S-1-(4-hydroxyphenyl)-ethanol dehydrogenase from A. aromaticum: catalytic stability studies

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Biocatalysts play a pivotal role in various industrial processes due to their selectivity and efficiency. However, their structural complexity often makes them susceptible to degradation, resulting in a progressive loss of activity. Therefore, alongside selectivity, the robustness of biocatalysts against inactivating conditions during reaction and storage is one of their most desired properties. Specifically, resistance to thermal inactivation and inactivation induced by extreme pH is crucial.

Derived from the denitrifying bacterium *Aromatoleum aromaticum* EbN1 (Azoarcus sp.), the enzyme *S*-1-(4-hydroxyphenyl)-ethanol dehydrogenase (S-HPED) belongs to the short-chain dehydrogenase/reductase family (SDR) and represents promising biotool for the stereoselective synthesis of chiral aromatic alcohols [1-3].

The presented study focuses on evaluating the activity and stability of S-HPED both under storage and process conditions within the pH range of 5.5 to 9.0. The relationship between the dynamics of aggregation and activity loss under various pH levels, and in the presence of glucose as a stabilizer, was analyzed. Based on inactivation experiments, the mechanism of thermal inactivation under storage conditions at pH 9.0 was modelled. The irreversible first-order mechanism of S-HPED inactivation was verified through isothermal and multi-temperature evaluations.

Our findings indicate that *S-HPED*, alongside *R*-1-(4-hydroxyphenyl)-ethanol dehydrogenase, is the second enzyme belonging to the SDR family for which a one-step thermal inactivation mechanism was confirmed under similar pH conditions [4]. These results provide the prerequisite for drawing initial conclusions on the inactivation mechanism of the entire SDR family. Confirming the first-order mechanism across a broader spectrum of enzymes from this group would provide stronger evidence to support such a general hypothesis.

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