Proceedings Paper:
Ries, ME orcid.org/0000-0002-8050-3200, Budtova, T and Ezzawam, W (2018) Diffusion and relaxometry NMR to study interactions between carbohydrates in ionic liquids. In: Abstracts of Papers of the American Chemical Society. 255th National Meeting and Exposition of the American Chemical Society (ACS) - Nexus of Food, Energy, and Water, 18-22 Mar 2018, New Orleans, LA, USA. American Chemical Society

ABSTRACT SYMPOSIUM NAME: Structure & Dynamics of Materials via NMR Spectroscopy (Oral)
ABSTRACT SYMPOSIUM PROGRAM AREA NAME: POLY
CONTROL ID: 2826451
PRESENTATION TYPE: Oral Only : Consider for Sci-Mix
TITLE: Diffusion and relaxometry NMR to study interactions between carbohydrates in ionic liquids
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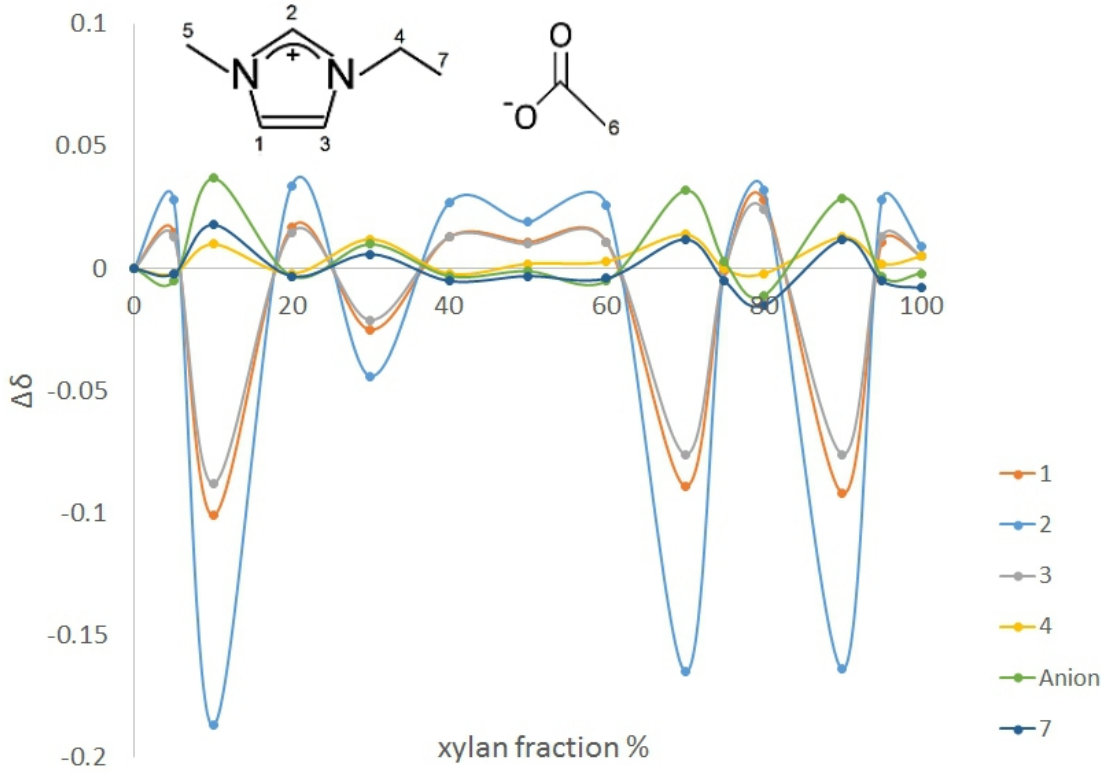
ABSTRACT BODY:
Abstract: We have studied the interactions between two plant polysaccharides, microcrystalline cellulose and birch xylan, dissolved in the ionic liquid 1-ethyl-3-methyl-imidazolium acetate ([C2mim][OAc]).

Xylan in [C2mim][OAc] was investigated using rheology, NMR diffusion, spectroscopy and relaxometry for a range of xylan concentrations (0 to 15% w/w), across the temperature range 30 °C to 60 °C. These results are compared and contrasted with a similar published study on cellulose in [C2mim][OAc]. Due to the higher molecular weight of cellulose (30 kg/mol), as compared to xylan (9 kg/mol), the cellulose samples have significantly higher viscosity weight for weight. When NMR results were plotted as a function of the fraction of hydroxyl groups from each polymer, instead of their weight concentration, all the data collapsed onto one master curve.

Mixtures of xylan and cellulose in [C2mim][OAc] were then investigated using the same methods. In these mixtures the total weight fraction of carbohydrate was kept constant, at 10% w/w, whilst the composition was varied in increments from pure cellulose through to pure xylan. All the results were interpreted with reference to expected “ideal mixture” behaviour, quantifying how much the properties varied from what would be anticipated by simple additive rules. This revealed that at certain cellulose to xylan weight ratios (xylan:cellulse of 10:90, 70:30 and 90:10) there were strong interactions between the two biopolymers causing deviations in the “expected” results by ~100%. This was most clearly seen in the NMR diffusion and relaxometry where the ions are indirectly acting as a probe of the polymer-polymer interactions.



The change in ppm of the various proton resonances as a function of xylan concentration, going from pure cellulose (0% xylan) to pure xylan (100% xylan).