CHAPTER IV
EXPERIMENTAL SECTION

4.1 Feed Inlet Temperature

The temperature of the feed inlet was set by increasing the temperature of the burner (burner flame). To increase the temperature of the burner, fuel oil atomization at the burner injector and the flow of the fuel oil were increased. The required temperature setting of the feed inlet was controlled by the temperature indicator controller (TIC).

The temperature of the feed inlet was varied from 125 to 150 ^{o}C at an increment of 5 ^{o}C. The temperature of the feed inlet, controlled by TIC, had an error Parameters such as feedstock flow, reflux feed rate and steam reboiler feed rate were kept constant throughout. After the feed inlet temperature was adjusted to a particular setting, the system was allowed to reach an equilibrium the steady-state, which took approximately 2 hours. Determining the steady-state was done by analyzing product samples collected every half an hour by means of the standard ASTM distillation method. The steady-state was determined to be reached after two hours, when the distillation curves of the samples were constant.

4.2 Feed Flow Rate

The feed flow rate was adjusted by means of the Level Indicator Controller (LIC), which affects the degree of opening of the control valve located prior to

located prior to the furnace. LIC was adjusted such that the control valve was in a more opened position, thereby allowing the flow of the feed to increase. The flow rate can be determined in this process from the orifice flow meter located prior to entering the furnace.

The initial flow of the process, as used by the plant, was set at 47 U.S. gallons per minute (gal/min). The flow was then adjusted, as previously described, to a value of 41 gal/min and then another value reading 45 gal/min. The temperature was maintained throughout this set of experiments at 140^{o}C. In addition, other parameters such as the reflux feed rate and the steam feed rate were kept constant. The products were collected after the system attained the steady-state, which took approximately 2 hours. The state of equilibrium was adjudged from the standard ASTM distillation method of samples collected every half an hour. The steady-state was determined to be reached when the distillation data of the samples were constant.

4.3 Reflux Feed Rate

The reflux system of the process, as shown in Figure1.1, is an internal type. The vapor exiting the top of the column is first cooled by an air-cooled condenser and then by a heat exchanger. The resulting liquid is then collected in an overhead drum. The condensed liquid is returned by a pump, which draws the liquid from the mid-level of the drum. The temperature of the top of the column, reflecting the reflux feed rate, can be affected by changing the speed of the pump motor, which is implemented by adjusting the motor's inverter.

Due to the fact that the reflux unit lacks a flow indicator, the reflux feed rate is controlled and correlated to the values of the pump motor revolutions

per minute. An increase in pump motor speed, correlating to an increase in the reflux feed rate, results in a temperature decrease at the top of the column. *Vice versa*, a decrease in the pump motor revolution (decrease in the reflux feed rate) causes an increase in the temperature of the top of the column.

In this experiment the initial value of the pump motor revolution was set at 2900 rpm. This value is the typical operational speed operated within the plant at the reflux unit. The corresponding temperature at the top of the column at the value of 2900 rpm is typically 105^{o}C. For this section of the experiment, the speed of the pump motor was adjusted twice, to the values of 2780 and 3000 rpm. The temperature recorded at the top of the column were 108 and 100^{o}C, respectively. Other parameters such as feed inlet temperature (maintaining at 140^{o}C), feed flow rate and reboiler steam feed rate, were kept constant. At each speed setting, the system was allowed to reach the steady-state, which took 2 hours. The steady-state was determined by analyzing samples collected every half an hour by means of the standard ASTM distillation method. The steady-state was concluded to have been reached when the distillation values of the samples were constant.