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Plastic-Munching Bugs Turn Waste Bottles Into Cash

New Bacteria-Driven Process Could Make Recycling Plastic Bottles More Attractive

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Newly discovered bacterial alchemists could help save billions of plastic bottles from landfills. The Pseudomonas strains can convert the low-grade PET plastic used in drinks bottles into a more valuable and biodegradable plastic called PHA.

PHA is already used in medical applications, from artery-supporting tubes called stents to wound dressings.

The plastic can be processed to have a range of physical properties. However, one of the barriers to PHA reaching wider use is the absence of a way to make it in large quantities.

The new bacteria-driven process termed upcycling could address that, and make recycling PET bottles more economically attractive.

PET bugs Although billions of plastic bottles are made each year, few are ultimately recycled. Just 23.5% of US bottles were recycled in 2006.

This is because the recycling process simply converts the low value PET bottles into more PET, says Kevin O'Connor at University College Dublin, Ireland.

"We wanted to see if we could turn the plastic into something of higher value in an environmentally friendly way," he says.

O'Connor and colleagues knew that heating PET in the absence of oxygen a process called pyrolysis breaks it down into terephthalic acid (TA) and a small amount of oil and gas.

They also knew that some bacteria can grow and thrive on TA, and that other bacteria produce a high-value plastic PHA when stressed. So they wondered whether any bacteria could both feed on TA and convert it into PHA.

Bacteria hunt "It was a long shot to be honest," says O'Connor. His team studied cultures from around the world known to grow on TA, but none produced PHA. So they decided to look for undiscovered strains, in environments that naturally contain TA.

Analysing soil bacteria from a PET bottle processing plant, which are likely to be exposed to small quantities of TA, yielded 32 colonies that could survive in the lab using TA as their only energy source.

After 48 hours they screened each culture for PHA. Three cultures, all similar to known strains of Pseudomonas, accumulated detectable quantities of the valuable plastic.

The next step is to improve the efficiency of the process, says O'Connor. "A quarter to a third of each cell

is filled with plastic we want to increase that to 50 to 60%."

Less landfill Sudesh Kumar, a microbiologist at the University of Science, Malaysia, in Penang, is impressed with the study.

"There are many other systems that are economically more viable to produce PHA with better material properties," he says. "But Kevin's work offers an interesting novel approach to solve the problem of PET accumulation in landfill dumps."

But it is still unlikely that using the new approach alone will appeal to industry, O'Connor says.

"Working with this kind of environmental technology in isolation, the chances of success are reduced," he says. The best approach, he continues, would be to use the new bacteria as just one part of a bio-refinery capable of upcycling an array of waste products in an environmentally friendly way.

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