

Chapter 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Batch fermentations of molasses to ethanol are carried out by using *Saccharomyces cerevisiae* M30 in shaking flasks. The unstructured model is developed from Monod kinetics with modified both substrate and product terms and counted with death rate and cell maintenance for biomass equation. The inhibitory effects of high ethanol concentration, high sugar concentration and temperature on yeast metabolism are assigned in quantitative terms added into the growth and metabolism functions. The effects of initial sugar concentration on kinetic parameters are investigated and the functions can be given by polynomial equations. The operating temperature in term of superposition of activation and deactivation is used in the model. Exponential relationships between the operating temperature and model parameters such as the specific growth, production rate, maximum product concentration, and conversion yield are observed. The simulation reveals a good fit between the developed model and the experimental results for initial reducing sugar varied from 3 to 25%w/v and operating temperature ranging from 30°C to 42°C. The optimum conditions for both cell growth and ethanol production in the batch fermentation using molasses as a substrate is 22%w/v of reducing sugar concentration at 33°C.

5.2 Contributions

This study demonstrates the macro scopes of mathematical model that can easily explain the dynamics of fermentation process. Literatures showed that concentration of key parameters and operating temperature affect on cell dynamic. Therefore, in this study we develop a model which contains the effects of initial substrate concentration, substrate and ethanol concentration and temperature. To our knowledge, no other model for ethanol fermentation has combined as many key parameters as ours. Moreover, this model would be useful for the further development of other fermentation system.

5.3 Recommendations

Based on this study, further improvements are recommended.

1. In this study, the effects of initial sugar concentration on kinetic parameters are expounded in polynomial equation. However, the form of equations could be further developed for the better expression of the correlations.
2. The modified model should be applied for the simulation of other fermentation systems such as fed-batch and continuous fermentation as applied with the data from industry.