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Remote Controlled of In-Situ Forming Thermo-sensitive Hydrogel Nanocomposite for Hyperthermia Therapy Application: Synthesis and Characterizations

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Abstract : Magnetically responsive hydrogel nanocomposite (NCH) based on composites of superparamagnetic of Fe3O4 nano-particles and temperature responsive hydrogel matrices were developed. The nanocomposite hydrogel system based on the temperature sensitive N-isopropylacrylamide hydrogels crosslinked by poly(ethylene glycol)-400 dimethacrylate (PEG400DMA) incorporating with chitosan derivative, was synthesized and characterized. Likewise, the NCH system was synthesized by visible-light free radical photopolymerization, using carboxylated camphorquinone-amine system to avoid the common risks of the use of UV-light especially in hyperthermia treatment. Superparamagnetic of iron oxide nanoparticles were introduced into the hydrogel system by polymerizing mixture technique and monomer solution. FT-IR with Raman spectroscopy and Wide angle-XRD analysis were utilized to verify the chemical structure of NCH and exfoliation reaction for nanoparticles, respectively. Additionally, morphological structure of NCH was investigated using SEM and TEM photographs. The swelling responsive of the current nanocomposite hydrogel system with different crosslinking conditions, temperature, magnetic field efficiency, and the presence effect of magnetic nanoparticles were evaluated. Notably, hydrolytic degradation of this system was proved in vitro application. While, in-vivo release profile behavior is under investigation nowadays. Moreover, the compatibility and cytotoxicity tests were previously investigated in our studies for photoinitiating system. These systems show promised polymeric material candidate devices and are expected to have a wide applicability in various biomedical applications as mildly.

Keywords : hydrogel nanocomposites, tempretaure-responsive hydrogel, superparamagnetic nanoparticles, hyperthermia therapy
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