CHAPTER I

INTRODUCTION

1.1 Background

Dynamic Simulation of stage separation process is a significant field in chemical engineering. Among those processes, a distillation column has long been a major process. The design of continuous distillation is a steady state design that based on specification of feed and product. The result of design show number of tray in the column and operating condition such as operating pressure, reboiler energy, reflux ratio and product quality. However, operating condition is not at steady state all the time. Since the change of operating variables such as feed flowrate, feed composition, reflux flow rate, temperature, pressure are effected to the operation condition and control of distillation. In order to maintain the operating condition and product quality, a study of dynamic behavior is a good way to control and operate distillation column.

In the design or simulation of separation processes, the phase equilibrium composition strongly influence the size and utilities consumption of the process units. Experimental information on phase equilibrium is seldom available at the process conditions. This situation has leaded to the generalized use of phase equilibrium predictive methods based on thermodynamic models (equation of state or excess functions) or empirical correlation. Several authors have pointed out the great sensitivity of distillation column design to the accuracy of predicted phase equilibrium compositions. In view of this sensitivity, most process simulators have an array of phase equilibrium predictive methods. The selection of suitable method for the prediction of vapor - liquid equilibrium and related thermodynamic properties should be based on the molecular interaction forces between the mixture components. The use of a proper thermodynamic model does not guarantee the required accuracy but provides the designer with the flexibility required to fit the model to the process needs.

For the fractionation train of a given mixture, one may identify particular sets of conditions for which the most important thermodynamic parameters should be fitted. In this work, an equation of state is used to generate the phase equilibrium information required for modeling the fractionation process of Debutanizer column, three models of equation of state are used. There are GRK, SRK and PR. These three models will be compared to select the best thermodynamics models that fit to the column behavior, the program will be developed.

1.2 Objective

1.2.1 To understand the effect of thermodynamic property to the dynamic behavior of multicomponent distillation

1.2.2 To compare the result from dynamic simulation model with the actual data from refinery.

1.2.3 To suggest the suitable thermodynamic models that suitable for Debutanizer column.

1.2.4 To develop a dynamic simulation program.

1.3 Scope of work

1.3.1 Create mathematical model for the dynamic simulation of Debutanizer column.

1.3.2 The following thermodynamic models are to be used :

1. GRK, Generic - Redlich - Kwong equation of state.
2. SRK, Soave - Redliche - Kwong equation of state.

3. PR, Peng - Robinson equation of state.

1.3.3 Develop a computer program for dynamic simulation.

1.3.4 Compare the computer program with an existing steady state simulation program, PRO II, and actual data in Refinery.

1.4 Benefits expected

1.4.1 To suggest guidelines for selecting a suitable thermodynamic model for the column.

1.4.2 To use a computer program to study the behavior of dynamic distillation when it needs to change operating condition such as flowrate composition and training of operators.