CHAPTER I

INTRODUCTION

1.1 Introduction

Superabsorbent polymers, SAPs have drawn much interest since the early 1970's when it was a time of significant interest in block and graft copolymer in general. During that period, Fanta et al., at the Northern Regional Laboratory of the United States Department of Agriculture investigated grafting copolymerization onto starch and other polysaccharides, which yielded products that could absorb several hundred to several thousand times its weight in water and also had highly water holding capacity under pressure [1]. SAP research and development has focused on its extraordinarily high-water absorbency and its applications. Over 80% of SAP has found extensive commercial applications as sorbents in personal care products, such as, infant diaper, feminine hygiene products and incontinence products [2]. Not only that many new applications have already been investigated through such active research and development, SAPs have already been used effectively in some new applications as matrices for enzyme immobilization, biosorbents in preparative chromatography, materials for agricultural mulches, matrices for controlled release devices, bioseparation [3], moisture retention in soil, superabsorbent polymer composites as a sealing material, debris flow control, artificial snow and gel actuator, etc [4]. Desired features of superabsorbents are high swelling capacity, high swelling rate, and good strength of the swollen gel. Majority of reported superabsorbents comprises only the first feature mentioned, *i.e.* high absorbency. But there are few studies for improving absorption rate and gel strength. Absorbent particles are conventionally strengthened through surface crosslinking. Traditionally, inorganic component are used as filling material for purpose of improving material properties and reducing product cost. The addition of inorganic powder (usually < 5%) to superabsorbent polymer provides a method for increasing the gel strength [5].

1.2 Objectives of the research work

The objectives of this research are as follows:

1.2.1 To synthesis the superabsorbent poly[acrylamide-*co*-(itaconic acid)]/silica composites by solution polymerization. Influences of reaction parameters such as mole percent of acrylamide: itaconic acid, type of silica, concentration of silica, *etc.*, were studied.

1.2.2 To characterize some chemical and physical properties of the synthesized superabsorbent polymers.

1.2.3 To study water absorption capacity of the synthesized superabsorbent polymers.

1.3 Expected benefits obtainable for development of the research

1.3.1 To achieve the synthesized superabsorbent polymers with high water absorption rates and water absorption capacities possibly for thin disposable diapers and feminine napkin application.

1.3.2 To explain some influences of the reaction parameters in order to possibly transfer far-more developed technologies for the synthesis of effective superabsorbent polymers.

1.4 Scopes and work plan

The synthesis of superabsorbent polymer composites by solution polymerization is a highly flexible technique to produce superabsorbent polymers with a high capacity of absorption and enhanced gel strength. Acrylamide (AM) and itaconic acid (IA) are used as a comonomer pair. Silica is used as an inorganic particulate component in the polymerization process to strengthen the polymer. They are polymerized using APS and TEMED as an initiator and cointiator, respectively, and N-MBA as a crosslinking agent, at the temperature of 45 °C for 30 min. The study influences of reaction parameters on properties of synthesized copolymer are investigated. The important procedure to achieve a better result is as follows:

1.4.1 Literature survey and in-depth study of this research work.

1.4.2 Synthesis of superabsorbent poly[acrylamide-*co*-(itaconic acid)]/silica composites *via* a solution polymerization by changing the following parameters so as to attain an appropriate reaction condition:

a) The optimum concentration ratio of monomer in aqueous solution between acrylamide-to-itaconic acid ratios of 100:0, 99:1, 98:2, and 97:3.

b) The type of inorganic component, silica aerosil 90, silica aerosil 200, and silica aerosil 300.

c) The optimum concentration of inorganic component, silica between 0-2.0 %weight on the total monomers.

1.4.3 Characterization of the synthesized polymer by means of:

a) Identification of functional group and structure in the synthesized copolymer by Fourier transform infrared spectroscopy.

b) Surface morphology of the synthesized copolymer by scanning electron microscopy.

c) Thermal properties of the synthesized copolymer by differential scanning calorimetry.

d) The water absorbency of the synthesized copolymer in distilled water.

e) The water absorbency under load (APPENDIX) of the synthesized copolymer under various loads at: 0.28 and 0.7 psi.

f) The water absorbency of the synthesized copolymer with various times in distilled water at: 15, 45, 105, 225, 1125, and 1605 min.

g) The water absorbency of the synthesized copolymer with various temperature of distilled water at: 30, 40, 50, 60, and 70 °C.

h) The silica retained in the gel by sinteration.

1.4.4 Summarizing the results and preparing the report.