Structural Characterization of PETase toward Superior Poly(ethylene terephthalate) Degradation

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Plastics, including poly(ethylene terephthalate) (PET), are very popular with their desirable characteristics. However, non-biodegradability, once thought to be great merit of plastics, causes the severe environmental problem. With the recently found PET-degrading bacterium, *Ideonella sakaiensis*, its possible use in microbial PET degradation becomes considerable. Here we firstly report the crystal structure of *I. sakaiensis* PETase (*Is*PETase) with high resolution. It helps to confirm the catalytic features of *Is*PETase and predict its molecular mechanism on degrading PET. Moreover, we succeed in developing the variant of *Is*PETase with 32.4% enhanced PET-degradability over its wild type using structural-based protein engineering. In this study, the reasons *Is*PETase has superior activity were successfully predicted with the 3D structure and related biochemical studies. This work was supported by the Technology Development Program to Solve Climate Changes on Systems Metabolic Engineering for Biorefineries (NRF-2012M1A2A2026556 and NRF-2012M1A2A2026557) from the Ministry of Science and ICT through the National Research Foundation of Korea