Electrospray Ionization FT-ICR MS Characterization of Tunable Carbohydrate-Based Materials for Sorption of Oil Sands Naphthenic Acids

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Results and Discussion

The potential for sorption and possible degradation of components in oil sands processed waters (OSPW) by the use of synthetically engineered copolymers is receiving growing attention. Recent research has highlighted the sorption of total oil sands naphthenic acids fraction compounds (NAFCs) by β-cyclodextrin (β-CD) copolymers. The incorporation of β-CD within copolymer frameworks represents a novel modular approach with significant potential for controlled tuning of the textural mesoporosity of the sorbents. Here, we report the Fourier transform ion cyclotron resonance mass spectrometry (FT-ICR MS) characterization of aqueous samples containing oil sands NAFCs following sorption with a range of cyclodextrin-based copolymers. The materials investigated were β-CD crosslinked with three different types of diisocyanates, namely: *i*) 4,4'-dicyclohexylmethane diisocyanate, *ii*) 4,4'-diphenylmethane diisocyanate, and *iii*) 1,4-phenylene diisocyanate. Variable sorption of NAFCs was observed according to the crosslinking density of the copolymer framework and the nature of the cross-linker unit. Furthermore, the sorption of the NAFCs by the copolymers was not affected by other parameters such as metal ions, salinity, and non-oil sands acid fractions present in OSPW. The observation of molecular selective sorption in copolymer materials containing β-CD represents an important contribution toward the development of sorbent materials for the controlled removal of oil sands acids in aquatic environments. The FT-ICR MS measurements also contribute further to the understanding of the thermodynamic sorption mechanism of such materials.

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References

[1] Headley, J. V., *et al*., Energy & Fuels, **27**, 1772-1778 (2013).