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Fabrication and Process Investigation of Vancomycin Loaded Silica Xerogel/Polymer Core-shell composite Nanoparticles for Drug Delivery

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Abstract

Biodegradable polymer-inorganic composites particles can provide significant advantages while avoiding the shortcomings of using polymer or inorganic particles alone as drug delivery vehicles. Most of the existing fabrication methods for polymer nanoparticles and silica xerogel nanoparticles are not applicable for composite nanoparticles. To overcome these difficulties, a novel sol-gel emulsion polymerization method was successfully developed through the integration of sol-gel and modified double emulsion processes, in which gelation of the silica solution was enabled in nanodroplets generated in the modified emulsion process. Spherical vancomycin loaded silica xerogel/polymer core-shell composite nanoparticles with a tunable size and good drug encapsulation efficiency were fabricated through this novel method. By changing the process variables of the modified double emulsion process in terms of the second sonication time and PVA concentration, the average diameter of the composite nanoparticles could be adjusted in the range of 192~569