Development of an integrated approach for α-pinene recovery and sugar production from loblolly pine using ionic liquids - DTU Orbit (19/08/2019)

In the southeastern US, loblolly pine (Pinus taeda L.) is widely used as a feedstock in the wood, pulp and paper industry. In loblolly pine, the oleoresin is composed of terpenes and has long been a valuable source for a variety of chemicals, and has recently attracted interest from a biofuel perspective for the production of advanced cellulosic biofuels. To date, there have been very few examples where a single conversion process has enabled recovery of both terpenes and fermentable sugars in an integrated fashion. We have used the ionic liquid (IL), 1-ethyl-3-methylimidazolium acetate [C2C1Im][OAc] at 120 °C and 160 °C in conjunction with analytical protocols using GC-MS, to extract α-pinene and simultaneously pretreat the pine to generate high yields of fermentable sugars after saccharification. Compared to solvent extraction, the IL process enabled higher recovery rates for α-pinene, from three tissues type of loblolly pine, i.e. pine chips from forest residues (FC), stems from young pine (YW) and lighter wood (LW), while also generating high yields of fermentable sugars following saccharification. We propose that this combined terpene extraction/lignocellulose pretreatment approach may provide a compelling model for a biorefinery, reducing costs and increasing commercial viability. Our preliminary techno-economic analysis (TEA) revealed that the α-pinene recovery based on hexane extraction after IL pretreatment could reduce the minimum ethanol selling price (MESP) of ethanol generated from fermentation of sugars recovered from pine by $0.6–1.0 per gal.

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