Synthesis and Characterization of Thermoresponsive Chitosan–Aloe Composite as an Injectable Hydrogels

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Abstract

This study reports the synthesis and characterization of thermoresponsive chitosan and Aloe composite as an injectable hydrogel. Phosphorylated chitosan (PCTS) was first synthesized using a phosphorus pentoxide/methanesulfonic acid system [1], followed by conjugation with isobutyric acid (ISB) to yield PCTS-ISB, in which the hydrophilic–hydrophobic balance drives thermoresponsive behavior. Structural confirmation by NMR spectroscopy verified successful ISB substitution onto the chitosan backbone, while Dynamic Light Scattering (DLS) demonstrated a temperature-dependent increase in particle size. To enhance bioactivity, PCTS-ISB was combined with fresh *Aloe vera* juice, which naturally contains acemannan, a mannose-based polysaccharide recognized for its wound healing and tissue regeneration properties [2]. The sol-gel transition behavior of the PCTS-ISB/Aloe composite was evaluated by the tube tilting method, revealing a phase transition at approximately 37°C, corresponding to physiological temperature. These findings demonstrate that the PCTS-ISB/Aloe composite holds strong potential as a minimally invasive injectable hydrogel system capable of forming a desired shape *in situ*, with promising applications in tissue engineering.

References 1) W.Tachaboonyakiat et al., *Polym. J.* 42(2), 148-156 (2010). 2) J. Chokboribal et al., *Carbohydr. Polym*. 133, 556-566 (2015).