Integration of autohydrolysis and organosolv process for recovery of lignin from corncob

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Lignocelluloses, such as hardwood, softwood and agricultural residues, are low cost feedstocks mainly composed by cellulose, hemicellulose and lignin. Lignin is the third most abundant naturally synthesized polymer. It presents an amorphous polyphenolic structure, which can be used for the development of bio-based materials and chemicals. However, the bioconversion of renewable lignocelluloses to value-added products requires their fractionation through pretreatment technologies [1,2].

This work evaluated a combination of two environment-friendly pretreatments: liquid hot water (LHW) at 200 ºC for 30 min for removing hemicelluloses, followed by a delignification process using non-catalysed ethanol organosolv to obtain lignin with a high purity, and also cellulose for other purposes. For that, an experimental design was performed, as following: ethanol concentration 20–60%, temperatures: 140–180 ºC, and holding time 40–120 min. Lignins were recovered by precipitation after ethanol evaporation and air-dried. All fractions were characterized in terms of extraction yield, total phenolics, antioxidant capacity (DPPH), and thermal properties (differential scanning calorimetry – DSC). Corncob presented 35.9% cellulose, 30.5% hemicellulose and 21.1% lignin. During LHW, the hemicellulose was solubilized, and 62.7% cellulose and 30.4% lignin were recovered on solid fraction (HPLC analysis). Regarding to organosolv, only ethanol concentration influenced lignin extraction, being the maximum yield (65% on corncob dry matter) obtained with 60% ethanol at 180 ºC during 40 min. Glass transition temperature varied between fractions (60–90 ºC) and all fractions presented high antioxidant activity (comparable to BHT standard). Ethanol organosolv lignins are characterized by their high purity, low glass transition temperature, high solubility in organic solvents, a very low sulphur content, and their antioxidant capacity, showing a great potential to be used as radical scavenger (anti-oxidant), matrix material in bio-based composites, carbon fibres, phenolic resins and poly-urethane foams.

References

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