New Technology to Recycle Problematic Polystyrene

European researchers have presented a new method for recycling problematic polystyrene. The new technology shows how microbes may help transform petroleum-based waste into a useful biodegradable plastic.

Polystyrene is a type of plastic with a whole range of uses, including disposable cups and all sorts of packaging. More than 14 million metric tons of polystyrene are produced annually worldwide. Its major drawback is its very long lifespan. Polystyrene can be recycled, but the resulting product is a low grade plastic that has limited use and is neither cost nor material-property competitive compared to virgin polystyrene. Consequently, there is little or no market for recycled polystyrene, and most post-consumer polystyrene waste ends up in landfills where it breaks down very slowly.

Recently, European researchers have reported a new approach to recycling polystyrene that could help divert polystyrene from landfills.

In a first step, the plastic is turned into oil through a chemical process called pyrolysis, which breaks down the plastic by heating it in the absence of air. This oil is composed 83% of styrene - the "elementary bricks" that form the polystyrene when grouped together. This oil is then fed to a specific bacterium, *Pseudomonas putida*, a common soil microbe. This bacterium has proved capable of turning the styrene oil into tiny granules of a biodegradable form of plastic called PHAs (polyhydroxalkanoate), which can be degraded in the environment. The PHA granules are easily extractable from the bacteria.

The possible uses of this new process are numerous thanks to the properties of PHA, which is heat resistant and can be used in a variety of forms.

According to the authors, the crude oil could be redistilled, thus providing a cleaner styrene oil that could be consumed by the bacteria while the remaining fraction could be burned to provide energy for the whole process (the energy required to generate the oil is 10 times smaller than the energy gained from burning the oil).

Ways to increase the yield of PHA plastic are also under study and an evaluation of the costs is planned.

This study presents a new strategy to recycle polystyrene into PHA that may also work for other plastics. Furthermore, it provides new insights regarding the link between petrochemical products and biodegradable forms of plastics, which could be very useful in future research for the petrochemical industry.


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