UNIVERSITI TEKNOLOGI MARA

UNSTRUCTURED KINETIC MODEL OF BATCH FERMENTATION FOR BIOMASS PRODUCTION OF *LACTOBACILLUS PLANTARUM*

NURUL AIMAN BINTI ZULKIFLI

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ABSTRACT

The biomass concentration, substrate utilisation and product concentration become the basic model equation in batch culture. In this study, Monod model, Leudeking-Piret model and product inhibition equation are used to maximise the biomass of *Lactobacillus plantarum* (*L. plantarum*) through the modelling and simulation by MATLAB software. Estimated kinetic parameter of *L. plantarum* from the previous study can affect the results which involve the biomass, glucose and lactic acid concentration. The product inhibition equation did not affect the biomass and product concentration with initial glucose concentration. In conclusion, the Monod model can maximise the biomass concentration without considering the product inhibition equation.

CHAPTER 1

INTRODUCTION

1.1 Background of Study

The kinetics of fermentation can normally be described by a cell growth model (r_X), a product formation model (r_P), and a substrate utilisation model (r_S). In this study, we use *Lactobacillus plantarum* (*L, plantarum*) which is lactic acid bacteria to maximise the growth of lactic acid production by batch fermentation process through modelling and simulation of kinetic models. Numerous studies use batch fermentation as their method to develop the kinetic models for the various type of bacteria strain that they used in their research.

The mathematical models are categorised by unstructured or structured models which are used to simulate a bioprocess. The biomass can only be defined as the concentration of organism in the unstructured models. The changes that could be held in the inner cells do not affect these models. (Charalampopoulos et al.,n.d.). The unstructured models are primary model that are used to describe bacterial kinetics in complex natural substrates. The unstructured models have proven to accurately describe lactic acid fermentation in a wide range of experimental conditions and media (Bouguettoucha and Amrane, 2011). Vinayagam and Murty (2015) stated that Monod model and logistic model are unstructured models that usually used to define the microbial cell growth.