

CHM03**Swelling Behaviour of Stimuli-Responsive Cationic Cellulose/Carboxymethyl Cellulose Hydrogel from Biomass Waste of Oil Palm Empty Fruit Bunch**

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Abstract

This research presents the development of a versatile hydrogel derived from abundantly available oil palm empty fruit bunch (OPEFB) biomass waste. The hydrogel, composed of cationic cellulose (CC) and carboxymethyl cellulose (CMC), was chemically crosslinked with epichlorohydrin, resulting in a CC/CMC hydrogel with a gel content of 22.73% and a degree of swelling of 26.77 g/g. This versatile hydrogel exhibited a porous structure with an average pore size of 57 μm . To assess its potential applications, the swelling behaviour of the CC/CMC hydrogel was evaluated under various conditions, including temperature, pH, and different media. The swelling media studied were: distilled water at different temperatures (42, 60, and 80 $^{\circ}\text{C}$), buffer solution at different pH values (4, 7, and 10), sodium hydroxide, ammonia, hydrochloric acid, acetic acid, sodium chloride, calcium chloride, and aluminium chloride solution. The results indicated that the hydrogel swelled significantly in alkaline conditions and high temperature but shrank in acidic media. Additionally, the swelling capacity decreased with increasing ionic strength and cationic charge. These findings offer valuable insights into the potential for developing advanced functional materials. This CC/CMC hydrogel is a smart, adaptable material with promising applications. Its stimuli-responsive properties make it suitable for use in various fields, including drug delivery and vaccine carriers.

Keywords: *Biomass waste; Empty fruit bunch; Stimuli-responsive; Cellulosic hydrogel; Swelling*