CURRENT RESEARCH AND DEVELOPMENT IN BIOTECHNOLOGY ENGINEERING AT IIUM

VOLUME I

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PRODUCTION OF FERMENTABLE SUGAR FROM LIGNOCELLULOSIC MATERIALS USING STATISTICAL DESIGN

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ABSTRACT

Statistical optimization of physical parameters affecting the production of fermentable sugar using rice husk as substrate by central composite design has been carried out. The regression model was developed through the effects of linear, quadratic and interaction which showed that higher product yields was dependent on temperatures, pH and agitation speed of 55°C, 8 and 200 rpm respectively. The enzyme concentration of 5% (v/v) (7.56 U/ml) in the presence of 2.5% (w/v) rice husk concentration are the optimum conditions that resulted in higher fermentable sugar production.

Keywords: fermentable sugar, enzymatic hydrolysis, rice husk, central composite design

INTRODUCTION

Lignocelluloses waste is available in the form of cereal crop residues, sugarcane bagasse and forestry waste. The principal components of these wastes are cellulose, hemicellulose, and lignin. Cellulose is a polymer of glucose while hemicellulose is predominantly composed of xylans which, on hydrolysis, yield the pentose sugar and xylose. Both of these sugars can be fermented by suitable microorganisms to produce ethanol (Srinivasan, 1992; Chidthaisong et al., 1999; Ahmed et al., 2001). Lignocellulose plant matter contains cellulose (23-53%), hemicellulose (20-35%), polyphenolic lignin (10-25%) and other extractable component (Knauf and Moniruzzaman, 2004).

Fermentable sugars consist of glucose and xylose which can be fermented to ethanol (Ladiesh and Svarczkopf, 1991). This definition assumes the availability of microorganisms capable of fermenting both hexoses and pentoses to ethanol and is optimistic since the technology for xylose fermentation to ethanol is still in its developmental stage.

Rice husk is one of the major agricultural residues; for examples in Thailand alone about 21–26 million tonnes of rice are produced annually. During the processing of rice across the country, about 5,890 thousand tonnes of rice husk are produced annually as by-product (Kapur et al. 1998). Most of these by-products are burnt in open air and may cause substantial environmental problems, such as smoke and release of methane (a greenhouse gas).