CHAPTER I

INTRODUCTION

The use of ion-exchange becomes more and more common in the field of chemical engineering. It is commonly employed in a large number of chemical processes, which can be divided into three main categories, namely substitution, separation and removal of ions.

Ion-exchange can be defined as a reversible exchange of ions between a solid phase of resin and a solution phase in which there are no changes in the structure of the solid. Most ion exchange materials are synthetic plastics consisting of a hydrocarbon network to which are attached a large number of active groups. The development of the hydrocarbon network is now formed by copolymerization of styrene and divinylbenene monomers. An increase in the content of the cross-link agent decreases solubility, matrix elasticity, and ion mobility but increases the mechanical strength of the resin.

Ion exchange resins can be classified into four main groups: strongly acid cation resin; strongly basic anion resin, weakly acidic cation resin, and weakly basic anion resin, all of which are dependent on the functional groups of the resins.

The ion-exchange system of a strongly acidic cation resin was employed in this study. Dowex50-X8, which represents a commercially manufactured resin, is based on a styrene divinyl benzene copolymer that has been sulfated with sulfuric acid; the X8 denotes 8% divinyl benzene. The resin can adsorb Na^+ ions from an aqueous solution and return in exchange the same number of H^+ ions. As the solution passes through the column, it becomes more dilute in Na^+ and more concentrated in H^+. Eventually, the resin becomes saturated with

Na^+ ions and further exchange ceases. The ion exchange process is reversible so that the resin can be regenerated by allowing it to come in contact with a strong hydrochloric acid solution. The exchange of Na^+ ions is not instantaneous since it takes time for Na^+ ions to diffuse from the bulk solution to the surface of the resin and then to positions inside the resin. The exchange rate becomes slower as the Na^+ ion concentration in the resin approaches saturation. The main objective of this work was to determine a better expression for describing the exchange rate of ion exchange resins.