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Enzymatic Degradation of PET Plastic by Mechanical Agitation

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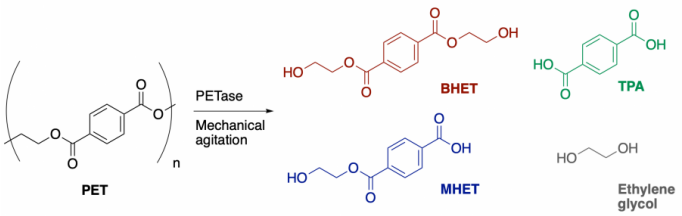
PURPOSE OF THE ABSTRACT
Due to the rising problem of plastic pollution, it is becoming necessary to develop new methods of removing plastic waste from the natural environment. As a plastic generally used for single use purposes, polyethylene terephthalate (PET) is produced on an annual scale of over 50 million tonnes.[1] A large proportion of the PET produced ends up as plastic waste in the environment, despite it being fully recyclable. In 2016, an enzyme able to degrade PET by using it as its sole carbon source was discovered, providing a potential solution to part of the plastic waste problem.[2] In this work, PETase enzymes have been used in whole cell form to degrade PET substrates by both traditional biocatalytic methods and mechanical agitation. By HPLC analysis and SEM imaging, it has been found that optimal time lengths of mechanical agitation and aging periods improved the degradation of PET substrates, achieving higher yields of breakdown products than seen previously. This sustainable method of PET breakdown offers potential for molecular recycling, using reduced solvent volumes in comparison with traditional approaches and utilises enzymatic methods as a sustainable approach to breaking down the plastic waste polluting our natural environment.

FIGURES



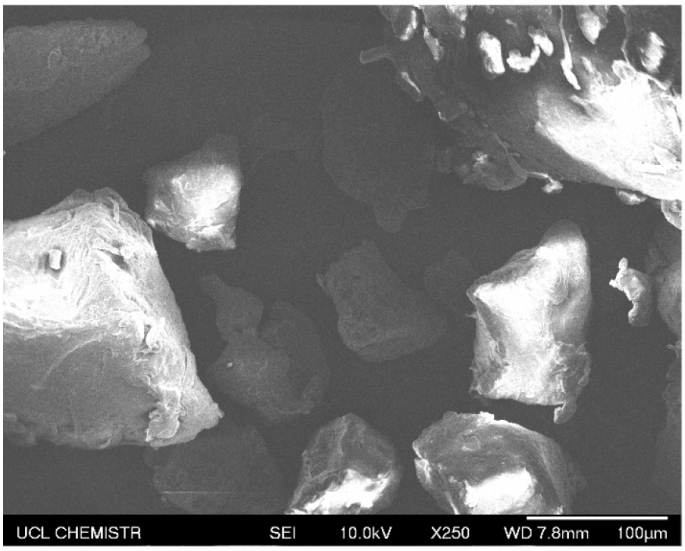


FIGURE 1

PET breakdown

Scheme showing PET breakdown into monomers: bishydroxyethyl terephthalate (BHET), mono(2-hydroxyethyl) terephthalic acid (MHET), terephthalic acid (TPA) and ethylene glycol (EG).

FIGURE 2

SEM image

SEM imagery showing PET powder prior to enzymatic breakdown.

KEYWORDS

polyethylene terephthalate (PET) | PETase enzymes | mechanical agitation | natural environment

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