

# ENZYMATIC POLYMERIZATIONS – NOVEL WAYS TO (NEW) POLYMER SYSTEMS

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The *in vitro* enzymatic synthesis of polymers via non-metabolic pathways is a relatively old area of precision polymer synthesis. The enzymatic polymerization of polysaccharides was for instance already reported more than 50 years ago. However, other polymerization methods using cheap petroleum-based monomers soon replaced research on biocatalytic polymerization techniques.

These days fast depletion of the petroleum stock and increase in the cost of petroleum-based monomers puts a limit to their use in the future and enzymatic polymerizations are currently facing a Renaissance.

Enzymes have excellent features (activity, selectivity, specificity) for designing synthetic processes to obtain a wide range of products under mild and environmentally friendly conditions. Typical characteristics of enzyme catalysis are high catalytic activity, large rate acceleration of reactions under mild reaction conditions, high selectivity of substrates and reaction modes, and no formation of byproducts. In the field of organic synthetic chemistry, enzymes are already used extensively for the production of chemical and pharmaceutical intermediates and end products.

At present, petrol-based monomers are still predominately used in enzymatic polymerizations. By combining biobased monomers and enzymatic polymerizations in polymer synthesis, not only the research field of enzymatic polymerization could be greatly accelerated but also the utilization of renewable resources will be promoted. This will provide an essential contribution to achieving sustainability for the polymer and coatings industry, which will eventually play an important role in realizing and maintaining a sustainable society.

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