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Immobilized PET-degrading enzymes for microplastic control

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The accumulation of polyethylene terephthalate (PET) represents a major environmental threat due to its durability and widespread use. Enzymatic hydrolysis mediated by PET-degrading enzymes, particularly leaf-branch compost cutinase (LCC), offers a sustainable approach for PET depolymerization into its monomers: BHET, MHET, TPA, and EG.[1,2] In this study, two recombinant LCC were successfully produced in *E. coli* Rosetta pLysS using a pET-21a(+) vector. For process evaluation, two methods (HPLC and UV-Vis spectroscopy) were optimized. The golden-standard LCC-ICCG variant and one in-house developed mutant (LCC-ISN) were tested for nanoPET degradation. Some nanomaterials were tested as support for native and mutant enzymes immobilization. [3,4]

The use of smaller concentrations of enzyme was proven more efficient for PET hydrolysis in the first 24 hours. The in-house produced mutant LCC-ISN has a higher activity in degrading nanoPET in the first 24 hours as compared to the golden-standard LCC-ICCG.

Magnetic nanoparticles covered with amino-silanes or with Chitosane, further functionalized with EDTA anhydride and Co^{2+}, were tested as support for the enzyme variants immobilization, and the resulted biocatalysts were efficient for the nanoPET degradation.

The immobilization method and the use of the in-house mutant represent a new approach towards resolving the ongoing efforts to develop enzyme-based solutions for PET biodegradation and sustainable plastic recycling.

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