

Poster 16

Enzyme Responsive Polymer Hydrogels

Paul D. Thornton and Rein V Ulijn*

*School of Materials, The University of Manchester,
Grosvenor Street, Manchester, M1 7HS, U.K.*

Previous studies have demonstrated that the physical properties of polymer hydrogels can be changed in response to applied stimuli such as temperature, ionic strength, solvent polarity, electric/magnetic field or light¹. Macroscopic swelling can be controlled by the appropriate stimulus giving rise to dramatic changes in molecular accessibility, providing a system for the selective removal (or release) of agents from (into) the environment.

In this study we have developed a polymer hydrogel, consisting of a peptide coupled poly(ethylene glycol) acrylamide hydrogel, that responds to enzyme stimulus. Changes in swelling were analysed using two-photon microscopy (TPM) to reveal increased, or decreased, penetration of fluorescently labelled markers following enzyme reaction. High performance liquid chromatography (HPLC) was employed to test the selectivity of various enzymes on different PEGA coupled peptide chains.

The use of enzymes as biological stimuli to trigger hydrogel swelling or collapse opens up new avenues: (a) enzymes are uniquely chemo-, regio-, and enantioselective; (b) enzymes naturally work under mild conditions (aqueous, pH 5–8); (c) a number of enzymes play key roles as selective catalysts in cell pathways and disease states. Enzyme responsive materials could therefore pave the way to selective removal/delivery of agents in response to disease markers. Increased swelling causes the release of an encapsulated molecule, which will only occur if the hydrogel encounters the target protease in a complex mixture that may contain other enzymes. Decreased swelling enables the targeting, and subsequent entrapment, of a unique protease within a complex mixture for the selective removal of (harmful) macromolecules².

Future applications are anticipated increasingly in biomedical settings, with potential applications in drug delivery, wound dressings or as implant coatings (smart biomaterials)³.

References

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