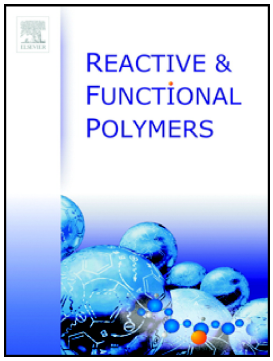

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PII: S1381-5148(17)30055-X
DOI: doi: 10.1016/j.reactfunctpolym.2017.03.014
Reference: REACT 3825

To appear in: *Reactive and Functional Polymers*

Received date: 17 October 2016
Revised date: 20 February 2017
Accepted date: 22 March 2017

Please cite this article as: Magdalena Prokopowicz, Adrian Szewczyk, Rafał Łunio, Wiesław Sawicki , Monolithic polydimethylsiloxane-modified silica composites prepared by a low-temperature sol–gel micromolding technique for controlled drug release. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. React(2017), doi: 10.1016/j.reactfunctpolym.2017.03.014

Monolithic polydimethylsiloxane-modified silica composites prepared by a low-temperature sol−gel micromolding technique for controlled drug release

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Abstract

Sol–gel derived multi-component silica composites are widely accepted as smart materials in orthopedic surgery as bone fillers and bioactive skeleton drug delivery systems. This paper discusses the effect of hydroxy-terminated polydimethylsiloxane (PDMS) (10, 20, 30 and 40 % (w/w)) on the physicochemical properties of low temperature sol–gel processed polydimethylsiloxane/calcium phosphate/silica (PDMS-modified CaP/SiO_2) composites. The micromolding technique was employed to obtain PDMS-modified CaP/SiO_2 composites–monolithic granule-type formulations. The effectiveness of PDMS-modified CaP/SiO_2 granules as potential skeleton drug delivery systems was studied *in vitro* using Rhodamine B (ROD) as a model for highly water-soluble molecules. Results indicated that the composites with PDMS contents at 20 and 30% (w/w) showed similar mechanical properties to those of human cancellous bones. The content of PDMS had a significant effect on the release of ROD. These results showed that PDMS-modified CaP/SiO_2 granules with 20 and 30% (w/w) PDMS could provide the zero-order release profile of highly water-soluble molecules.

Keywords: monolithic silica composites; sol−gel process; micromolding technique; controlled release