Exploring the production of α-Galactosidase and its utilization in legume-based products.

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Outline

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Abstract

α-Galactosidase, a hydrolytic enzyme with significant potential in medicine and food industries, especially for removing raffinose family oligosaccharides (RFOs) from legume products, was explored in this study. Purified α-Galactosidase from *Aspergillus niger* NRC114 exhibited a purification fold of 123 and a molecular weight of 64 kDa, with optimal pH and temperature at pH 3.5 and 60°C, respectively, demonstrating acid and thermal stability. Addition of K^+, Mg^{2+}, Co^{2+}, and Zn^{2+} enhanced enzyme activity, with K_m (Michaelis constant) and V_{max} values of 0.401 µM and 14.65 µmol min^{-1}. Enzyme-treated soy yogurt showed increased total phenolics and flavonoids over storage time, indicating high acceptability. Immobilization of α-Galactosidase on Sepabeads EC-EA and Sepabeads EC-HA via direct covalent coupling and glutaraldehyde-mediated adsorption/cross-linking methods achieved activity yields of 63% and 55%, respectively. Optimal temperatures for immobilized enzymes were 60°C, with slightly higher temperatures for cross-linked enzymes. The covalently immobilized enzyme had an optimal pH of 6.0, while the cross-linked enzyme had an optimal pH of 5.0. α-Galactosidase immobilized on these carriers showed effective hydrolysis of stachyose and raffinose, with the immobilized enzyme reusable up to 18 times when using raffinose as a substrate, and Mn^{2+} addition enhancing enzyme activity. Despite differences in production and characteristics, both forms of α-galactosidase exhibited excellent stability and potential for application in various industries beyond legume product processing.

Reference

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