ABSTRACT

THE EFFECT OF ADDITION POLYETHYLENE GLYCOL (PEG) 4000 ON STABILITY OF α –AMYLASE ENZYME FROM *Aspergillus fumigatus*

By

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The enzyme industry has occupied an important position in the industrial field. However, the enzymes application in the industrial sector is limited because the cost of enzymes is quite high, and the enzymes stability that are not resistant to extreme conditions. This study aims to obtain the α-amylase enzyme from *Aspergillus fumigatus* with high activity and purity level and increase the stability of the α-amylase enzyme through the addition of polyethylene glycol (PEG) 4000. To achieve this goal, this research did the production, isolation, purification and characterization of the purified enzymes and the enzymes with PEG 4000 added. The activity of the α-amylase enzyme was tested by Fuwa and Mandels method, and the protein content was tested by Lowry method. The results showed that the specific activity of purified enzyme was 456.88 U/mg which increased about 15 times compared to the crude extract enzyme which only had a specific activity of 31.18 U/mg.. The purified enzymes had optimum pH of 5.0 at 50 ^{o}C with a value of k_i = 0.0163 ± 0.0001 min^{-1}; $t_{1/2}$ = 42.524 ± 0.3690 minutes; and ΔG_i = 101.384 ± 0.0233 kJ mol^{-1}. While the enzymes resulting from the addition of PEG 4000 at concentrations of 12, 18, and 24% had optimum pH of 5.5 at 55 ^{o}C with the values of k_i = 0.0117 ± 0.0001; 0.0098 ± 0.0001; and 0.0088 ± 0.0003 min^{-1}; $t_{1/2}$ = 59.243 ± 0.3550; 70.730 ± 0.0001; and 78.767 ± 2.5330 minutes; and ΔG_i = 103.888 ± 0.016; 104.383 ± 0.0001; and 104.677 ± 0.0877 kJ mol^{-1}. The addition of PEG 4000 can increase the stability of the α-amylase enzyme from *A. fumigatus* as indicated by decrease in the inactivation rate constant value, increase in the half-time value, and increase in energy due the denaturation.

Keywords: α-amylase, *A. fumigatus*, PEG 4000, stability of enzyme

ABSTRAK

PENGARUH PENAMBAHAN POLIETILEN GLIKOL (PEG) 4000 TERHADAP STABILITAS ENZIM α-AMILASE DARI *Aspergillus fumigatus*

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Industri enzim telah menduduki posisi penting dalam bidang industri. Namun, aplikasi enzim di bidang industri terbatas karena biaya enzim yang cukup tinggi dan stabilitas enzim yang tidak tahan terhadap kondisi ekstrim. Penelitian ini bertujuan untuk mendapatkan enzim α-amilase dari *Aspergillus fumigatus* dengan aktivitas dan tingkat kemurnian yang tinggi serta meningkatkan stabilitas enzim α-amilase melalui penambahan polietilen glikol (PEG) 4000. Untuk mencapai tujuan tersebut, dilakukan produksi, isolasi, pemurnian, dan karakterisasi enzim hasul pemurnian dan enzim hasil penambahan PEG 4000. Aktivitas enzim α-amilase diuji dengan metode Fuwa dan Mandels serta kadar proteinnya diuji dengan metode Lowry. Hasil penelitian menunjukkan bahwa aktivitas spesifik enzim hasil pemurnian adalah 456,88 U/mg yang meningkat sebanyak 15 kali dibandingkan ekstrak kasar enzim yang hanya memiliki aktivitas spesifik sebesar 31,18 U/mg. Enzim hasil pemurnian memiliki pH optimum 5,0 pada suhu 50 ^{o}C dengan nilai k_i = 0,0163 ± 0,0001 menit^{-1}; $t_{1/2}$ = 42,524 ± 0,3690 menit; dan ΔG_i = 101,384 ± 0,0233 kJ mol^{-1}. Sementara enzim hasil penambahan PEG 4000 konsentrasi 12, 18, dan 24% memiliki pH optimum 5,5 pada suhu 55 ^{o}C dengan nilai k_i = 0,0117 ± 0,0001; 0,0098 ± 0,0001; dan 0,0088 ± 0,0003 menit^{-1}; $t_{1/2}$ = 59,243 ± 0,3550; 70,730 ± 0,0001; dan 78,767 ± 2,5330 menit; dan ΔG_i = 103,888 ± 0,016; 104,383 ± 0,0001; dan 104,677 ± 0,0877 kJ mol^{-1}. Penambahan polietilen glikol 4000 dapat meningkatkan stabilitas enzim α-amilase dari *A. fumigatus* yang ditunjukkan dengan terjadinya penurunan harga konstanta laju inaktivasi, peningkatan harga waktu paruh, dan peningkatan energi akibat denaturasi.

Kata kunci: α-amilase, *A. fumigatus*, PEG 4000, stabilitas enzim