CHAPTER 1

INTRODUCTION

Synthetic polymers, now quite ubiquitous in modern life, can be classified into two types: thermoplastic and thermoset. One of the most important thermosetting industrial polymers is phenol-formaldehyde polymers which can be called phenolic resins, the first synthetic resins. During the early period of phenolic uses, they were considered a convenient replacement material for natural resins like shellac which were quite scarce and expensive plastics. Phenolic resin posses many good properties, such as temperature , electrical and solvent resistance. Now the most important market segments of phenolic resins are those that relate to the wood working industry, thermal insulation and molding compounds. In addition, they can be used as raw materials for synthetic fibers and in photoresists for the production of microchips. The industrial development of phenolic resins is still continuing despite the long history. Their importance is likely to remain considerable because the raw materials can be obtained at reasonable cost from both petroleum and coal.

Phenolic resins are synthesized by condensation of phenol and formaldehyde. Different reaction conditions have profound effect on the characteristic and structure of the resulting products. In an acidic medium, when the initial molar ratio of phenol to formaldehyde is larger than unity, the reactions lead to relatively linear molecular structures called novolacs, whereas under base-catalyzed conditions, and with the initial phenol to formalddehyde ratio less than unity, short and highly methylolated structures are produced, called resoles. The resoles, accounting for the largest percentage of phenolic resin production, have many industrial uses since they can be crosslinked to give thermoset plastics with desirable properties without any hardening agent. Even though phenolic resin formation is one of the oldest known reactions, but it is difficult to discuss the formation mechanism and to determine the properties and structures of these resins due to the complex mixture of products which are formed during the reactions. Therefore there have been some attempts to study on the modelling of this reaction system, but there still have been few studies.

This study is to develop the kinetic model of phenol and formaldehyde reaction under base-catalyzed condition, resole formation.

The Objective of This Study

The main objective of this study is to develop a kinetic model to predic the behavior of resole resin formation in batch reactor by using all experimental data in the literatures for estimating parameters in the model.

The Scope of This Study

The scope of this study covers;

(1) study of phenolic resin formation.

(2) review of modelling of resole formation.

(3) develop a kinetic model and estimate parameter to predict behavior of resole formation.

(4) compare the results from the model with the experiments from the literatures.

This study is limited to mono-, di- and tri-methylolphenol formation only.