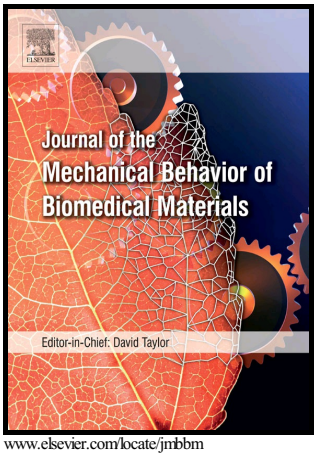

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Design of a remote-control drug delivery implantable chip for cancer local on demand therapy using ionic polymer metal composite actuator

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Abstract:

Since the local, on demand, cancer therapy is a challenging clinical issue today, this paper presents the design, fabrication and characterization of a remotely controlled single reservoir drug delivery chip using Ionic Polymer Metal Composite (IPMC) actuator. Here, Drug release was externally programmed and controlled wirelessly on demand by a communication circuit. The transmitter and receiver circuits were designed to control the release/sealed status remotely even from 7 cm distance while the transmitter and receiver were coupled magnetically. IPMC here was used as the moving cap of the reservoir, that in release mode, lets the drug out on demand with a low received power of 20 mW. The novel simple design could release the whole content of the drug which is remarkable in comparison with the designs which need complicated optimizations of diffuser, nuzzle and IPMC diaphragm pump, leading to an incomplete release. To make sure that there is no leakage in the sealed mode, IPMC was attached to a polydimethylsiloxane (PDMS) support film. Biocompatibility of all the components of the chip were tested by 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay.

Keywords: Drug delivery; Ionic Polymer Metal Composite; Actuator; Drug reservoir; Remote control; Biocompatibility

Introduction

Intermittent oral delivery of the drugs has been recently frequent in clinical therapies for most diseases including cancer. These methods, improperly, provide a high level of drug in the blood right after administration which leads to significant side effects in patients while the concentration of the drug rises in the blood stream. In cancer treatment specifically, the drug includes toxic molecules which attack both the normal and cancerous cells and makes the