ABSTRAK

IMOBILISASI ENZIM LIPASE DARI ISOLAT BAKTERI *Klebsiella* sp. LPG172 SECARA ADSORPSI MENGGUNAKAN MATRIKS ZEOLIT ALAM LAMPUNG

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Dalam penelitian ini, dilakukan imobilisasi enzim lipase dari bakteri *Klebsiella* sp. LPG172 menggunakan matriks zeolit alam Lampung. Tahap penelitian dilakukan dengan memproduksi ekstrak kasar lipase yang kemudian dimurnikan dengan fraksinasi ammonium sulfat, dialisis dan kromatografi kolom filtrasi gel sephadex G-75. Lipase hasil pemurnian diimobilisasi menggunakan zeolit alam Lampung teraktivasi dan ditentukan kondisi optimumnya. Ekstrak kasar enzim lipase mempunyai aktivitas sebesar 34,60 U/mL dengan kadar protein sebesar 3,34 mg/mL. Fraksi enzim hasil pemurnian dengan kromatografi kolom filtrasi gel sephadex G-75 memiliki kadar protein sebesar 0,69 mg/mL dengan nilai aktivitas hidrolisis serta transesterifikasi masing-masing sebesar 1.615,33 U/mL dan 1.178,80 U/mL. Setelah diimobilisasi menggunakan matriks zeolit alam Lampung teraktivasi aktivitas hidrolisis dan transesterifikasi enzim lipase masing-masing menjadi 1.205,67 U/mL dan 1.108,80 U/mL.

Proses imobilisasi lipase *Klebsiella* sp. LPG172 menggunakan zeolit alam Lampung teraktivasi mengubah kondisi optimum pada kedua aktivitas enzim. Pada reaksi hidrolisis, lipase bebas memiliki kondisi optimum pH 7, suhu 80˚C dengan waktu inkubasi selama 25 menit. Namun, setelah diimobilisasi lipase bekerja secara optimal pada pH 8, suhu 50˚C serta waktu inkubasi selama 15 menit. Sedangkan dalam reaksi transesterifikasi, lipase bebas memiliki kondisi optimum pada pH 7, suhu 70˚C dengan waktu inkubasi 25 menit. Setelah diimobilisasi lipase bekerja secara optimal pada pH 8, suhu 60˚C dengan waktu inkubasi selama 10 menit.

Kondisi optimum yang diperoleh digunakan dalam uji stabilitas lipase imobil terhadap pemakaian berulang. Pada reaksi hidrolisis, lipase imobil dapat dilakukan pemakaian 2 kali dalam siklus reaksi dengan aktivitas sisa sebesar 43,09% dari aktivitas awal. Sedangkan pada reaksi transesterifikasi pemakaian enzim lipase imobil dapat dilakukan sebanyak 3 kali siklus reaksi dengan persen aktivitas akhir sebesar 55,98%.

Kata kunci: hidrolisis, imobilisasi, *Klebsiella* sp. LPG172, lipase, transesterifikasi, zeolit alam Lampung.

ABSTRACT

IMMOBILIZATION OF LIPASE FROM ISOLATE *Klebsiella* sp. LPG172 BY ADSORPTION USING LAMPUNG NATURAL ZEOLIT MATRIX

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In this research, the immobilization of lipase from *Klebsiella* sp. LPG172 was carried out using natural zeolite from Lampung. The research involved producing a crude lipase extract, which was subsequently purified through ammonium sulfate fractionation, dialysis, and sephadex G-75 gel filtration chromatography. The purified lipase was then immobilized using activated natural zeolite from Lampung, and its optimal conditions were determined. The crude lipase extract exhibited an activity of 34.60 U/mL with a protein concentration of 3.34 mg/mL. The enzyme fraction obtained from sephadex G-75 gel filtration chromatography had a protein concentration of 0.69 mg/mL, with hydrolysis and transesterification activities of 1615.33 U/mL and 1178.80 U/mL, respectively. After immobilization with activated natural zeolite from Lampung, the lipase hydrolysis and transesterification activities were 1205.67 U/mL and 1108.80 U/mL, respectively.

The immobilization of *Klebsiella* sp. LPG172 lipase using natural zeolite from Lampung altered the optimal conditions for both enzyme activities. For the hydrolysis reaction, free lipase had optimum conditions at pH 7, a temperature of 80°C, and an incubation time of 25 minutes. However, after immobilization, the lipase worked optimally at pH 8, a temperature of 50°C, and an incubation time of 15 minutes. In the transesterification reaction, free lipase had optimum conditions at pH 7, a temperature of 70°C, and an incubation time of 25 minutes. After immobilization, the lipase functioned optimally at pH 8, a temperature of 60°C, and an incubation time of 10 minutes.

The optimal conditions obtained were used to test the stability of the immobilized lipase against repeated use. In the hydrolysis reaction, the immobilized lipase could be used for 2 cycles with the final activity reducing to 43.09% of its initial activity. In the transesterification reaction, the immobilized lipase could be used for 3 cycles with a final activity percentage of 55.98%.

Keywords: hydrolysis, immobilization, *Klebsiella* sp. LPG172, lipase, transesterification, Lampung nature zeolite.