Kinetic Study of β-Cyclodextrin Production from Sago Starch by Cyclodextrin Glycosyltransferase of *Bacilus* sp. C26

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ABSTRACT

In this study, CGTase from *Bacillus* sp. C26 was used to produce β-CD from sago starch as a substrate. The maximum β-CD production was obtained with an enzyme concentration of 10 U/g of sago starch at pH 8.5 and temperature 50°C. The effect of temperature on kinetics of β-CD production by CGTase was investigated by varying temperature in the range of 40-70°C. K_m and V_{max} were calculated from the Lineweaver–Burk plot using different concentrations of substrate at all tested temperatures. It was found that initial rate of β-CD production increased when temperature increased. The increase in initial rate of β-CD production along with increasing temperature at high substrate concentration was higher than that at low substrate concentration. The V_{max} increased from 2.35 to 6.78 g β-CD/L/h when temperature increased from 40 to 65°C while K_m decreased from 39.2 to 9.78 g starch/L when temperature increased from 40 to 60°C. The lower value of K_m indicated that CGTase has higher affinity for the substrate. The catalytic efficiency (V_{max}/K_m) shows the optimum temperature at 65°C. The energy activation (E_a) of CGTase calculated by Arrhenius equation was 8.85 kcal/mol·K. The denaturation constant (K_d) values for CGTase was high at low substrate concentration while the denaturation energy constants (E_d) decreased when substrate concentration increased. It was found that CGTase was more stable in high substrate concentration. The mathematical models for catalytic efficiency and half life show the optimum temperature at 51, 52, 53 and 54 °C for 5, 10, 20, and 30 g starch/L, respectively, at 10 U/g enzyme concentration of CGTase. It was also found that the hydrolysis activity of CGTase was much lower than the activity of β-CD production.