

## CHAPTER I

### INTRODUCTION

#### 1.1 Introduction

Azeotropic distillation is commonly used to separate close boiling mixtures with far fewer trays than in conventional distillation and with less recirculation, resulting in lower equipment and energy costs. It is widely used for the dehydration of alcohol and is being applied in new area of chemical processing because of its efficiency.

One industrial application is to concentrate the isopropyl alcohol (IPA) by dehydration process. In the production process of nitrocellulose, IPA has high water content and its concentration is lower than the azeotropic mixture. The disposal cost is quite high and there is also an effect on the environment, so IPA recovery process is used to obtain purified IPA. Simple distillation is first used to separate water from the dilute IPA, then the distillate from this column is azeotropic mixture, which has concentration about 86%. However this IPA concentration is not high enough for reused in industries. Therefore, the water must be further removed. There are many processes for removing water from azeotropic mixture such as using desiccant, membrane technology and heterogeneous azeotropic distillation.

Using certain desiccant may cause corrosion to vessel and normally operate only in batch process. For membrane technology, it has not enough data for development at present and the investment is high. Thus, some industries choose the heterogeneous azeotropic distillation for water removing from azeotropic mixture by using ternary components system. Advantages of this process are the continuous operation and the lower investment than membrane technology. Formally, benzene was used to be an entrainer that form heterogeneous azeotrope with water and IPA. Now the industries have changed from using benzene to other chemicals because benzene is one of carcinogenic chemicals. Cyclohexane (CHX) is one of chemicals that can replace benzene, but there is not enough research information. Thus, this

research work is to study the optimum condition for improving the efficiency of industrial heterogeneous azeotropic distillation with CHX as an entrainer.

## 1.2 Objectives

The objectives of this work are:

1. To study the phase behavior of ternary liquid system of IPA – water – CHX.
2. To study the optimum condition of heterogeneous azeotropic distillation for dehydration of IPA.

## 1.3 Scope of Works.

1. Determination of plait point compositions of IPA – water – CHX mixture at different temperature.
2. Finding of the suitable operating condition for azeotropic distillation that can separate high purity IPA product by varying feed rate and reflux rate. The experimental samples are analyzed by gas chromatography and Karl-Fisher titration.
3. Determination of vapor compositions at top of column by using material balance method.

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