

ABSTRAK

STUDI KOMPARATIF: PENINGKATAN KESTABILAN ENZIM α -AMILASE DARI *Aspergillus fumigatus* MENGGUNAKAN METODE AMOBILISASI PADA MATERIAL KITIN, BENTONIT, DAN HIBRIDA KITIN-BENTONIT

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Kestabilan enzim menjadi faktor penting bagi enzim industri saat diaplikasikan dalam proses *batch* pada suhu dan pH yang ekstrim. Studi komparatif telah dilakukan dalam meningkatkan kestabilan enzim α -amilase dari *Aspergillus fumigatus* menggunakan metode amobilisasi pada material kitin, bentonit, dan hibrida kitin-bentonit. Penelitian ini bertujuan untuk mengetahui matriks pengamobil paling baik guna meningkatkan kestabilan enzim. Prosedur penelitian dilakukan melalui tahapan berikut: produksi, isolasi, pemurnian, amobilisasi, dan karakterisasi enzim. Enzim hasil pemurnian memiliki suhu optimum 55 °C, $k_i = 0,0179 \text{ menit}^{-1}$, $t_{1/2} = 38,72 \text{ menit}$, dan $\Delta G_i = 104,35 \text{ kJ mol}^{-1}$. Suhu optimum enzim hasil amobilisasi pada kitin, bentonit, dan hibrida kitin-bentonit berturut-turut sebesar 55, 70, dan 60 °C. Enzim hasil amobilisasi pada kitin memiliki nilai $k_i = 0,0114 \text{ menit}^{-1}$, $t_{1/2} = 60,79 \text{ menit}$, dan $\Delta G_i = 105,60 \text{ kJ mol}^{-1}$. Enzim hasil amobilisasi pada bentonit memiliki nilai $k_i = 0,0057 \text{ menit}^{-1}$, $t_{1/2} = 121,58 \text{ menit}$, dan $\Delta G_i = 107,51 \text{ kJ mol}^{-1}$. Enzim hasil amobilisasi pada hibrida kitin-bentonit memiliki nilai $k_i = 0,0041 \text{ menit}^{-1}$, $t_{1/2} = 169,02 \text{ menit}$, dan $\Delta G_i = 108,43 \text{ kJ mol}^{-1}$. Enzim hasil amobilisasi dapat digunakan berulang hingga enam kali. Setelah diamobilisasi pada kitin, bentonit, dan hibrida kitin-bentonit, enzim α -amilase mengalami peningkatan kestabilan berturut-turut sebesar 2, 3, dan 4 kali lipat.

Kata kunci: α -amilase, *Aspergillus fumigatus*, amobilisasi, hibrida kitin-bentonit

ABSTRACT

A COMPARATIVE STUDY: THE STABILITY IMPROVEMENT OF α -AMYLASE ENZYME FROM *Aspergillus fumigatus* BY THE IMMOBILIZATION METHOD ONTO CHITIN, BENTONITE, AND CHITIN-BENTONITE HYBRID MATERIALS

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Enzyme stability is a significant factor for industrial enzymes when applied on batch process at extreme temperature and pH. A comparative study had been investigated to improve the stability of α -amylase enzyme from *Aspergillus fumigatus* by immobilization method onto chitin, bentonite, and chitin-bentonite hybrid materials. This research aims to find the best support material for increasing the enzyme stability. The research procedures were performed, as follows: enzyme production, isolation, purification, immobilization, and characterization. The native enzyme has optimum temperature of 55 °C, $k_i = 0.0179 \text{ min}^{-1}$, $t_{1/2} = 38.72 \text{ min}$, and $\Delta G_i = 104.35 \text{ kJ mole}^{-1}$. Optimum temperatures of immobilized enzyme onto chitin, bentonite, and chitin-bentonite hybrid were 55, 70, and 60 °C respectively. The immobilized enzyme onto chitin has value of $k_i = 0.0114 \text{ min}^{-1}$, $t_{1/2} = 60.79 \text{ min}$, and $\Delta G_i = 105.60 \text{ kJ mole}^{-1}$. The immobilized enzyme onto bentonite has value of $k_i = 0.0057 \text{ min}^{-1}$, $t_{1/2} = 121.58 \text{ min}$, and $\Delta G_i = 107.51 \text{ kJ mole}^{-1}$. The immobilized enzyme onto chitin-bentonite hybrid has value of $k_i = 0.0041 \text{ min}^{-1}$, $t_{1/2} = 169.02 \text{ min}$, and $\Delta G_i = 108.43 \text{ kJ mole}^{-1}$. All immobilized enzymes could be reused on sixth cycles. After immobilization onto chitin, bentonite, and chitin-bentonite hybrid, the stability of α -amylase had been improved to two, three, and four-fold higher than the native form, respectively.

Keywords: α -amylase, *Aspergillus fumigatus*, immobilization, chitin-bentonite hybrid