foam

Plastic foam's image gets a makeover.

STORY BY
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Styrofoam has a bad reputation. In fact, most of what is thought of as Styrofoam—a Dow Chemical trademark that is always blue—is actually foamed polystyrene or polyethylene.

It's not evil, but most would agree that the processes used to make foamed plastics aren't exactly great for the environment. Foamed plastics are loved for their convenience, but like many items of convenience, their creation and disposal isn't very green.

Styrofoam got its bad rap in the early 1980's. Back then, foams were made by aerating plastic with chlorofluorocarbons or CFCs, which were linked to the growing hole in the ozone layer. As a result, plastic foam cups and food containers were banned in several West coast cities; major food chains like McDonalds stopped packing burgers into foam clamshells; and foam manufacturers found substitute blowing agents. In 1987, almost everyone stopped using CFCs when the Montreal Protocol, an international agreement aimed at phasing them out, went into effect.

But foamed plastic's ill repute didn't stop with CFCs. Nowadays foamed plastic is like any other plastic: it's made from petroleum and takes eons to degrade. The big difference is that foam is mostly air and takes up a lot of unnecessary landfill space. About 20 percent of municipal waste is made up of plastic, mostly packaging, according to the U.S. Environmental Protection Agency.

With ever-diminishing petroleum and the threat of global warming, plastic foam is overdue for another eco-makeover, a challenge that the plastics' industry and Michigan State University researchers are taking on.

One option for making foamed plastic greener is to recycle it. Shipping businesses often take back packing peanuts and heavy-duty formed foam can be cut up and reused once or twice. But food-contaminated foam, like the trays that come with raw meat from the grocery store, rarely gets another chance.

There are only a few places in the U.S. where foam food containers are recycled. Dart Container Corp., the largest manufacturer of foam cups in

the world, is one. Dart has recycled foam for 15 years at its headquarters in Mason, Mich. It turns it mostly into a low-grade plastic used to make plant trays. Outside the metal-sided factory, anyone can drive up and drop off their cups or peanuts.

When the recycling plant is out of commission, the foam quickly piles up. Half of the 2000-square-foot room at the front of the facility is packed to the ceiling with bags of cups, plates, lunch trays and packaging dropped off by nearby residents or trucked in from schools. Even on an "off" day when some of the machinery is undergoing repairs, the noise in the factory is deafening.

Further inside, several ceilings high of ripe-smelling foam lunch trays and cups wait for workers to resume their 24-hour-a-day hand sorting. The chemists at the plant have tried to isolate the food smell, which persists even after washing and reduces the value of the recycled product, but the contamination is so minute it can't be detected with the lab's equipment.

After sorting, the foam is placed on the "godzilla-vator"—a giant conveyor belt at a 70-degree angle to the ceiling. From there the foam is sliced and diced, washed and dried and then heated and formed into pea-sized grains for resale.

Despite the benefits of keeping foam out of the landfill, recycling has its challenges. The foam needs to be dried, which takes energy. "What you have are millions and millions of little sponges and you have to get rid of that water," said Fred Forrester, Dart's chief engineer.

Transporting foam also takes energy and space but doesn't yield much material. That's often a losing proposition. It's like trucking around air. Though Dart feels a responsibility to take back the food-contaminated foam, not many companies are following suit, Forrester said.

Ramani Narayan, a Michigan State University chemical and bioengineering professor, understands why.

"The key is not whether something is recyclable, but does it actually get recycled? Is the infrastructure there? And, more importantly, is it cost effective?" he asked.



Background photograph courtesy of Stock.Xchng. Other photographs by Sarah Crespi

1: Recycled foam pellets contaminated with food are of low value because of their smell and color. 2: Dart's recycling center is one of the few in the U.S. that recycles foam cups and plates. 3: Uncontaminated foam pellets at Dart recycling center.

Narayan has a plan for foams that eliminates the need for recycling. He has worked with plastic industry companies like Cargill Inc. on polylactic acid (PLA) or corn plastic, a starch-based plastic used in plastic cups and flatware. He has also researched and patented new bio-based foams. These foams are made from plant starch and water, both renewable resources.

Renewable sources like plants are ideal when it comes to disposable items because they help make the final product carbon neutral, Narayan said. Carbon neutral means that the making and disposing of the cups does not contribute to the greenhouse gas effect. The starch from plants that take carbon out of the air is harvested and processed into a biodegradable cup. After the cup is used and thrown away, it biodegrades, releasing the carbon back into the atmosphere. The next crop of plants captures the same amount of carbon. Traditional plastics use petroleum, a long-term storage for carbon.

These bio-based foams, sold as Green Cell Foam, have packaged Toyota parts and served as ice cream shipping containers. They are convenient for shippers because they dissolve in water. After unwrapping a newly received item, the packaging can be washed down the drain.

This feature is rather inconvenient, however, when used for drinks like coffee. Making biofoam more durable is the job of engineers, Narayan said. Though one solution is to carry a durable, reusable mug, other processes like food preparation require disposable packaging for sanitary reasons.

"Disposable plastic-ware, like forks, knives, spoons, plates are not necessarily bad," Narayan said. "You don't want the person making stuff in the fast food restaurant to use their hands. You want them to use disposable gloves."

Though biodegradable foams make sense, they won't become widespread until costs drop and the foams become less temperature and water sensitive. Also, while biofoams are biodegradable,

what happens to them after use is still important to consider.

Modern landfills are lined with cement and are a dead end for most biodegradables. The Environmental Protection Agency estimates that each household sends 700 pounds of compostable waste to the landfill every year.

Still, more people are composting as the problem of waste continues to grow. Mama Bear's café in Lansing, Mich. serves its organic, local fare on reusable plates and compostable cups, bowls and flatware for to-go orders, according to owner Cecilia Garcia.

"We encourage our customers to compost at home. If someone's not a regular, we'll tell them to put it in their compost and it'll degrade in 45 days," Garcia said. The restaurant also recently got permission from the city to compost food waste on site.

Dart's Forrester suggested plastic foams could be a source of fuel in the future. Provided they are combusted in a well-controlled incinerator "these polymers retain the same kind of energy level that they had when they came out of the ground as petroleum," he said. Similarly, biofoams can be burned for their energy, but these options require a change in infrastructure.

These days there are many "end of life" options for plastics. It's unclear which will win out. But if industry and researchers have their way, disposable plastics aren't going away anytime soon, unless it's in a compost bin.

"Disposables have helped us maintain our health," Narayan said. "The only thing we have to make sure of is that after use it gets disposed of properly, whether it is waste to energy, recycling or biodegraded in composting conditions." 🌱

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Plastic Terms

• PHOTODEGRADABLE PLASTIC

Degrades when exposed to light and air. They disappear from view, but tiny molecules of the plastic hang around indefinitely.

• BIODEGRADABLE PLASTIC

Breaks down by microorganisms. Some biodegradable plastics are a mix of petroleum and starch. Only the starch degrades, leaving bits of plastic behind.

• COMPOSTABLE PLASTIC

According to the American Society for Testing of Materials, "compostable" means that a substance degrades within 180 days in large-scale composting conditions without leaving toxic materials behind.

• BPI LABEL

The Biodegradable Products Institute label helps consumers recognize products that meet ASTM composting standards.

