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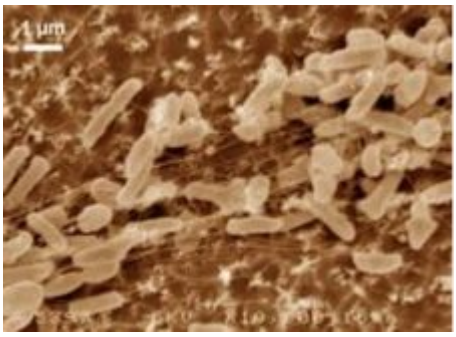
Some Hope For Plastics in the Environment?

By Josh Bloom — July 13, 2016



Ideonella sakaiensis. Photo: Wikipedia

When we were much younger, the beach offered a form of entertainment that is rare today. It wasn't so great for your posture, since you were looking down instead of straight ahead, but no one cared. There was treasure to be found: sea glass **(1)**.

"Sea Glass Stoop" Photo: Jewelry by the Sea

And, if you were *really* lucky, you might even find one of these:

At that time, finding a good piece of blue sea glass was like striking gold. (***Virtually all of it came from one product. Anyone want to guess?*** **(2)**

Now, this is the norm:

Photo: 123rf.com

Quite a difference, no? The amount of plastic that litters our environment is both overwhelming and disgusting. (Only 23 percent [1] of plastic water bottles are recycled in the US.) And much of it is there because most drinks now come in plastic bottles rather than glass. Since littering is nothing short of a national pastime, it is inevitable that more and more of this junk will fill our beaches, oceans, national parks, and nature preserves.

And, plastic bottles never decompose, so we're stuck with them forever.

Or maybe not.

Although plastics are chemically and environmentally inert— meaning that they may be around long after the last life form vanishes from the earth—a recent story [2] offers at least a glimmer of hope that we can possibly put a dent in the ever growing pile of garbage that is strewn around the planet.

Earlier this year, a research team at Kyoto Institute of Technology in Japan, identified a new bacterium [3] that was capable of "eating" polyethylene terephthalate, aka PET (3)— the plastic that is used for bottled water and other drinks. The Kyoto scientists named the bug *Ideonella sakaiensis.*

Even cooler—the bacteria weren't just sitting in the Frequent Flier lounge waiting for people to start chucking Poland Spring bottles around so they could chow down. They *evolved* the ability to eat plastic, and PET plastic is all that they eat. This is logical, since the samples that yielded the new bug were found only in areas that were contaminated with PET (in and around a recycling plant). If not for the plastic, the *Ideonella* bacteria would not exist.

The underlying mechanism behind this process is analogous to the process that causes bacteria

to become resistant to antibiotics—selective pressure. When an antibiotic is first used, the drug will kill a very high percentage of the target bacteria. However, bacteria, as well other microbes, have a built in survival mechanism—rapid mutation. There may be millions of mutant strains of a given bug, and by sheer chance, some of them will have the ability to disable or survive the antibiotic.

So, while all their buddies are dying off, the new guys are the only ones left, and they take over. Poof. Resistant bacteria. This is the primary reason why we are in the middle of an antibiotic crisis— evolution (4, 5).

In a similar manner, of the trillions of bacteria that happen to be found in the areas where *Ideonella* was found, some of them mutated in such a way that they contained two enzymes—both of which are necessary to breakdown PET, With such an abundant "food source," they thrived.

But, the bugs can only do so much. They eat slowly. The Kyoto group found that it took "6 weeks at 30°C [86º F] to fully degrade a thumb-nail-sized piece of PET." More efficient than the New York City bus system, but still not even remotely close to being useful.

The New York City bus system and similarly speedy entities.

Yet, that could change as well. Experiments to speed up the digestion process are underway by using standard genetic engineering techniques. There's a pretty good chance that it will work. Whether it will work well enough to take care of a planet full of trash sounds implausible, but this could come in handy in a more limited way (6).

Either way, this is some mighty cool science. Meanwhile, perhaps we should rethink glass bottles. Wouldn't it be nice to be scouring the beach for "hidden treasure" rather than a bunch of plastic trash?

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Notes:

(1) There is a "Masonry-Dixon" line here. One side calls it sea glass, and the other, beach glass. They will never agree. Sorry, "beach glass people." You're on the wrong side of the "looking glass" here.

(2) It takes decades for sea glass to form. The blue sea glass came from Phillips Milk of Magnesia bottles. They are now plastic as well.

(3) PET (a polyester) is short for polyethylene terephthalate. It is a polymer that is composed of two components: terephthalic acid, and ethylene glycol. Both components are further broken down by the bacteria.

(4) That these bacteria were formed by evolution is all but certain. PET has been in use for only 70 years. Before this time, this new species could not have never evolved. There would have been no adaptive advantage for any bacteria to "learn" how to eat a plastic that did not yet exist.

(5) Although misuse of antibiotics has certainly accelerated bacterial resistance, it would have happened anyhow. Within a year of the time when penicillin was first used there were already bacteria that were resistant to it.

(6) This sort of makes me wonder what the fools at Greenpeace think. They are against GM-anything, but in this case, the technology would be used to clean up garbage. Which is more important to them? Orthodoxy or the earth? Damned if I know. They probably don't either.

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