Gut bacteria from a worm can degrade plastic

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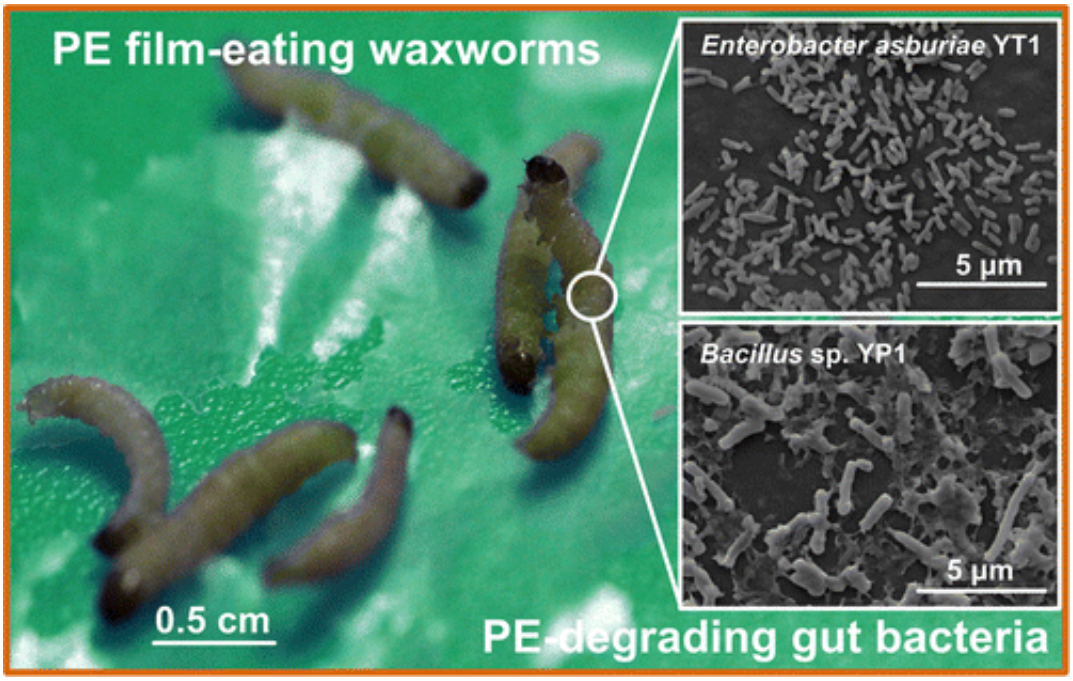

Plastic is well-known for sticking around in the environment for years without breaking down, contributing significantly to litter and landfills. But scientists have now discovered that bacteria from the guts of a worm known to munch on food packaging can degrade polyethylene, the most common plastic. Reported in the ACS journal *Environmental Science & Technology*, the finding could lead to new ways to help get rid of the otherwise persistent waste, the scientists say.

Jun Yang and colleagues point out that the global plastics industry churns out about 140 million tons of polyethylene every year. Much of it goes into the bags, bottles and boxes that many of us use regularly—and then throw out. Scientists have been trying to figure out for years how to make this plastic trash go away. Some of the most recent studies have tried siccing bacteria on plastic to degrade it, but these required first exposing the plastic to light or heat. Yang's team wanted to find bacteria that could degrade polyethylene in one step.

The researchers turned to a plastic-eating moth larva, known as a waxworm. They found that at least two strains of the waxworm's gut microbes could degrade polyethylene without a pretreatment step. They say the results point toward a new, more direct way to biodegrade plastic.

More information: "Evidence of Polyethylene Biodegradation by Bacterial Strains from the Guts of Plastic-Eating Waxworms" *Environ. Sci. Technol.*, 2014, 48 (23), pp 13776–13784, DOI: 10.1021/es504038a

Abstract
Polyethylene (PE) has been considered nonbiodegradable for decades. Although the biodegradation of PE by bacterial cultures has been occasionally described, valid evidence of PE biodegradation has remained limited in the literature. We found that waxworms, or Indian mealmoths (the larvae of Plodia interpunctella), were capable of chewing and eating PE films. Two bacterial strains capable of degrading PE were isolated from this worm's gut, Enterobacter asburiae YT1 and Bacillus sp. YP1. Over a 28-day incubation period of the two strains on PE films, viable biofilms formed, and the PE films' hydrophobicity decreased. Obvious damage, including pits and cavities (0.3–0.4 μm in depth), was observed on the surfaces of the PE films using scanning electron microscopy (SEM) and atomic force microscopy (AFM). The formation of carbonyl groups was verified using X-ray photoelectron

spectroscopy (XPS) and microattenuated total reflectance/Fourier transform infrared (micro-ATR/FTIR) imaging microscope. Suspension cultures of YT1 and YP1 (108 cells/mL) were able to degrade approximately 6.1 ± 0.3% and 10.7 ± 0.2% of the PE films (100 mg), respectively, over a 60-day incubation period. The molecular weights of the residual PE films were lower, and the release of 12 water-soluble daughter products was also detected. The results demonstrated the presence of PE-degrading bacteria in the guts of waxworms and provided promising evidence for the biodegradation of PE in the environment.

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