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UNIVERSITY & RESEARCH

Biocatalysis for the production of fine and bulk chemicals from biomass

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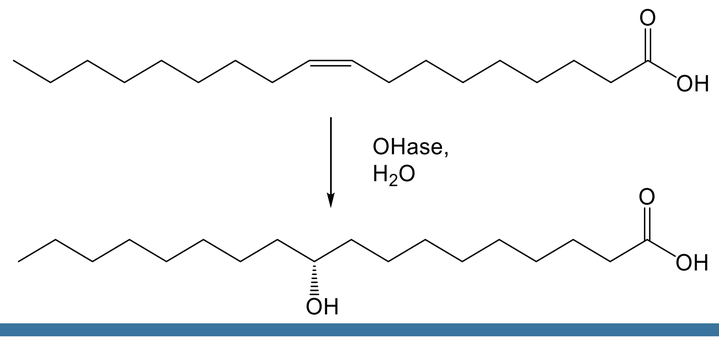
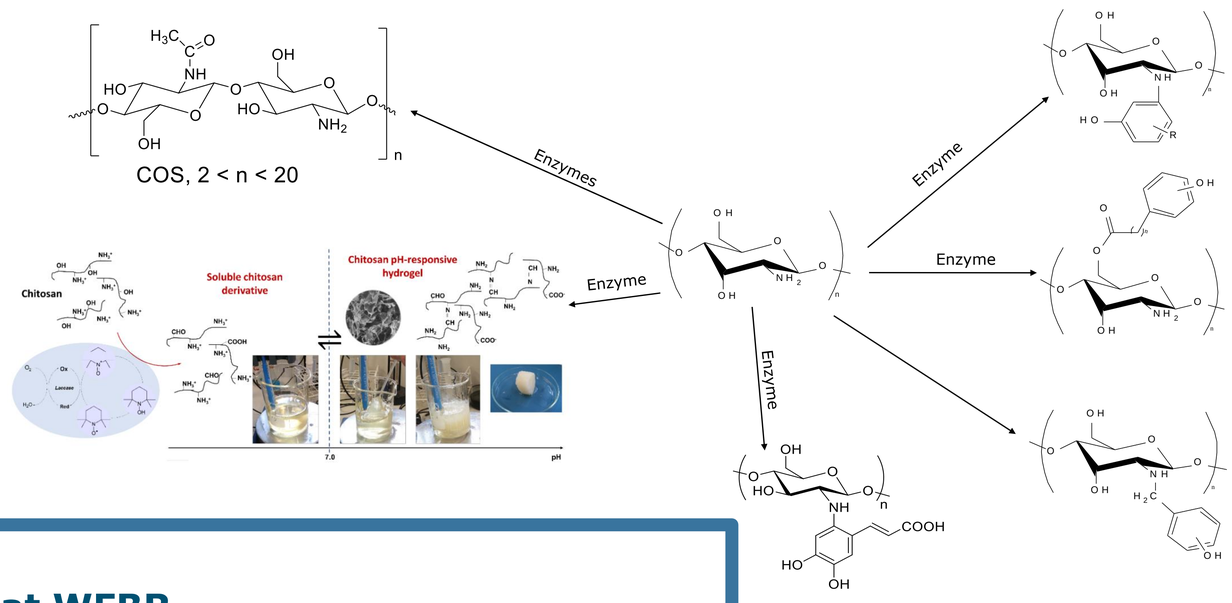
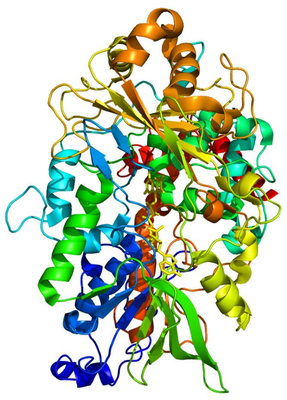
Synthesis of hydroxy fatty acids using oleate hydratase

Oleate hydratases convert unsaturated fatty acids found in vegetable oils into hydroxy fatty acids. The obtained hydroxy fatty acids are of interest due to their properties as emulsifiers and bioactives. They are also interesting chemical precursors for estolides, macrolactones and various building block chemicals. WFBR develops synthetic procedures for the production of hydroxy fatty acids and their derivatives from complex fatty acid mixtures such as oil hydrolysates.



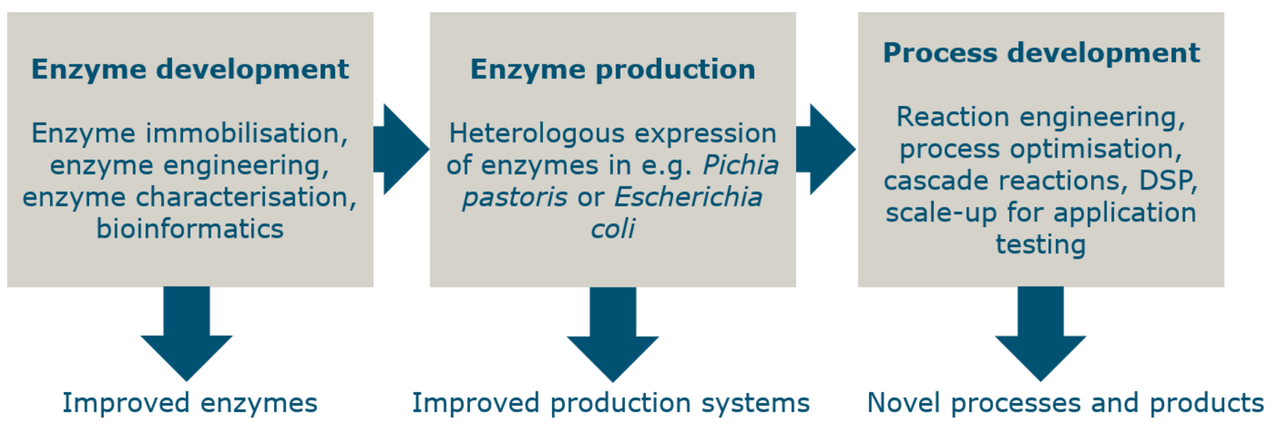
Biopolymer functionalisation: modified chitosans





Biocatalysis at WFBR

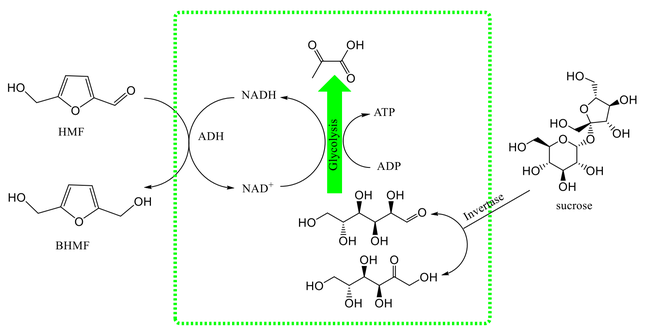
Wageningen Food & Biobased Research (WFBR) is a knowledge institute that performs contract research in the domain of sustainable innovations in healthy food, fresh food chains and biobased products. The Biobased Products division focusses on the development of novel, circular processes for the production of added-value chemicals and materials from biomass or industrial waste streams. In this context, biocatalysts are commonly applied for their exquisite selectivity and the mild conditions under which they are active. Activities in the field of biocatalysis encompass enzyme production and development (e.g. immobilisation or engineering) and the development and optimisation of biocatalytic processes. These activities occur in collaboration with experts in the fields of biorefinery, chemical synthesis, fermentation technology, materials science and downstream processing, enabling us to combine these fields of expertise to develop an optimal process.



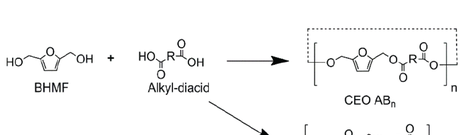
WFBR develops methods to convert underutilised biopolymers, such as chitosan, to compounds with properties of interest for home and personal care, biomedical and food/nutraceutical applications.

Synthesis and polymerisation of furan-derived building blocks

WFBR develops methods for the production of novel polymer building blocks from biomass-derived compounds. The furanic diol 2,5-bis-(hydroxymethyl)furan (BHMF) was produced from glucose-derived 5-(hydroxymethyl)-furfural (HMF) using resting cells of baker's yeast. Lipase-catalysed esterification of BHMF with various diacids yielded oligomeric esters with improved thermostability suitable for further processing into (co-)polymers.



Production of BHMF using resting cells of baker's yeast



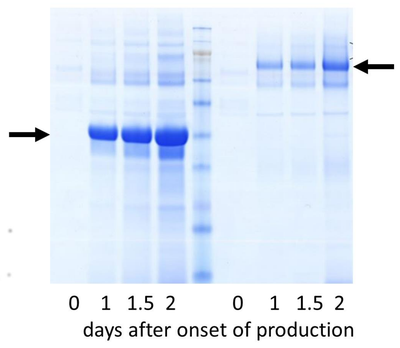
Monomers	SEC		TGA	
	n	Mw	Td, 5% (°C)	Td, max (°C)
diMe-FDCA			160	210
BHMF			140	
diMe-FDCA and BHMF	2	890	163	190
BHMF and diMe-Succinate	4	1315	174	210
diMe-FDCA, BHMF and 1,6-hexandiol	5	1051	174	315

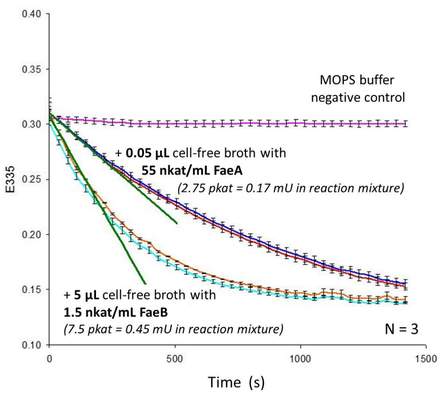
Lipase-catalysed formation of oligoesters

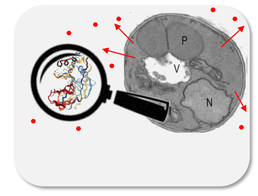
Enzyme production in *Pichia pastoris*

WFBR develops methods for the production of proteins (enzymes) in the yeast *Pichia pastoris.* This expression system enables the production of proteins at high yield (g/L range). Downstream processing is simplified by secretion of the target protein into the culture medium. Cell-surface display may be used for e.g. the production of whole-cell biocatalysts.

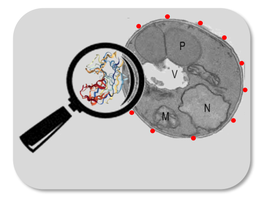
Production of two A. niger feruloyl esterases:







Secretion into culture medium



Cell-surface display

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