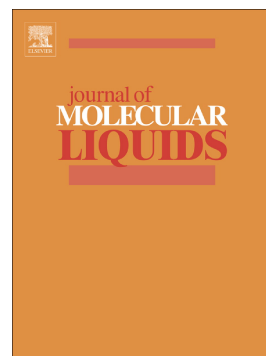


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Adepu K. Kumar, Ekta Shah, Aesha Patel, Shaishav Sharma, Gaurav Dixit

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Physico-chemical characterization and evaluation of neat and aqueous mixtures of choline chloride + lactic acid for lignocellulosic biomass fractionation, enzymatic hydrolysis and fermentation

Adepu K Kumar*, Ekta Shah, Aesha Patel, Shaishav Sharma, Gaurav Dixit

Bioconversion Technology Division, Sardar Patel Renewable Energy Research Institute,

Post box No. 2, near BVM Engineering College, Vallabh Vidyanagar, 388 120, Gujarat, India

*Corresponding Author:

Email: kiranbio@gmail.com

Phone: +91-9099137446; Fax: +91-2692-237982

Abstract

Comprehensive physico-chemical properties of different molar ratios of neat and aqueous (*aq*) natural deep eutectic solvent (NADES) mixtures containing choline chloride + lactic acid (CC-LA) were evaluated between the temperature ranges of 283.15 K to 363.15 K, respectively. Vogel-Fulcher-Tamman (VFT) model on dynamic viscosity and density studies clearly showed stronger interactions between water and NADESs. Pretreatment of rice straw (RS) with increasing LA content in the NADESs increased lignin extraction. Maximum lignin removal of 63.6 % (*w/w*) was observed with CC-LA (1:9) mixture and decreased with increasing concentrations of water content in the NADESs. Further, > 95% of the solubilized lignin was recovered from neat NADESs pretreated liquid fraction, while comparatively lower lignin extraction efficiency was observed with the *aq*NADESs pretreated mixtures. Alongside, recovery of NADES insoluble fractions (NIF) and hemicelluloses were decreased with increasing LA content in the NADESs. The cellulose content (% *w/w*) was significantly increased from 40% to 65% after CC-LA-H₂O (1:9:2.5) pretreatment. Enzymatic hydrolysis of the cellulose enriched NIF produced maximum reducing sugars of 66.4 g/L with CC-LA-H₂O (1:9:2.5). Irrespective of the *aq*NADESs pretreatment, direct fermentation of the reducing sugars using *Clavispora* NRRL-Y 50464 produced maximum ethanol yields of 17.11 g/L within 180 min with a theoretical conversion efficiency of 94%, respectively.

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