

Enzyme Immobilization: A Strategy to Overcome Enzyme Limitations and Expand Their Applications

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Abstract : Due to their inherent sustainability and compatibility with green chemistry principles, enzymes are attracting increasing attention for various applications like bioremediation or biocatalysis. These natural catalysts boast remarkable substrate specificity and operate under mild biological conditions. However, their intrinsic limitations, such as instability at high temperatures or in organic solvents, impede their wider applicability. Enzyme immobilization on supportive matrices emerges as a promising strategy to address these challenges. This approach not only facilitates enzyme reusability but also offers the potential to modulate their stability, activity, and selectivity. The present study investigates the immobilization and application of two distinct groups of hydrolases on supportive matrices: PETases, naturally capable of PolyEthylene Terephthalate (PET) degradation, and cholinesterases (ChEs), key enzymes in neurotransmitter regulation. All tested enzymes will be immobilized on porous and non-porous particles using both covalent and non-covalent methods. Additionally, the stability of PETases and cholinesterases will be explored, followed by exposure to denaturing conditions to assess their resilience under harsh conditions. Furthermore, due to the exceptional catalytic efficiency and selectivity, their biocatalytic efficiency will be tested using xenobiotic substrates, aiming to establish them as replacements for conventional chemical catalysts in environmentally friendly processes. By exploiting the power of enzyme immobilization, this research strives to unlock the full potential of these biocatalysts for sustainable and efficient technological advancements.

Keywords : biocatalysis, bioremediation, enzyme efficiency, enzyme immobilization, green chemistry

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