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SYMPOSIUM

Synthesis and Development of Poly(*N*-Hydroxyethyl Acrylamide)-*Ran*-3-Acrylamidophenylboronic Acid Polymer Fluid for Potential Application in Affinity Sensing of Glucose

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Abstract

Background:

In previous work, we described viscosity and permittivity microelectromechanical systems (MEMS) sensors for continuous glucose monitoring (CGM) using poly[acrylamide-*ran*-3-acrylamidophenylboronic acid (PAA-*ran*-PAAPBA). In order to enhance our MEMS device antifouling properties, a novel, more hydrophilic polymer-sensing fluid was developed.

Method:

To optimize sensing performance, we synthesized biocompatible copolymers poly(*N*-hydroxyethyl acrylamide)-*ran*-3-acrylamidophenylboronic acid (PHEAA-*ran*-PAAPBA) and developed its sensing fluid for viscosity-based glucose sensing. Key factors such as polymer composition and molecular weight were investigated in order to optimize viscometric responses.

Results:

Compared with PAA-*ran*-PAAPBA fluid of a similar binding moiety percentage, PHEAA-*ran*-PAAPBA showed comparable high binding specificity to glucose in a reversible manner and even better performance in glucose sensing in terms of glucose sensing range (27–468 mg/ml) and sensitivity (within 3% standard error of estimate). Preliminary experiment on a MEMS viscometer demonstrated that the polymer fluid was able to sense the glucose concentration.

Conclusions:

Our MEMS systems using PHEAA-*ran*-PAAPBA will possess enhanced implantable traits necessary to enable CGM in subcutaneous tissues.

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Abbreviations: ([1]H NMR) proton nuclear magnetic resonance, (AAPBA) *N*-3-acrylamidophenylboronic acid, (AIBN) 2,2′-azodiisobutyronitrile, (CGM) continuous glucose monitoring, (Con A) concanavalin A, (DMSO) dimethyl sulfoxide, (HEAA) *N*-hydroxyethyl acrylamide, (MEMS) microelectromechanical systems, (MW) molecular weight, (PAA) polyacrylamide, (PAA-*ran*-PAAPBA) poly(acrylamide-*ran*-3-acrylamidophenylboronic acid), (PAAPBA) 3-acrylamidophenylboronic acid, (PHEAA) poly(*N*-hydroxyethyl acrylamide), (PHEAA-*ran*-PAAPBA) poly(*N*-hydroxyethyl acrylamide-*ran*-3-acrylamidophenylboronic acid), (THF) tetrahydrofuran

Keywords: antifouling, boronic acid, continuous glucose monitoring, microelectromechanical systems, poly(acrylamide-*ran*-3-acrylamidophenylboronic acid), poly(*N*-hydroxyethyl acrylamide)-*ran*-3-acrylamidophenylboronic acid)

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