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Valorisation of lignin by depolymerisation and fractionation using supercritical fluids and conventional solvents

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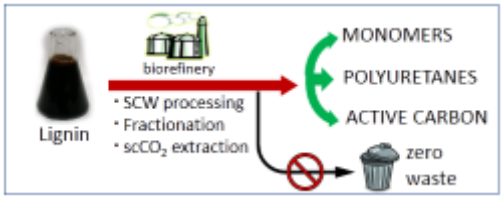
Graphical abstract



Highlights

- Lignin is rapidly depolymerized by supercritical water oxidation
- Lignin is valorised into different fractions that have potential applications
- Analytical techniques are proposed to characterize the fractions

Abstract

A procedure for Lignosulphonate valorisation is investigated. An attempt has been made to obtain diverse value-added products maximizing the atom economy. This procedure is carried in sequential steps starting with an oxidative depolymerization in supercritical water. Next, the reaction mixture is fractionated according to its solubility in water and in ethyl acetate. Several analytical methods - CHN elemental analysis, aqueous GPC and ^{31}P-NMR - were used to determine the composition of these fractions and to assess their suitability for different applications. Water-insoluble fractions were converted to a lignin-derived hydrochar for the synthesis of active carbon of superior quality. Monomers were recovered from bio-oil fraction by supercritical carbon dioxide extraction and the remaining oil is proposed as a potential starting material for the synthesis of polyurethane foams.

Abbreviations[1]

[1] GPC: Gel Permeation Chromatography
PH: Preheater
BPR: Back Pressure Regulator
LS: Lignosulphonate
Q: Quench
AcEt: Ethyl Acetate
VAN: Vanillin
GUA: Guaiacol
AcV: Acetovanillone