

Ionic liquids in bio-refining

Synthesis and applications

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Akademisk avhandling

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Abstract

Fossil fuel resources are not limitless so alternative renewable recourses are needed to fill the void that inevitably will be created once the supplies of this resource start do dwindle. Biomass has the potential to fill this void. Today only a small part of the world annual production of biomass is utilized by humankind, while the rest is allowed to decay naturally. To utilize this renewable resource in the production of fuel and chemicals, the so called bio-refineries specialized in fractionation and making use of all component of the biomass are needed. Ionic liquids could aid in this task.

Ionic liquids (ILs) have shown great potential in the field of biomass processing in general and in the pretreatment of (ligno)-cellulose in particular. However, a few things need to be addressed before any large-scale processing can be considered: Finding new routes for IL synthesis that make “on-site” production possible; Investigation into the challenges facing IL pretreatment of (ligno)-cellulose such as possible depolymerization of cellulosic material during the pretreatment and investigating what influence different ILs have on the pretreatment of cellulosic material by methods like enzymatic hydrolysis.

This work aims to address these issues and will present a route for IL synthesis making use of alcohols and carboxylic acids both commonly found in a biorefinery. Some of these ILs have also been tested for their ability of dissolve cellulose. Furthermore, this work will address the possibilities but also challenges upon IL-mediated (ligno)-cellulose processing. This includes investigating several ILs and their efficiency as a pretreatment solvent for enzymatic hydrolysis; these studies involve a large variety of different cellulosic materials. This work demonstrated that depolymerization during the IL pretreatment is a possibility and that this can complicate the recovery processes. Furthermore, this work gives guidance into what type of ILs might be suited as pretreatment solvents for different cellulosic materials, including amorphous and crystalline cellulose, processed and native lignocellulose, different types of wood samples and hemicellulose.

Keywords

Ionic liquids, pretreatment, cellulose, hemicellulose, lignocellulose, ion exchange, bio-refinery, quaternarization, acetate, imidazolium.

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