CHAPTER I

INTRODUCTION

1.1 Scientific Rationale

Superabsorbent polymers (SAPs) are materials that have the ability to absorb and retain large volumes of water and aqueous solutions. This makes them ideal for use in water absorbing applications such as baby nappies and adults incontinence pads to absorbent medical dressings and controlled release medium. Many kinds of SAPs have been commercialized since they are widespreadly applied not only in the fields of personal care products, biosorbent, biomaterials, but also in soil for agriculture and horticulture, medicine for the drug delivery system, wastewater treatment, gel actuator, etc., where water absorbency or water retention is important.

Early superabsorbents were made from chemically modified starch and cellulose and other polymers like poly(vinyl alcohol) PVA, poly(ethylene oxide) PEO all of which are hydrophilic and have a high affinity for water. When lightly cross-linked, chemically or physically, these polymers became water-swellable but not water-soluble.

Today's superabsorbent polymers are made from partially neutralised, lightly cross-linked poly(acrylic acid), which has been proven to give the best performance versus cost ratio. The polymers are manufactured at low solids levels for both quality and economic reasons, and are dried and milled in to granular white solids. In water they swell to a rubbery gel that in some cases can be up to 99wt% water. The extent of water absorption depends primarily on the types of hydrophilic monomers, the initiation system, the degree of crosslinking, the method used to precipitate the polymer, and the ionic strength of the test fluid. There has been increasing in the synthesis and various applications such as high water sortion of new superabsorbent. Many attempts have been made to develop new superabsorbents though methods such as irradiation and chemically crosslinking. Superabsorbents can be prepared by simultaneous copolymerization and one or more monofunctional crosslinking and one multifunctional monomer or by crosslinking of a homopolymer or copolymer in solution. The latter involves two steps in which, in the first step, the linear polymer is synthesized in the absence of a crosslinking agent and in the second step, the synthesized polymer is then crosslinked using either chemical reagent or irradiation (1-4) .

In recent years, considerable researches have been done on the characterization and swelling behaviour of superabsorbents prepared by simultaneous free radical co-polymerization and crosslinking in the presence of an initiator and a crosslinking agent. An increased swelling capacity of superabsorbents, such as the swelling capacity, is obtained by adjustments to the concentration and composition of the initial monomer mixture (1-5). Ionic hydrogels have been investigated for the production of contact lenses and artificial organs in biomedicine, as an adsorbent for the removal of some agent in environmental applications. With the growing use of a variety of dyes, pollution from dye wastewater is one of the major environmental problems of the world. Dyes that have low biodegradability greatly influence natural ecosystems and thus humans. Although some treatment methods have been developed, economic removal of dyes still remains a significant problem. Adsorption has evolved into one of the most effective physical processes for decolorization of textile wastewater. The most commonly use adsorbent for color removal is activated carbon but it is relatively expensive. The application of the other adsorbents such as peat wood, fired clay and some other low-cost materials has been studied and recently received further attention owing to their economic advantages.

1.2 Objectives of the Research Work

The objectives of this research are as follows:

1.2.1 To synthesize the poly[acrylamide-*co*-(crotonic acid)] by foamed solution polymerization. Effects of influential parameters such as mole fraction of acrylamide:crotonic acid, initiator and crosslinking agent concentrations, reaction time, reaction temperature, and agitation rate on swelling capacity were studied.

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

1.2.3 To study absorption capacity of the resulting polymer.

1.2.4 To study electrochemical behavior of the system redox reaction.

1.2.5 To apply the synthesized superabsorbent polymer to treating dye solution as a model of textile wastewater.

1.3 Expected Benefit Obtainable from the Development of This Research

1.3.1 Obtained poly(AAm-*co*-CA) which can absorb great amounts of water and dye solution.

1.3.2 Improved high water absorption of this newly synthesized copolymer.

1.3.3 Confirmed donor-acceptor concept for the monomer pair used in this research.

1.4 Scope and Workplan of Research Work

The Acrylamide-crotonic acid superabsorbent polymers were prepared by free radical polymerization in aqueous solution of acrylamide (AAm) with crotonic acid (CA) as comomer. They are polymerized by a redox initiator with a crosslinking agent, in water at the reaction temperature of 50°C for 30 minutes. The influences of the reaction parameters on properties of the synthesized copolymer are investigated. The important reaction procedure to obtain a better result is as follows:

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

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

a) The effect of mole percent of monomer ratio (acrylamide/crotonic acid) at 100/0, 98/2, 95/5, 93/7, 90/10, 80/20, 70/30.

b) The effect of reaction temperatures at 45, 50, 60, and 70°C.

c) The effect of initiator content of ammonium persulfate (APS) to *N, N, N', N'*,-tetramethylethylenediamine (TEMED) ratio at : 0.5/2.0, 1.0/2.0, 1.5/2.0, 2.0/2.0% wt.

d) The effect of crosslinking content : *N, N'*-methylenebisacrylamide (N-MBA) at 0.5, 1.0, 1.5, 2.0% wt.

1.4.3 Characterization of the newly synthesized polymer by means of :

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

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

c) The water absorbency of the synthesized polymer in distilled water, and in dye solution.

d) The electrochemical properties of the monomer pair and the synthesized polymer.

1.4.4 Application of the newly synthesized polymer for treating wastewater

a) Efficiency of the wastewater treatment

1.4.5 Summarizing the result and preparing the report.