CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The adsorption kinetics of cation exchange resin was performed using both batch and continuous flow systems. The exchange between Na^+ in the solution and H^+ on the resin was investigated in these studies. The experimental data were collected by using a computer as a tool for data acquisition. From the experimental results, conclusions are drawn as follows:

1. The rate of ion exchange was found to increase with increasing flow rate when performed in the continuous flow system and with increasing mixing speed when performed in batch operation, thereby establishing that the liquid phase mass transfer had a contributing resistance to the overall transfer mass resistance.

2. The rate of exchange was found to increase with increasing the entering sodium ion concentration in both the batch and continuous flow system. This indicates that the exchange rate is governed by the mass transfer resistance in the liquid phase.

3. Due to the time needed for the pH electrode to respond to the concentration of hydrogen ions, the response time of the pH reading was taken into account in formulating the adsorption kinetics expression. It was found that the calculate values agreed very well with the experimental data. The valve of $\alpha_e = 0.13\ s^{-1}$ was determined.

4. The no-adsorption experiment was employed for examining the flow characteristics in the column. The flow pattern in the column was agreed well with the modeling as one CSTR and one PFR in series.

5. The study of adsorption kinetics was first carried out with batch operation, so that the complication of degree of mixing was eliminated. The predicted rate of exchange based on the concept of relative volatility was suitable for describing the experimental data. The model parameters for the exchange of Na^+ and H^+ on Dowex 50 resin behave in a manner predictable from the theoretical derivation.

6. The equations for the ion exchange in the fluidized-bed column based on the previous experiments represent the predicted measured leaving hydrogen ion concentration (h_{mp}) which fits very well with the experimental leaving hydrogen ion concentration (h_{me}). The model parameters were thereby determined.

5.2 Recommendations

1. The dead space volume in which there is no exchange can be reduced by filling with inert materials at the top cover of the column, or the volume of the top of the bed can be varied by redesigning the top cover. Thus, the dead volume of each experiment can be reduced.

2. To protect the bulb of the pH electrode from breaking during the removal of the probe from the housing for calibration, we recommend adding another four-way four-selection valve before the liquid passes through the column. The apparatus can be divided into two parts so when the pH electrodes are calibrated, they will not disturb the part of the ion exchange resin column.

3.