Mechanism and Engineering of enzymes for PET decomposition

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The worldwide production and use of plastics have led to the accumulation of non-biodegradable plastic waste in landfills and ocean, resulting in serious environmental problems. Poly(ethylene terephthalate) (PET) composed of terephthalic acid and ethylene glycol linked by ester bond is one of the most commonly used plastics for fiber and packaging materials. Although various microbial hydrolases including cutinases, lipases, and carboxylesterases have been reported to degrade PET, the biodegradation of high crystallinity PET under ambient temperature remains infeasible. Recently, the bacterium *Ideonella sakaiensis* 201-F6 was isolated and it uses PET as a carbon source at moderate temperature (30°C) using PET hydrolase (PETase) and monohydroxyethyl terephthalate hydrolase (MHETase). In this study, the extensive structural and biochemical studies on *Is*PETase and *Is*MHETase suggest the mechanism of PET degradation. Furthermore, we developed the variants with remarkably enhanced thermal stability and highly improved PET degradation ability based on structure-based protein engineering.