Radiation synthesis and characteristic of polyDMAEMA

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Abstract

A hydrogel is a kind of polymer which can be swollen but can not be dissolved in the water. There are some hydrogels which can be modulate the swelling ratio in response to environmental stimuli such as temperature, pH, and electric field. In recent years, the synthesis and characteristic study of environmental sensitive hydrogels became more important[1~3]. N,N'-Dimethylaminoethyl methacrylate (DMAEMA) has similar structure with N-isopropylacrylamide, which is a kind of typical temperature sensitive hydrogels. So DMAEMA was also classified into this kind of hydrogels[4,5]. In this work, the polyDMAEMA hydrogels were synthesized through radiation technology. The measurement of property showed that they had standard temperature and pH sensitivity, but the electric sensitivity was not obvious functions.

1. Radiation synthesis of polyDMAEMA hydrogels

The aqueous solution of DMAEMA and crosslinker (N,N'-methylene-bis-acrylamide) was prepared and bubbled with nitrogen for 15 min. Then the glass tube was sealed and irradiated by γ-rays from ^{60}Co source at room temperature. Gel fraction was use to measure gel yield. It increased with dose and leveled off around 18 kGy, and the dose rate had no effect on gel fraction. The effect of monomer and crosslinker concentration in aqueous solution on the gel fraction also investigated. The results showed that 1% (g/v) of crosslinker and 40% (v/v) monomer were enough to get stable value of gel fraction.

2. The characteristics of polyDMAEMA hydrogels

2.1 Swelling behavior

The polyDMAEMA hydrogels showed good swelling performances. The equilibrium degree of swelling decreased with the increase of monomer concentration in the solution from which the polyDMAEMA was made. For example, the equilibrium degree of swelling is about 870 for 30% monomer concentration while 510 for 50%.

2.2 pH-sensitivity of polyDMAEMA hydrogels

Obvious pH-sensitivity was observed from the polyDMAEMA hydrogels. The sensitive point was around ph=2.5. The swelling ratio as a function of pH value showed in Fig. 1.

2.3 *The thermally reversible behavior*

One of the essential requirements for thermally reversible hydrogels is the coexistence of hydrophilic and hydrophobic groups within a molecule and they must be matched well with each other. The polyDMAEMA hydrogel possesses such structure and showed temperature sensitivity at a temperature range of 38~40°C.

2.3 Electric responsive behavior

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Usually, the pH sensitive hydrogels have also electric responsiveness which would be more and more important in practice, such as in bisensors[6]. The polyDMAEMA hydrogels also exhibited the electric responsiveness at a field voltage of approximately 3.0, although it was not so typical.

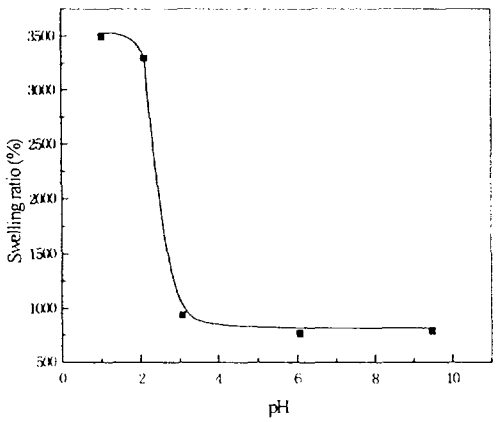

Fig.1. Swelling ratio as a function of pH value

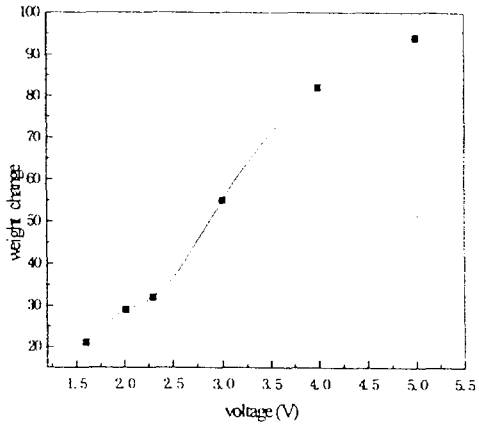

Fig.2. Effect of voltage on the electrical responsiveness of polyDMAEMA

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