

ABSTRACT - ADVANCED RECYCLING CONFERENCE 2024 :

Plasticentropy, Recycling Multilayers Plastic Waste

PLASTIC POLLUTION IS A GLOBAL ENVIRONMENTAL THREAT.

Mechanical recycling can retrieve the waste and yield feedstock for plastic production, but it falls short of delivering a product with original strength and composition (Lange, 2021). Removing the used ink, glue, coating, and label is not an easy task. Multilayer plastic packaging is facing challenges due to the combination of different materials including polymers, paper, aluminum and organic or inorganic coatings. The recycling process involves collection, sorting, cleaning, shredding, separation of layers, and recycling.

Chemical recycling technologies like delamination, hydrolysis, glycolysis, aminolysis, methanolysis, catalytic depolymerization have promising future to successfully break down MLP to its basic components, but we believe that enzymatic catalysis being the most

Plastic degradation by biological systems with re-utilization of the by-products could be a future solution to the global threat of plastic waste accumulation.

We will present how the enzymes we've discovered in the saliva of *Galleria mellonella* larvae (wax worms) are capable of oxidizing and depolymerizing polyethylene (PE), polystyrene (PS) and polypropylene (PP). Three of the most produced and sturdy polyolefin-derived plastics, representing together 51% of the global plastic production¹. This effect is achieved after a few hours' exposure at room temperature under physiological conditions (neutral pH).

To the best of our knowledge, these enzymes are the first enzymes with this capability, opening the way to potential solutions for multilayers plastic waste management through bio-recycling/up-cycling.

Although multilayer plastic recycling faces several challenges, such as complexity of composition, cost, and lack of infrastructure, we will explain our goals and roadmap to develop sustainable industrial process to overcome these challenges.

¹source: <https://plasticseurope.org/es/wp-content/uploads/sites/4/2023/10/Plastics-the-fast-Facts-2023.pdf>

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