Biodegradable drug delivery vehicles produced by controlled ring-opening polymerizations

Mthulisi Khuphe and Paul D Thornton
University of Leeds, UK

Polymers are often employed as drug carriers to provide protection to encapsulated therapeutic molecules against premature metabolism and clearance in vivo. Proteolytic enzymes may be exploited to trigger the swelling and/or degradation of (poly)peptide-containing carrier vehicles, while reduced environmental pH may be exploited to trigger the hydrolysis of ester linkages in (poly)ester-containing carrier vehicles, resulting in controlled payload release, on-demand. We report the creation of several biodegradable polymeric nanomaterials from N-carboxyanhydride ring-opening polymerization (NCA ROP) and O-carboxyanhydride ring-opening polymerization (OCA ROP). A range of delivery vehicles, including nanoparticles, chemical hydrogels and vegetable oil-based organogels have been created that selectively release encapsulated payload molecules upon interaction with acidic environmental pH and/or enzymes that are over-expressed at particular disease sites.

cp11mk@leeds.ac.uk

Tuning the physicochemical properties of polysaccharides with microporous and mesoporous structure

Lee D Wilson¹, Mohamed H Mohamed¹ and John V Headley²
¹University of Saskatchewan, Canada
²Water Science and Technology Directorate- Environment Canada, Canada

Polyurethanes (PUs) were prepared by cross-linking β-cyclodextrin (β-CD) with two different types of diisocyanates, respectively. Materials with diverse structural and textural properties were obtained by varying the rate of diisocyanate addition: rapid (R) or drop-wise (D; 0.1 mL/min). Characterization of the structural and textural properties was investigated by spectroscopic (1H NMR in solution, solid state ¹³C CP-MAS solids NMR, dynamic light scattering, UV-vis, and IR), thermogravimetric analysis, powder x-ray diffraction, and scanning electron microscopy. The accessibility of the β-CD inclusion sites of the polymers was independently evaluated using an equilibrium dye adsorption method at equilibrium and in parallel with a kinetic dye-based uptake method. The characterization methods strongly support that drop-wise additions affords materials with greater cross-linking relative to the rapid addition method. Herein, we report the first example of a cross-linked polyurethane containing β-CD with tunable microporous and mesoporous structure and physicochemical properties according to the mode of cross-linker addition (R versus D) to control the reaction conditions shown in Scheme 1.

lee.wilson@usask.ca