FORMULATION OF ENZYMES FOR INDUSTRIAL APPLICATIONS

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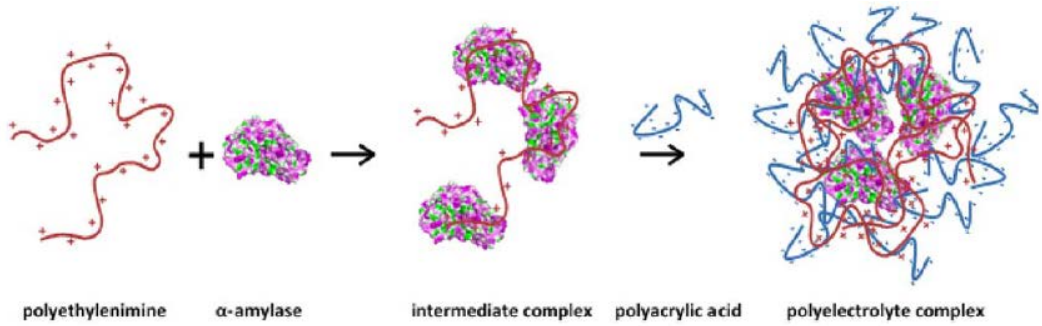
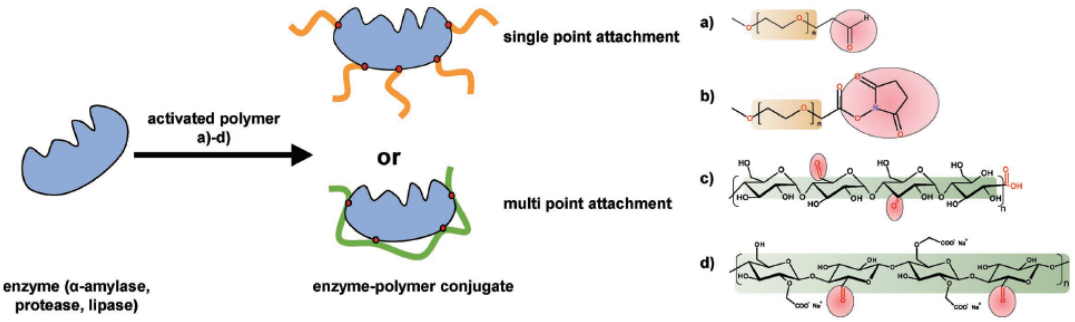
Industrial enzymes are an attractive market with high annual growth. They are key performance enablers for food & feed applications and for detergent formulations in the laundry area. New methods and appropriate enzyme formulation approaches are of crucial importance to protect enzymes against environmental influences. In addition to the established phytases and proteases, BASF will focus on the formulation of different enzyme classes as well. Fundamental knowledge is necessary to formulate enzymes without any loss of enzyme activity which is directly connected to the performance and subsequently to the margin of the product.

We will present two different strategies to formulate enzymes. Both approaches provide stabilization and activity in applications using enzymes with activities greater than average. Using contrary charged polyelectrolytes like polyacrylic acid and polyethylenimine, polyelectrolyte complexes (PECs) are formed *in-situ* around enzymes. α-amylase immobilized in such a polyelectrolyte complex shows an increased stability at low pH values. Within the second strategy, enzymes are covalently linked to polymers. Such enzyme-polymer conjugates are synthesized with various polymers – PEG as well as polysaccharide based – and with three different enzymes. The thermal stability in general and the enzyme shelf life in a standard detergent formulation is enhanced significantly for the conjugated enzymes. The colloidal and physico-chemical stability was characterized in terms of size, size distribution, electro-kinetic potential, and morphology. The thermodynamic parameters of interactions in solution were analyzed by calorimetry. Enzyme shelf life was checked by specific enzyme test assays and showed promising results regarding their potential in stabilizing enzymes.



Preparation of polyelectrolyte complexes with encapsulated a-amylase.



Enzyme modification with four different polymers: a) mPEG-aldehyde, b) mPEG-N-hydroxysuccinimide ester, c) maltodextrine aldehyde, and d) carboxymethyl cellulose aldehyde. The red circles indicate the functional group reactive toward covalent coupling with the enzyme's amino group.

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