

Definition & Historical Development

- Biocatalysis refers to the use of natural catalysts, such as protein enzymes, to conduct chemical reactions.
- groups and the efficiency of catalysts into single reagents.
- Enzymes can also be combined with other enzymes in one-pot reactions, allowing for complex multi-step syntheses.





triglycerides using lipases



Therapeutics

Synthesis of molecules to target diseases. i.e.: synthetic penicillin production using penicillin G amidase



Food Industry

Artificial sweeteners, prebiotics, vitamins. I.e.: conversion of xylose to xylitol

BIOCATALYSIS

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• These biocatalysts are particularly advantageous in chemical processes because they combine the selectivity of directing



Commodity plastics

Production or larger molecules (polymers) with unique properties. i.e: Polylactic acid (PLA)



Agriculture

Pesticides, herbicides, fungicides, etc. i.e.: production of pyrethrins (pesticide) using CYP82 enzymes

Selected Examples Enzymes Hydrolases Isomerases Transferases Lyases Oxidoreductases



Penicilin acylase

Penicilin

Advantages & Limitations

Advantages

Unique Catalytic Opportunities

Enable unique catalytic opportunities not accessible with conventional chemistry.

Efficient Chiral Synthesis

Shorter, efficient routes to complex chiral intermediates.

High Specificity and Selectivity

Reduces unwanted by-products.

Mild Reaction Conditions

Difficult to scale from lab to industrial level. Saves energy and reduces equipment costs.

References

1 R. A. Sheldon and J. M. Woodley, Chem. Rev., 2018, 118, 801–838. 2 C. M. Heckmann and F. Paradisi, *ChemCatChem*, 2020, **12**, 6082–6102.



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High Cost

High production and purification costs.

Scalability