Highly Efficient PET Degradation by Rational Protein Engineering of Thermo-Stable PETase from *Ideonella sakaiensis*

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As a solution for Poly(ethylene terephthalate) (PET) waste problem, microbial PET degradation in normal temperature became considerable thanks to *Ideonella sakaiensis* PETase (*Is*PETase). However, its low thermal stability limits its ability for efficient and practical enzymatic degradation of PET. Using the structural information on *Is*PETase, we developed a rational protein engineering strategy for high thermal stability to improve PET degradability. In particular, the IsPETaseS121E/D186H/R280A variant, which was designed to have a stabilized β6-β7 connecting loop and extended subsite IIc, showed enhanced PET degradability by 14-fold at 40 °C compared to native *Is*PETase using *in vitro* system. The designed structural modifications were further verified through structure determination of the variant, and this variant showed highly efficient PET degradation through *in vivo* system as well. This work was supported by the Technology Development Program to Solve Climate Changes on Systems Metabolic Engineering for Biorefineries from the Ministry of Science and ICT through the National Research Foundation (NRF) of Korea (NRF-2012M1A2A2026556 and NRF-2012M1A2A2026557)