"LIFE FINDS A WAY" TO RECYCLE PLASTIC WASTE

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One of my favorite movie quotes is "Life finds a way" from Jurassic Park. This line was delivered when Dr. Malcolm was explaining that mankind can't stop nature or dinosaurs from finding a way to survive. More broadly, the adaptability and diversity of life is surprisingly robust. A prepared mind may create the next area of development by inventing at the interface between biology and physical sciences. We will examine this precept for plastic waste.

The 'circular economy' is a concept that our materials should be chosen, designed into products and 'reused' to maintain the flow of the same materials or molecules in commerce. This concept is a reversal of our 'make, use and dispose' economy that is prevalent in developed nations over the past 50 years.

Wax worms are common insects that evolved to live in bee hives. Now we know they can eat plastic.

PHOTOGRAPH BY JONATHAN PLANT, ALAMY

The worms live in honeycombs, where they feed on wax.

PHOTOGRAPH BY AGENCJA FOTOGRAFICZNA CARO, ALAMY

Life sciences may help alleviate the plastic waste generated by our society. Both layman and scientist have found that both insects and fungi (i) can eat plastics. For instance, the most widely noted insect is the wax worm. The discovery of this plastic eating behavior was widely attributed to Federica Bertocchini, a developmental biologist at the University of Cantabria in Spain who noticed the phenomena upon cleaning wax worms from her bee hive (ii). After depositing these invasive worms into a polyethylene bag, the worms escaped through holes they created within minutes. It turns out that the enzymatic process used to eat wax in the bee hive also works on trash bags.

Fungi are "responsible for over 90% of all decomposition on the planet" (iii). They may also have a role in mineralizing waste plastic. Indeed, some species do 'eat' plastics. Scientists researching these fungi have developed new enzymes that depolymerize PET, the plastic in soda bottle (iv). The most popular fungus to eat, the mushroom, may never be looked the same way again.

While these processes are too slow today, the enzymes excreted by the insects are a starting point for a potential solution. In a quote from The Guardian:

“Industrial enzymes are widely used in, for example, washing powders and biofuel production. They have been made to work up to 1,000 times faster in a few years, the same timescale McGeehan envisages for the plastic-eating enzyme. “

Carbios, a French ‘green’ company, is scaling up an enzymatic recycling process for PET. The pure recycle stream for bottles enables the depolymerization to proceed to pure monomers. This process enables the recycling of the same molecules back into plastic providing a means to realize the Circular Economy.

Note: Enzymatic processes are one means to realize the Circular Economy. However, other processes also exist for returning polymers to monomers. This will be a growing area for research and development.

Have questions?
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i Fungi & The Plastics Problem, Radical Mycology (https://radicalmycology.com/publications/articles/fungi-the-plastics-problem/)

ii Carrie Arnold , “This Bug Can Eat Plastic. But Can It Clean Up Our Mess?”, National Geographic April 24, 2017

iii ”Fungi & The Plastic Problem”, Radical Mycology (https://radicalmycology.com/publications/articles/fungi-the-plastics-problem/)

iv https://www.theguardian.com/environment/2018/apr/16/scientists-accidentally-create-mutant-enzyme-that-eats-plastic-bottle