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Green thermo-mechanical processing of lignocellulosic biomass for lignin recovery

Lignin extraction from biomass is heavily dependent on chemical processes that are harmful to the environment and the quality of the recovered lignin. Ionic liquid solvents are the latest solutions in green processing; however, their implementation for lignin recovery is limited by their high cost, typically high loadings requirements, and long processing times. To overcome these issues, in this study, high loadings of mixed hardwood flour (MHF) were processed with 1-butyl-3-methylimidazolium chloride(BmimCl) in a batch mixer. The biomass and ionic liquid mixture had a high complex viscosity (approx. 107 Pa·s) at low shear rates and displayed pronounced shear thinning behavior at 50 wt.% MHF loading. A 2x2 factorial design was implemented to study the effects of MHF solid loading amount and residence time on lignin extraction yield. A maximum yield of 36.6% was obtained at the maximum solid loading amount and residence time (50 wt.% and45 min, respectively). The extracted lignin samples were also characterized in comparison with commercial Kraft lignin and lignosulfonate. Lignin extraction at high solid loadings was successfully achieved; however, further improvements must be made in the post-processing procedure to remove the remaining BmimCl residue present on the lignin..