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Synthesis and Characterization of Carboxymethyl Cellulose-Chitosan Based Composite Hydrogels for Biomedical and Non-Biomedical Applications

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Abstract : Hydrogels have attracted much academic and industrial attention due to their unique properties and potential biomedical and non-biomedical applications. Limitations on extending their applications have resulted from the synthesis of hydrogels using toxic materials and complex irreproducible processing techniques. In order to promote environmental sustainability, hydrogel efficiency, and wider application, this study focused on the synthesis of composite hydrogels matrices from an edible non-toxic crosslinker-citric acid (CA) using a simple low energy processing method based on carboxymethyl cellulose (CMC) and chitosan (CSN) natural polymers. Composite hydrogels were developed by chemical crosslinking. The results demonstrated that CMC:2CSN:CA exhibited good performance properties and super-absorbency 21× its original weight. This makes it promising for biomedical applications such as chronic wound healing and regeneration, next generation skin substitute, in situ bone regeneration and cell delivery. On the other hand, CMC:CSN:CA exhibited durable well-structured internal network with minimum swelling degrees, water absorbency, excellent gel fraction, and infra-red reflectance. These properties make it a suitable composite hydrogel matrix for warming effect and controlled and efficient release of loaded materials. CMC:2CSN:CA and CMC:CSN:CA composite hydrogels developed also exhibited excellent chemical, morphological, and thermal properties.

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