Thermal Stability of Ionic Liquids and Extraction of Bamboo with Ionic liquid + Ethanol Mixtures at High Pressures

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Imidazolium-based ionic liquids are recognized as effective solvents for biomass. Their viscosities are lowered when mixed with co-solvents which introduces advantages in terms processing. This study addresses two questions. One pertains to their thermal stability, and the other is whether such mixtures can be effective in processing of lignocellulosic materials if the ionic liquid is used as the minor component (less than 50 %) of the mixture.

Recent evaluations of the thermal stability of these ionic liquids and their mixture with cosolvents such as ethanol have shown that [BMIM]Cl and [EMIM]Cl are more stable in solution than their acetate counterparts [BMIM]Ac and [EMIM]Ac. Thermal stability is an important consideration in using these ionic liquid systems in processing of woody biomass, especially if the process is carried out at temperatures that will promote softening of lignin by approaching its glass transition temperature (approximately 150 ℃). Recent results have shown that in mixtures with ethanol, while the highest temperatures of operation without significant degradation are only around 120 ℃ for [EMIM]Ac, they are much higher, being around 150 ℃ for [BMIM]Cl. While both these ionic liquids are recognized in the literature for their effectiveness for dissolution of lignocellulosic materials, when temperatures are high (and above 100 ℃), [BMIM]Cl may be the preferred ionic liquid if degradation is to be avoided.

In this paper we will present the results on the thermal stability of imidazolium-based ionic liquid, and the results on the extraction of bamboo with mixtures of [EMIM]Ac and [BMIM]Cl with ethanol, using the ionic liquid as the minor component in the mixtures. Extractions were carried out with pure ethanol, and mixtures containing 1 and 20 wt % ionic liquid at 150 ℃ and 35 and 350 bar. The results will be discussed in terms of total extraction levels and the thermogravimetric (TGA), spectral (FTIR), and microscopic (SEM) characterization of the extracted bamboo.

(Only one page)