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*Abstract*

# Applications of Deep Eutectic Solvents for Lignin Extraction †

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Deep eutectic solvents (DESs) represent a new class of compounds with properties similar to ionic liquids, that have a significantly lower boiling point compared to the boiling point of each component, as well as practical applications on extractions from lignocellulosic biomass. Since 2004 they have been studied in terms of their applicability in the biodegradation of biomass of different types, the field being in continuous development [1]. Several DESs were shown to be good solvents for lignin solubilization and extraction from lignocellulosic biomass [2]. Lignin is a natural, complex aromatic hetero-polymer resulting from the radical polymerization of guiacil (G) units derived from coniferyl alcohol, syringyl (S) derived from synapilic alcohol, and p-hydroxyphenyl (H) resulting from the p-coumaril precursor [3]. Fragmentation or depolymerization of lignin leads to practical applications that allow the implementation of lignin in the food industry, as a precursor in the synthesis of some drugs, in engineering, as well as in genomics [4]. In this study we prepared, characterized, and tested several DESs for lignin solubilization and extraction. High purity reagents (over 98%), purchased from Sigma Aldrich (Merck Group, Darmstad, Germany) and Scharlau (Barcelona, Spain), were used for the experimental analyses. The FT-IR technique was applied to characterize DESs and lignocellulosic material. Other parameters, such as refractive indices, densities, pH, and surface tension were determined. UV-VIS spectrophotometric analysis was used for determining the concentrations of extracted and solubilized lignin based on calibration curve for each DES. The application of DESs for processing of lignocellulosic biomass was carried out under certain mixing conditions, temperature, and time intervals. The solvents showed different refractive indices, densities, pH, and surface tension, which are influenced by the types of molecular interactions, hydrogen bonds, and the arrangement of molecules within the solvent. The ability to solubilize and/or extract lignin depended on the type of DES, water content, and other parameters. The best DESs for lignin extraction were based on organic acids. Not all DESs that solubilized lignin were good candidates for lignin extraction. Several DESs were characterized and subsequently applied in the process of extraction and solubilization of lignin from lignocellulosic biomass. Some DESs, especially those which include organic acids, are good candidates for lignin extraction.

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