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Plastics to Surfactants

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PURPOSE OF THE ABSTRACT
The recent discovery of a hydrolytic enzyme, IsPETase, that can deconstruct poly(ethylene) terephthalate (PET), has sparked great interest in biocatalytic approaches to recycle plastics. Realisation of commercial utility will require the development of robust engineered enzymes that meet the demands of industrial processes. Recently, we have reported development and implementation of an automated, high-throughput directed evolution platform for engineering polymer degrading enzymes. Evaluation of >13,000 IsPETase variants, applying catalytic activity at elevated temperatures as a primary selection pressure, afforded a HotPETase variant with 21 mutations that has a melting temperature of 82.5°C and can therefore operate near or above the glass transition temperature of PET (60-70°C). HotPETase can depolymerise semi-crystalline PET more rapidly than previously reported PETases and can selectively deconstruct the PET component of a laminated packaging multi-material. This study established laboratory evolution as a platform to engineer useful plastic degrading enzymes to underpin biocatalytic plastic recycling processes, which we now want to apply to different plastics. We now aim to apply this high-throughput platform to alternative plastics and to up-cycle the degradation products to produce new anionic surfactants.

FIGURES

FIGURE 1

FIGURE 2

KEYWORDS
Directed Evolution | Up-cycling

BIBLIOGRAPHY