UNIVERSITI TEKNOLOGI MARA

DEVELOPMENT OF DESIGN ADVISOR TOOLS OF UPSTREAM PROCESSING FOR BIOPHARMACEUTICAL PRODUCTION

NURMALA IDAYU BINTI OTHMAN

Thesis submitted in fulfillment of the requirements for the degree of

BACHELOR OF ENGINEERING CHEMICAL AND BIOPROCESS

Faculty of Chemical Engineering

July 2017

ABSTRACT

Unstructured and structured kinetic model is used in introducing the production of monoclonal antibody starting from cell growth, substrates uptake until the antibody is produce. Basically, the production of monoclonal antibody are varies depending on the cell used. Thus, take time in the conformation of the production rate by the experimental data. A design advisor tool that focuses on upstream processing of biopharmaceutical production is developed in this research. The upstream process of monoclonal antibody production will be used as a reference model and it is limited to batch processing only. The unstructured model of kinetic equation is used in the growth model of the cell culture. MATLAB program is used to produce the command setting as well as the graphical user interface which is used to develop the advisor tool. The design advisor tool is tested and verified through a base case study of conceptual design of monoclonal antibody production which is performed by Kyparissidis in 2010 based on the kinetic parameter that is introduced by Kontoravdi in 2010. The developed advisor tool was able to predict the progress of cell growth, products formation, and the substrates uptake of the cells which is glucose and glutamate, and also the production of monoclonal antibody.

ACKNOWLEDGEMENT

I would like to express my grateful to Allah S.W.T for His mercy and giving me good health to finish my project. My profound gratitude, deepest regards and appreciation goes to all those who gave me the support that made it possible for me to complete this research especially to my supervisor, Madam Syazana binti Mohamad Pauzi, for her exemplary guidance, monitoring and constant encouragement, helpful advice, suggestion and feedback throughout the course of this research project. Without her continuous support and enthusiastic interest, this research project would not have been the same as presented here.

Deepest and sincere thanks to fellow friends and seniors for their support, valuable information and guidance which helped me in completing this research through various stages and who have helped me greatly throughout my learning process. Special thanks to Muhammad Azhar bin Mohd Nazaruddin and Nurul Huda binti Abd Latif for their time and support towards the completion of this research.

I am also thankful to Faculty of Chemical Engineering, UiTM for providing me with a good environment and facilities to complete this project. Last but not least, I would like to express thanks to my family for their constant encouragement without which this research would not be possible, thank you very much.

TABLE OF CONTENTS

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND STUDY

The demands for biopharmaceutical products seem to be increased year by year. There are several corporations which have been manufactured large scale of industrial plants that contain numerous 10,000 L or larger cell culture bioreactors in response to sturdy the demand, (Li, Vijayasankaran, Shen, Kiss, & Amanullah, 2010). Nowadays, hundreds of biopharmaceuticals have been approved and a lot more are in late stages of clinical progress as the global biopharmaceutical industry has raise since the first drug Humulin was approved in 1982, (Market Research, 2016). The important thing which is most desired from the output of biopharmaceutical industry is maintain in high quality of product but still at low cost, (Bayrak, 2016).

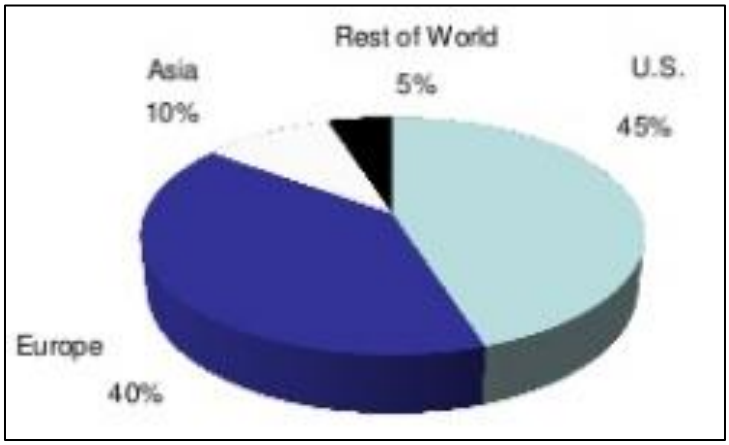

Figure 1.1: Global biopharmaceutical market overview, (Frost&Sullivan, 2013).