Designing Peptide Actuators for Controlled Release from Polymer Hydrogel Microparticles

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Abstract

We present PEG based hydrogel microparticles functionalised with a new generation of branched peptide actuators that, when activated by an enzyme, trigger charge induced swelling under physiological conditions allowing for the controlled release of macromolecules.

Poly(ethylene glycol) acrylamide (PEGA) microparticles were prepared by inverse suspension polymerisation with a mean diameter of 15 μm. Peptide actuators were prepared by solid phase peptide synthesis and consist of amino acids that give an overall net neutral charge. Upon specific enzyme action a cationic charge is induced within polymer. These neighbouring cationic groups induce swelling and an increase in the pore size within the polymer which can be exploited in triggered release of pre-entrapped payload molecules.

Using this system we demonstrate an enzyme specific increase in volume of ≈ 40 % at physiological conditions. This corresponds to a 350 % increase in release of an entrapped macromolecule.

This system may have applications in drug delivery, selective embolisation and bio-sensing.