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Smart polymer materials - Tuning the physicochemical properties of polysaccharides *via* cross-linking conditions

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The physicochemical properties (e.g. surface chemistry and solubility) of polysaccharide-based polymers can be tuned via cross-linking conditions. The structure and function of novel urethane-based polymer materials containing 1,6-hexamethylene diisocyanate (HDI) and β- cyclodextrin β-CD) in a 1:1, 3:1, and 6:1 (HDI:β-CD) mole ratios (denoted HDI-1, -3, and -6, respectively) were studied. The host-guest chemistry and adsorption properties of the HDI-polymers vary according to the accessibility of the cavity inclusion sites of β-CD, the surface chemistry of the non-inclusion domains of the polymer framework, and the nature of the guest. On one extreme, HDI-1 with the lowest cross-linker content is a water soluble linear polymer with ~100% inclusion site accessibility and a behavior that is characteristic of a "smart" material. The HDI-1 polymer herein adopts a compact and extended conformation as a function of temperature change and/or guest concentration gradient. On the other extreme, HDI-6 with the highest cross-linker content is a water insoluble branched polymer with negligible inclusion sites accessibility and readily available non-inclusion domains. The adsorption of the HDI-polymers for the perfluorocarbon and hydrocarbon guests occur within the non-inclusion sites, as well as within the inclusion sites in the absence of steric hindrance; whereas, the removal capacity meets or exceeds literature values. The molecular structure of the HDI-polymers was investigated using such techniques as Raman, 1D/2D 1H NMR, and circular dichroism spectroscopy.

Biography

Abdalla H Karoyo obtained his PhD from the University of Saskatchewan under the supervision of Prof. Lee Wilson and P. Hazendonk (University of Lethbridge) in the 2014/2015 academic year. He has worked with Environment Canada as a Chemical Scientist and is currently working with Prof. Wilson as a Post-doctoral fellow.

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