Aktivitas *Immobilized α-Amylase* dan *Free α-Amylase* dari *Zoogloea ramigera* ABL 1 dalam Medium Pati Cair dengan Perlakuan Faktor Lingkungan

Activity of Immobilized and Free α-Amylase from *Zoogloea ramigera* ABL 1 on Liquid Starch Medium using Treatment of Environmental Factors

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Abstract

The aim of this research was to characterize activity of immobilized and free *α*-amylase from amylolitic isolate of *Zoogloea ramigera* ABL 1 with different environment conditions, such as pH; temperatures, and metal ions. Amylases were harvested from the cultivation liquid starch medium of bacteria by centrifugation at the highest enzyme activities. These enzymes furthermore were immobilized by reacting it with Ca-alginate. Enzymes without that reaction were prepared as free enzymes. Both amylases were characterized based on those specific activities at temperature 30°C; pH s (4-10), pH 7; temperatures (10-80°C), and addition 1 mM of metal ions ($CaCl_2$, $CuSO_4$, $FeSO_4.7H_2O$, $MgSO_4.7H_2O$, $MnCl_2.4H_2O$, $ZnSO_4$) at the previous optimum temperature and pH. Specific activities of immobilized amylase at all different environment conditions were more stable and higher than free amylases. Immobilized amylases were stable at temperature ranging from 10–60°C, and their optimum activities occurred at 30°C. Those immobilized amylases were also stable at pH ranging from 4–7, with optimum activity at pH 7. The highest activity of immobilized amylase was affected by the addition of 1 mM $MnCl_2.4H_2O$. On the other side, free enzyme was affected by the addition of 1 mM $CaCl_2$. Therefore, it can be concluded that immobilization technique of amylase from *Zoogloea ramigera* ABL 1 can be carried out to enhance specific activity of enzyme at wide range of pH, temperature, and metal ion.

Key words: Amylolitic, specific activity, liquid starch medium, Ca-alginat

Abstrak

Penelitian ini bertujuan mengetahui karakter aktivitas *immobilized amylase* dan *free amylase* dari isolat amilolitik *Zoogloea ramigera* ABL 1 dengan beberapa kondisi lingkungan yang berbeda, seperti suhu, pH, temperatur, dan ion logam. Amilase dengan aktivitas enzimatik tertinggi diunduh dari kultur bakteri dalam medium pati cair melalui sentrifugasi. Enzim hasil pengunduhan kemudian diperlakukan *immobilization technique* dengan direaksikan Ca-alginat. Enzim tanpa perlakuan *immobilization technique* merupakan *free amylase*. Kedua amilase kemudian dikarakterisasi berdasar aktivitas spesifik enzim pada kondisi temperatur 30°C; pH (4−10), pH 7; temperature (10−80°C), dan penambahan 1 mM ion logam ($CaCl_2$, $CuSO_4$, $FeSO_4.7H_2O$, $MgSO_4.7H_2O$, $MnCl_2.4H_2O$, $ZnSO_4$) dengan temperatur dan suhu optimum hasil penelitian sebelumnya. Aktivitas spesifik *immobilized amylase* pada semua kondisi lingkungan lebih stabil dan tinggi daripada *free amylase*. *Immobilized amylase* bersifat stabil pada kisaran suhu 10–60°C, dan aktivitas optimumnya terjadi pada suhu 30°C. *Immobilized amylase* tersebut juga stabil pada kisaran pH 4–7, dengan aktivitas optimum berada pada pH 7. Aktivitas *immobilized amylase* yang tertinggi terjadi pada penambahan 1 mM ion logam $MnCl_2.4H_2O$. Sebaliknya, free *enzyme* dipengaruhi oleh penambahan 1 mM $CaCl_2$. Perlakuan *immobilization technique* pada amilase dari *Zoogloea ramigera* ABL 1 terbukti dapat digunakan untuk meningkatkan aktivitas spesifik enzim dengan kisaran pH dan temperatur yang luas, serta penambahan ion logam.

Kata kunci: Amilolitik, aktivitas spesifik, medium pati cair, Ca-alginat