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PII: S1385-8947(18)30009-3
DOI: https://doi.org/10.1016/j.cej.2018.01.009
Reference: CEJ 18329

To appear in: *Chemical Engineering Journal*

Please cite this article as: J.T. Peters, S.S. Hutchinson, N. Lizana, I. Verma, N.A. Peppas, Synthesis and Characterization of Poly(N-Isopropyl methacrylamide) Core/Shell Nanogels for Controlled Release of Chemotherapeutics, *Chemical Engineering Journal* (2018), doi: https://doi.org/10.1016/j.cej.2018.01.009

Synthesis and Characterization of Poly(N-Isopropyl methacrylamide) Core/Shell Nanogels for Controlled Release of Chemotherapeutics

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Abstract

A method is presented for synthesizing and characterizing core/shell nanogels based around poly(N-isopropyl methacrylamide) (PNIPMAAm). The effectiveness of the sequential addition reaction scheme was determined for its impact on temperature response, glass transition temperature, and details of polymer structure as revealed by ^{1}H NMR spectra. PNIPMAAm cores coated with poly(tert-butyl methacrylate) (PTBMA), poly(ethylene glycol phenyl acrylate) (PEGPhA), and poly(phenyl methacrylate) (PPhMA) were characterized for structure and effectiveness as carriers for the model chemotherapeutic Doxorubicin (DOX). Swelling studies showed that the core/shell polymerization significantly decreases the collapse, though had limited impact on the lower critical solution temperature (LCST) of PNIPMAAm. Coating with PEGPhA did impart large variability in the particle size. Proton NMR and DSC confirmed the core/shell structure for all samples; however it proved that PPhMA was less effective at coating the PNIPMAAm nanogel. The core/shell nanogels were then characterized for their application as drug delivery vehicles using DSC, partition coefficient, and drug release studies with DOX. These studies showed that coating PNIPMAAm with PTBMA developed a more effective drug delivery vehicle for hydrophobic drugs like DOX.

Keywords: PNIPMAAm, hydrogels, core, shell, controlled release

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