ENZYMATIC RECYCLING OF PLASTICS

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This lecture will cover recent achievements in the discovery, protein engineering and application of enzymes in biocatalysis [1] with special focus on enzymatic opportunities to recycle (or degrade) plastics.
We have investigated PET hydrolysis [2], for which we determined the first structure of an MHETase in complex with a substrate analogue [3] and also provided important adjustments of a published PETase structure [4]. We also used various methods of protein engineering to improve several PET-hydrolases for higher activity and thermostability [5]. Recently, we have identified the first urethanases in a metagenomic library able to degrade polyurethanes [6] and designed an enzyme cascade to degrade poly(vinylalcohols) [7].

References:
[1] Yi., D. et al., Chem. Soc. Rev., 50, 8003-8049 (2021); Wu, S. et al. Angew. Chem. Int. Ed., 60, 88-119 (2021); Rudroff, F. et al., Nat. Catal. 1, 12-22 (2018); Badenhorst C.P.S., Bornscheuer, U.T., Trends Biochem. Sci., (2018), 43, 180-198; Bornscheuer, U.T. et al., Nature, 485, 185-194 (2012)
[2] Wei, R. et al. (2022), ACS Catal., 12, 3382-3396 (2022); Wei, R. et al., Nature Catal., 3, 867-871 (2020); Bornscheuer, U.T., Science, 351, 1155-1156 (2016)
[3] Palm, G.J. et al., Nature Commun., 10, 1717 (2019)
[4] Wei, R. et al., Nature Commun., 10, 558 (2019)
[5] Pfaff, L. et al., ACS Catal., 12, 9790-9800 (2022); von Haugwitz et al., ACS Catal., 12, 15259-15270 (2022); Tarazona, N.A. et al., Chem. Catal., 2, 3573-3589 (2022)
[6] Branson, Y. et al., Angew. Chem. Int. Ed., 62, e202216220 (2023)
[7] von Haugwitz, G. et al., Angew. Chem. Int. Ed., 62, e202216962 (2023)