CURRENT RESEARCH AND DEVELOPMENT IN BIOTECHNOLOGY ENGINEERING AT IIUM

VOLUME IV

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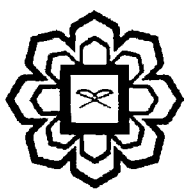

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CHAPTER 31

OPTIMIZATION OF CELLULASE ENZYME PRODUCTION USING ARTIFICIAL NEURAL NETWORK

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ABSTRACT

In this study, artificial neural network (ANN) has been used to optimize the production of cellulase enzyme by submerged fermentation from Palm Oil Mill Effluent (POME). ANN models were created and optimized using MATLAB software. The optimization process was done mainly to the media constituents that consist of cellulose and peptone. The data for media constituents were also used to determine the best parameters for ANN model. The values of R and R^2 for ANN were 0.99864 and 0.997, respectively which were higher than the 0.99749 R and 0.995 R^2 obtained from RSM. Optimal solution of media constituents for validation process was obtained by ANN model which consists of 0.48% peptone and 0.48% cellulose with the maximum yield of cellulase enzyme of 18.35 U/ml. Consequently, optimal process conditions were found with agitation at 202 rpm, pH at 7.1 and aeration at 1.7 with the maximum yield of cellulase enzyme of 27.05 U/ml.

Keywords: palm oil mill effluent, cellulose enzyme, artificial neural network, optimization, Matlab.

INTRODUCTION

There is a great interest in utilizing industrial wastes as feed stocks for fermentation processes, thereby converting low cost starting materials into products of greater value. One of the low cost starting materials is palm oil mill effluent (POME). POME consists of favorable nutrients composition - water (95-96%), oil (0.6-0.7%), and total suspended solids (4-5%) and considerable amount of minerals. Therefore, bioconversion of POME is considered to be a useful measure to produce the products such as fertilizer, fuel, citric acid, cellulase enzyme and so on. The product in focus in this study is cellulase enzyme, because of its wide applications in the textile, paper, pulp and feed industries.

Complete cellulase enzyme systems can be produced by a large diversity of microorganisms. Among the best characterized and most widely studied of these systems are the inducible cellulases of the filamentous fungus *Trichoderma reesei* (Rashid, 2009).

The performance of the fermentation processes is affected by numerous factors which includes pH, temperature, medium compositions and agitation speed. Since the submerged fermentation is used, moisture content is not a critical factor. Effects of these factors are very complex with possible interactions among them and they are often characterized through