

CHAPTER I

INTRODUCTION



1.1 Scientific Rationale

The growing interest for porous styrene-divinylbenzene copolymer beads in recent years is due to their great number of applications. These copolymer beads have been utilized in a wide variety of industrial purposes, for example, in the manufacture of resins for gel permeation chromatography, polymeric supports for size exclusion chromatography, ion exchange resins, polymer-supported catalysts, absorbent in chemical, medical, and agricultural application [1, 2]. This research extends its interesting swelling properties in absorption-desorption in organic solvents.

Nowadays, the navigation is worldwide, the industrial development is expanding tremendously and rapidly to acquire the convenience of the mankind. These industries undoubtedly produce various kinds of pollution problems, the main cause of which stems from the residue solvent in the drainage from the productions. Almost industrial solvents can be accumulated in the human body and afterwards damage lung, liver, kidney and other organs [3]. Both oil spill and contaminated solvents on water surfaces and in water pollute drastically the environment especially they reduce the amount of dissolved oxygen, which is vital for all living organisms beneath, and consequently damage permanently the natural ecology and environment around.

One desirable way to solve part of the above problems, the absorbent materials must be produced to remove some or all of these solvents and oil. Consequently, the main purpose of the present research is to search for the synthesized procedure of absorbent materials, test the absorption and desorption properties in various solvents matched their solubility parameters.

1.2 Objectives of the Research Work

1.2.1 To synthesize the styrene-divinylbenzene copolymer bead by suspension polymerization. Effect of such influential parameters such as reaction temperature, crosslinking agent concentration, diluent, etc., were studied.

1.2.2 To characterize the properties of the synthesized beads.

1.2.3 To determine the solubility parameters of the synthesized beads by swelling method.

1.2.4 To study absorption and desorption kinetics and diffusion coefficient of the synthesized beads in solvent mixture between toluene and heptane.

1.3 Scopes of the Research Work

In this research work, the focus is to synthesize porous crosslinking beads by suspension copolymerization technique for absorption-desorption of organic solvents, the appropriate parameters are not thoroughly known theoretically 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 Synthesizing the styrenic imbibed beads crosslinked with divinylbenzene by suspension copolymerization by changing the following parameters:

- a) The effect of monomer phase weight fraction: 0.06, 0.08, 0.10, and 0.17.
- b) The effect of agitation rates at 200, 270, and 300 rpm.
- c) The effect of reaction temperatures at 60, 70, and 80 °C.
- d) The effect of reaction times at 6, 8, 10, and 15 hours.
- e) The effect of initiator concentration of benzoyl peroxide: 0.1, 0.5, 1.0, and 2.0 %wt based on monomer phase.
- f) The effect of suspending agent concentration of poly(vinyl alcohol): 0.05, 0.1, 0.15, and 0.2 %wt based on monomer phase.
- g) The effect of crosslinking agent concentration of divinylbenzene: 3.0, 6.0, 9.0, 12.0, and 15.0 %wt based on monomer phase.
- h) The effect of diluent composition (toluene/heptane): 100:0, 80:20, 60:40, 40:60, and 20:80 %wt based on monomer phase.
- i) The effect of monomer composition of styrene/divinylbenzene/*n*-butyl acrylate and styrene/divinylbenzene/2-ethyl hexyl acrylate: 47:6:47, 70:6:24 %wt, respectively based on monomer phase.

1.3.3 Studying the swelling properties of the copolymer beads in toluene.

1.3.4 Studying the kinetic of absorption and desorption of the synthetic beads in solvent mixture between toluene and heptane.

1.3.5 Studying the properties of pore, e.g., pore size, pore volume and specific surface area.

1.3.6 Summarizing the results and preparing the report.

1.4 Contents of the Research Work

This thesis consists of 5 chapters. The first chapter deals with the background, the interest and the scope of this research work. Chapter 2 provides the theory of suspension polymerization technique and related theory that are important for understanding. Additionally, it includes the literature reviews of previous works that give beneficial information and trends for the work. The experimental in Chapter 3 described about chemical equipment, apparatus, procedure, and reaction parameters investigated in this work. The result and discussion are explained in Chapter 4. The effects of various reaction parameters on particle sizes, size distribution and swelling properties were shown and discussed in details. Finally, the summary and suggestion are in Chapter 5.