Deconstructive chemical pre-treatment accelerates microbial decomposition of plastics

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Chemical pre-treatments that deconstruct certain types of plastics can help naturally occurring microbial communities break down plastic

waste more quickly, according to researchers at Michigan Technological University. The research will be presented at Microbe, the annual meeting of the American Society for Microbiology, on June 12, 2022 in Washington D.C.

The compounds derived from the chemical deconstruction of polyethylene terephthalate (PET) or polycarbonate plastics or the pyrolysis of high-density polyethylene (HDPE) plastic can successfully sustain the growth. The genomes of microbial communities derived from multiple soils show that these organisms are capable of degrading complex carbon compounds, such as those found in gasoline, oil and plastics. Breaking up the plastic with chemical pre-treatment makes the carbon, oxygen and hydrogen from the plastic's molecular structure more accessible for bacteria to use as food.

"Bacteria grow quickly on this diet of deconstructed plastics and make more bacteria cells, effectively breaking down the plastic. We can use these plastic-fed bacterial communities to create lubricant and even protein powder, truly turning trash into treasure while taking a bite out of the plastic waste problem," said Dr. Stephen Techtmann, associate professor of biological sciences at Michigan Tech.

Of the 6.3 billion tons of plastic made every year, 79 percent accumulates in landfills, according to the United Nations' Environmental Programme. By 2050, plastic waste will have grown 3-fold, taking tens or thousands of years to degrade. The researchers demonstrated that combined chemical and biological degradation methods may be used to effectively degrade multiple types of plastic over a relatively short period and may be a future avenue to handle rapidly accumulating plastic waste.

"These finding supported our hypothesis that the natural environment is an untapped reservoir of microorganisms capable of degrading the

building blocks of plastic, and that mixed microbial communities can simultaneously degrade mixed plastic waste inputs," said Lindsay Putman, postdoctoral fellow in the department of biological sciences at Michigan Tech, who designed and led the study.

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