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The Optimised Statistical Model of Enzymatic Hydrolysis of Tapioca by Glucoamylase Immobilised on Mesostructured Cellular Foam Silica

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Abstract

Enzymatic hydrolysis of starches using free glucoamylase to produce reducing sugars, which are substrates for various fermentation processes, often have difficulties in recovering and recycling of the free enzyme back to the process. Therefore, free glucoamylase immobilisation onto inert insoluble supports is widely studied. One of these supports were siliceous-based compounds, which had large surface areas and particle diameters and could be used for many operating cycles. However, effectiveness of glucoamylase on these supports were observed only on soluble starches. Hence, it is considered a valuable thing to know performance of glucoamylase immobilised on Mesostructured Cellular Foam (MCF) silica in hydrolysing of insoluble starches such as tapioca. An optimised study on the enzymatic tapioca hydrolysis using MCF silica (9.2T-3D)-based glucoamylase and Kinetics of the process are described including the process justification of the predicted model. Immobilisation of glucoamylase on this support gave up to 82% efficiency with the immobilised enzyme specific activity of 1,856.78 U g^{-1}. Its uses to hydrolysis of tapioca starch resulted DE values of 1.740-76.303% (w/w) where the highest DE was obtained at pH of 4.1, temperature of 70°C and agitation speed of 140 rpm. The statistical optimisation produced a polynomial quadratic model. It has insignificant lack-of-fit and low standard deviation, so that the model applicable and reliable in simulating the results in which only 0.80% of the data were not described. Temperature affected the process highly, but the buffer pH, agitation speed and factorial interactions were considered not important. K_M value for immobilised enzyme was better than the free glucoamylase, however, its reaction rate was slower than the free glucoamylase catalysis.

Keywords: Enzymatic Hydrolysis; Glucoamylase Immobilisation; Mesostructured Cellular Foam Silica; Tapioca ; Central Composite Design

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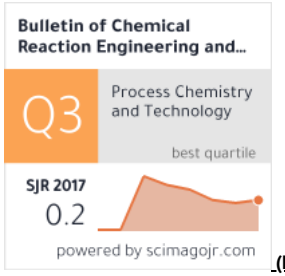

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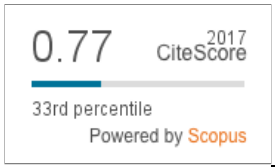

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Title and Abstract

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Indexing

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