CHAPTER 1

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 at period, Fanta et al., at the Northern Regional Laboratory of the United States Department of Agriculture studied grafting copolymerizations 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]. Also termed superabsorbents, the materials are not only be starch-based polymers which are biodegradable and normally last about one year, but they are also synthetic-based polymers from petrochemicals which are non-biodegradable and have an absorption efficiency of four years or an even long serving life.

1.2 Objectives

The objectives of this research are as follows:

1.2.1 To develop a suitable procedure of inverse suspension polymerization for synthesis of effectively superabsorbent polymers.

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

1.2.3 To study influences of reaction parameters on water absorption of the synthesized superabsorbent polymers.

1.3 Expected benefit obtainable for future development of this research

1.3.1 To achieve the synthesized superabsorbent polymers with high water absorption rates and water retention capacities possibly for thin disposable diapers and feminine hygiene 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 Scope and work plan

The synthesis of superabsorbent polymer by inverse suspension polymerization is a new technique with a relatively new concept, some appropriate parameters are theoretically well known. In this research, poly(potassium acrylate-co-acrylamide), superabsorbent polymer is synthesized by inverse suspension polymerization, which is a highly flexible and versatile technique to produce superabsorbents with a high capacity of absorption. Potassium acrylate and acrylamide are used as comonomers. They are polymerized by a thermal initiator with a cross-linking agent, in n-hexane emulsified by suspending agent at the temperature of 60°C for 2 hours. The influences of reaction parameters on properties of synthesized copolymer are investigated as follows. 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 Potassium salt of poly(acrylate-co-acrylamide) via an inverse suspension polymerization by changing the following parameters so as to attain an appropriate reaction condition:

a) the optimum total concentration of monomer in aqueous solution, in 5-10 molar range;

b) the optimum concentration ratio of monomer in aqueous solution from 10:90 to 90:10 molar ratio of acrylamide:potassium acrylate;

c) the optimum concentration of cross-linking agent from 0-0.1 % weight of the water soluble monomers;

d) the optimum concentration of suspending agent from 0.1-2 % weight by the volume of oil phase;

e) the optimum degree of neutralization of acrylic acid from 40-100 % neutralization;

f) the optimum concentration of initiator, ammonium persulphate between 0.5-3.0 g/cm^3 of the aqueous phase;

g) the type of suspending agents, Span 40, Span 60, and Span 80

1.4.3 The water absorbency of the synthesized polymer in distilled water, buffer solution and electrolyte solutions: potassium chloride, potassium iodide, potassium bromide, sodium chloride, magnesium chloride and calcium chloride was determined.

1.4.4 A aqueous fluid absorbency rate as vortex rate of the synthesized polymer in 0.9 % saline solution was determined.

1.4.5 Characterization of the synthesized polymer by means of:

a) Identification of functional group and structure in the copolymer by infrared spectroscopy;

b) Thermal properties of the copolymer by differential scanning calorimetry;

c) Surface morphology of the copolymer by scanning electron microscope;

d) Copolymer composition ratio of initial monomer by elemental analysis through a CHN/O analyzer.

1.4.6 A full thesis is written.