CHAPTER I

INTRODUCTION

1.1 Scientific rationale

The increasing interest for porous styrene-divinylbenzene copolymer beads in recent years is due to their diversified applications. Commercial use of these copolymers is made, for example, in the manufacture of resins for gel permeation chromatography, ion exchangers, chromatographic packing for size exclusion chromatography, polymer-supported catalysts, absorbents in medical, chemical, and agricultural application [1,2]. This research extends its interesting swelling properties in absorption-desorption in organic solvents.

Nowadays, the industrial development is expanding tremendously and rapidly to acquire the convenience of the mankind from which almost of industries, unfortunately, produce various kinds of pollution problems. One of such problems: the residue solvent is drained from production lines and discarded, perhaps, to water lines. One approach to solve parts of the above problems, the absorbent materials must be produced to get rid of some or all of these solvents. The swelling properties of styrene-divinylbenzene copolymers can absorb some organic solvents at a solubility parameter value of around 18.6 $(MPa)^{1/2}$. Consequently, the main purpose of this research is to search for the kinetic effect of the parameters for synthesis of these copolymers and evaluation of their absorptive-desorptive property of the copolymers. The copolymers are the crosslinked copolymer type, which can swell many times their original size while during absorption. Therefore the copolymers are tested for the absorption in toluene, one of the most useful solvents in many petrochemical industries and other chemical industries. This solvent can be accumulated in the human body, which consequently damages lung, liver and kidney, and other organs [3].

1.2 Objectives

1.2.1 To test the significance of main factors and their interactions based on the swelling ratio in toluene.

1.2.2 To study the kinetics of synthesis of the styrenic beads and to obtain a rate equation of the synthesis of this system and an absorption and desorption diffusion coefficient in toluene of the beads.

1.2.3 To characterize the bead properties in terms of surface morphology, absorption-desorption.

1.2.4 To test and run the production of styrene-divinylbenzene bead in a pilot scale.

1.3 Scopes of the investigation

The technique of suspension polymerization was used for synthesizing porous crosslinking beads for absorption-desorption of organic solvents, the parameters involved are not thoroughly known in the field. The necessary procedures to achieve the goal may be as follows:

1.3.1 *Literature survey and in-depth study for this research work.*

1.3.2 Trial experimental work for synthesis of the beads.

1.3.3 Studying the kinetic of synthesis of the styrenic beads with divinylbenzene as a crosslinker by suspension copolymerization. The effects of the parameters are the following:

a) The effect of initiator concentrations of benzoyl peroxide: 0.1, 0.5, 1.5 and 2.0% w/w.
b) The effect of temperatures at 60, 70 and 80°C.
c) The effect of agitation at 180, 240 and 300 rpm.
d) The effect of crosslinking agent of divinylbenzene: 5.0, 7.5 and 10.0% w/w.

e) The effect of diluent concentrations of toluene: 20, 60, 100 and 140% w/w.

1.3.4 The absorption of the copolymer beads in toluene.

1.3.5 Morphology of the copolymer beads by scanning electron microscopy.

1.3.6 Production of the styrenic beads in a pilot scale.

1.3.7 Summarizing the results and preparing the report.

1.4 Contents of this thesis

This research has achieved the following main results.

1.4.1 The relation between condition for the synthesis of the copolymers and the swelling ratio by SPSS program.

1.4.2 The kinetic of synthesis of the styrenic beads crosslinked with divinylbenzene by suspension polymerization, taking into account of the effects of initiator concentrations of benzoyl peroxide, temperature, agitation, crosslinking agent of divinylbenzene and diluent concentrations of toluene.

1.4.3 Relationship between the synthesis condition and the bead morphology, leading to the absorption ability in toluene.

1.4.4 A trial run for such a synthesis in a pilot scale production.

1.4.5 Rate equation of the synthesis of the styrenic beads.

1.4.6 Diffusion coefficient in toluene of the beads.