NEXT-GENERATION PLASTIC DEGRADING ENZYMES

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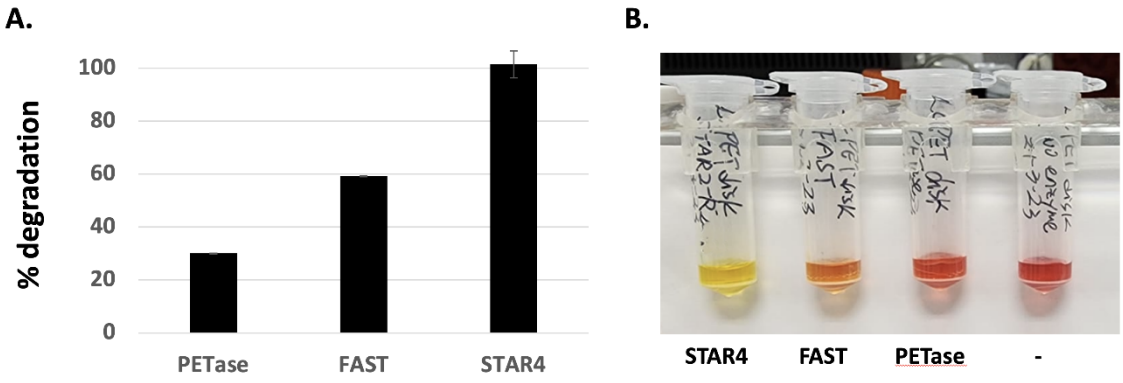
Single-use plastic packaging is a major source of global pollution, with around 33 billion tons predicted to litter the environment by 2050. With an estimated global production of 70 million tons annuall, polyethylene terephthalate (PET) is the most abundant plastic and is widely used in disposable containers for many commercial foods and drinks. Recently, several bacterial enzymes have been described that are capable of degrading PET to monomers. *Ideonella sakaiensis*, discovered at a plastic bottle recycling plant secretes *Is*PETase, a PET hydrolysing enzyme with intrinsic PET-degrading activity. Significant effort is being put into improving this activity to enable cost-effective green recycling of PET waste at scale. Using both a structure-guided and focused library approach, we have generated an improved PETase capable of degrading PET significantly more efficiently than wild-type enzyme. This variant, termed STAR4-PETase is capable of 100% degradation of low crystalline powdered PET in 3 days. Further engineering approaches are being undertaken to improve its performance on the more recalcitrant commercial grade PET.



Engineered PETase enzyme shows improved degradation of PET substrates. A. Enzymatic degradation of PET powder (3 days) by PETase, FAST and STAR4 enzymes (N=2 ± SD). B. Enzymatic degradation of PET coupon (24 hours) by indicated enzymes in the presence of phenol red pH indicator. Terephthalic acid liberated from enzymatic hydrolysis of PET causes colour change from red to yellow.