Effect of Compositional Parameter on Swelling Behavior of Cationic Acrylamide Based Superabsorbent in Free Equilibrium Swelling and Under Load Condition

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ABSTRACT

A series of cationic based superabsorbent polymers (SAPs) were prepared by solution crosslinking copolymerization of acrylamide (AAm) and [3-(methacryloylamino) propyl] trimethyl ammonium chloride (MAPTAC) using N,N' methylene-bis-acrylamide (NMBA) as crosslinking agent. Taguchi's method for design of experiments were used to obtain the optimum condition as well as investigating the effects of various parameters at gel formation such as total monomer concentration (TMC), cationic monomer and crosslinking agent concentration upon swelling behavior of superabsorbents in free and under load conditions. It was found that by increasing crosslinking agent and total monomer concentration absorbency decreased in free equilibrium swelling while it increased under load conditions. By raising cationic monomer MAPTAC, swelling capacity and rate of hydrogels were increased in both free and under load conditions. The effect of external salt solution composed of ions with different valency on the swelling behavior of the superabsorbent was also investigated.

Key Words: superabsorbent ; cationic; swelling behavior; acrylamide; absorbency under load

INTRODUCTION

Superabsorbent are a class of polymers with the ability to absorb large amounts of water during a short period of time. The absorbed water can be retained even under pressure. Because of their excellent characteristics they are widely used in many fields including in agriculture and horticulture[*], where they help to quick absorption and retention of water, leading to the reduction in water consumption, preventing plant death rate and improve fertilizer retention in the soil.[1-4] SAPs are used extensively in personal hygiene products, gel actuators, water blocking tapes, moisture control devices and artificial snow.[5-8] Hydrogels are also widely used in the formulation of drug delivery systems[8-10.] In such application water absorbency or water retention is essential. Therefore many researchers have attempted to improve performance of SAPs by enhancing their swelling capacity and rate with adequate gel strength in swollen state. The swelling capacity as well as other characteristics of the gel like the elastic modulus can be substantially changed by changes in the external conditions such as composition of the solution, external pressure, temperature and some other factor [1]. In many of today's applications of SAPs, having high

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