Title : Synthesis and property testing of Na-AMPS/CMC hydrogel with various PANI concentration

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ABSTRACT

This study aimed to develop and study the properties of a conductive composite hydrogel composed of sodium 2-acrylamido-2-methylpropanesulfonate (Na-AMPS), carboxymethyl cellulose (CMC), and polyaniline (PANI) for use as a wound dressing material. The hydrogel was prepared via photo-initiated free radical polymerization. PANI was added at different concentrations (0, 0.125, 0.25, 0.5, and 1 %w/w relative to Na-AMPS) to enhance electrical conductivity and render the material responsive to electrical stimulation.

The synthesized hydrogels were transparent, sheet-like materials with PANI well dispersed throughout the structure. The formation of the polymer network was confirmed by Fourier Transform Infrared Spectroscopy. Mechanical testing showed that adding PANI increased the storage modulus and complex viscosity, indicating that the hydrogel became stiffer as the PANI concentration increased.

Regarding water transport properties, the addition of PANI increased the water vapor transmission rate to a range of 65–73 $g \cdot h^{-1} \cdot m^{-2}$, which is suitable for wound dressing applications. The equilibrium swelling capacity slightly increased with the addition of PANI; however, it decreased at higher PANI concentrations. In addition, electrical conductivity measurements showed that conductivity increased with increasing PANI concentration.

In conclusion, the Na-AMPS/CMC/PANI composite hydrogel exhibits appropriate mechanical strength, good moisture management, and enhanced electrical conductivity. Therefore, it has potential for use as a conductive wound dressing and may support the future development of electrically stimulated wound-healing systems.

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