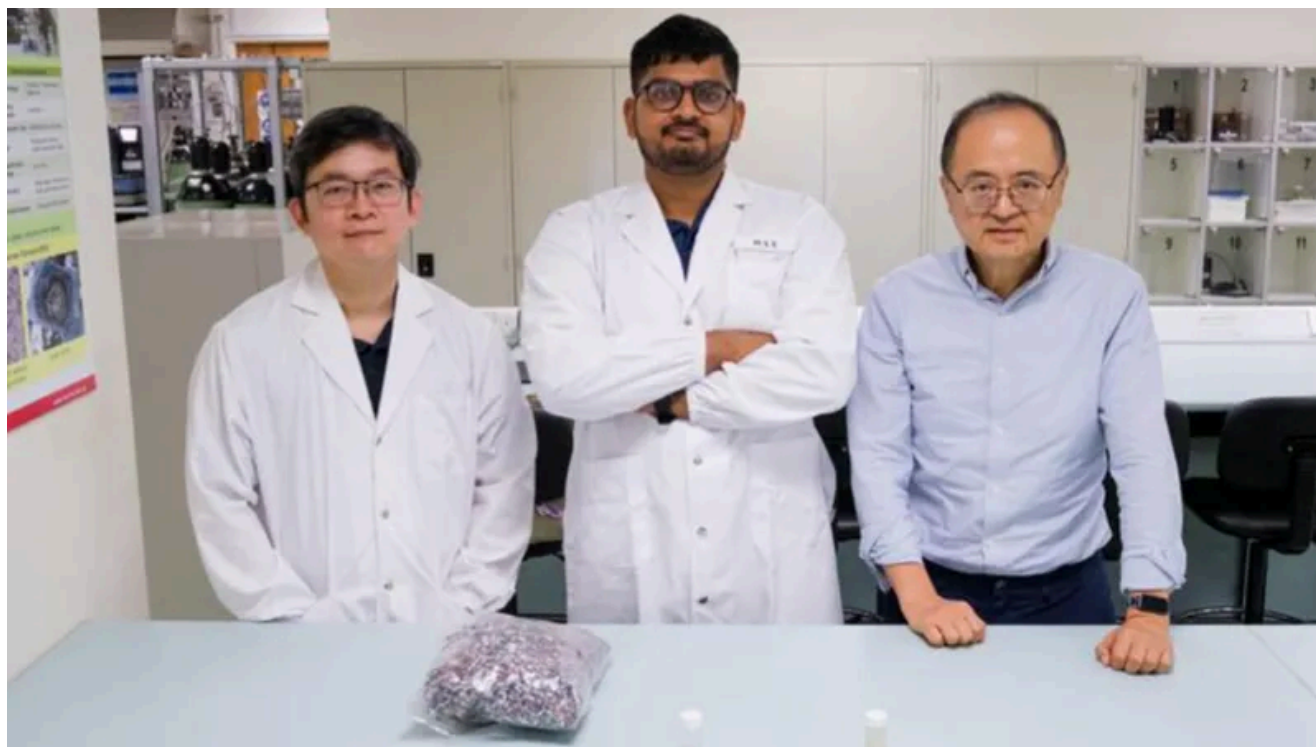


New recycling method recovers plastics from mixed packaging waste

News

Researchers from Nanyang Technological University, Singapore (NTU Singapore) have developed a new method to recycle mixed plastic packaging without using harmful chemical solvents. Selected for you...



(L-R) The NTU Singapore research team behind DIPS process include Dr Liang Yen Nan, Senior Research Fellow, Nanyang Environment and Water Research Institute (NEWRI); Kathirvel Periasamy, PhD student; and Professor Hu Xiao, School of Materials Science and Engineering, Programme Director for Sustainable Chemistry and Materials, NEWRI - NTU Singapore

The research team from NTU Singapore's School of Materials Science and Engineering and Nanyang Environment and Water Research Institute (NEWRI) has introduced a process called depolymerisation-induced polymer separation (DIPS) that selectively breaks down one type of plastic in mixed plastic packaging while leaving the other plastics intact, allowing each material to be recovered and reused.

The work is detailed in [*Industrial & Engineering Chemistry Research*](#).



recycling mixed plastic packaging just got easier and cleaner
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Mixed plastic packaging is made up of several different plastics bonded tightly together, making it challenging to recycle. Even if recycled, the material is often of low quality and has little commercial value. Consequently, most multilayer packaging ends up in landfills or incinerators.

In a statement, research lead Professor Hu Xiao, programme director of Chemistry and Materials at NEWRI, said: "We're seeing more mixed plastic packaging used in everyday food products, but recycling it safely and efficiently is still a major challenge. Our team set out to tackle this by developing a practical, scalable way to separate these materials without using harmful solvents."

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The DIPS method uses reactive extrusion, a solvent-free, continuous industrial process in which an extruder machine doubles as a chemical reactor.

During processing of mixed plastic packaging, poly(ethylene terephthalate) (PET) – the plastic commonly used for drink bottles – reacts with glycerol, a cheap and widely available reagent, and is selective.

different physical and chemical nature from the original plastic, causing it to naturally separate from polypropylene (PP), another common plastic used in packaging.

The separation happens automatically during processing, driven by differences in the materials' polarity and viscosity. The entire process runs at room pressure and without any solvents, making it safer and potentially more cost-effective than conventional chemical recycling approaches.

In laboratory tests, the recovered PP retained mechanical properties close to those of virgin plastic, achieving up to 90 per cent of its original tensile strength under optimal conditions.

Using samples from post-industrial mixed packaging waste, the method separated the plastic components and produced significantly better material quality compared to conventional mechanical recycling approaches, the team said.

While the recovered PET cannot be directly reused, it contains chemical groups that make it potentially useful for higher-value applications such as specialty materials to replace epoxy used in wind turbine blades or for conversion into a monomer.

The researchers believe the DIPS approach can be extended to other mixed plastic combinations and scaled up using commonly used industrial extrusion equipment.

First author Kathirvel Periasamy, a PhD student and Provost Graduate Awardee under NTU's flagship Interdisciplinary Graduate Programme, said: "Our process attempts to bridge the gap between laboratory research and industrial application. By simplifying separation and eliminating solvents, we aim to make plastic recycling more economically viable and environmentally sustainable."

[OECD estimates](#) that if mixed plastic waste were efficiently recycled at scale, it could unlock economic value of around \$250bn annually.

The research team now plans to collaborate with industry partners to validate the approach under scaled-up conditions and welcomes potential collaborators.

Mixed Plastic Recycling

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