ISGC 2022

N°652 / OC
TOPIC(s) : Waste and side streams valorization / Alternative solvents

Fractionation of phenolic monomers derived from lignin depolymerization liquor using ARIZONA liquid biphasic systems and Centrifugal Partition Chromatography (CPC)

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PURPOSE OF THE ABSTRACT

Lignin is one of the main structural components of lignocellulosic biomass, accounting for 15% to 30% of its dried weight. It is available at large-scale from the pulping liquor produced by the pulp and paper industry, representing a potential renewable resource. Nowadays, pulp and paper mills largely burn this liquor in an integrated process to produce electric and thermal energy. Although this combustion is still a valuable contribution to reduce fossil fuel consumption, lignin offers perspectives for higher added-valued applications and could be converted into several profitable commodities or fine chemicals. In this framework, oxidative processes for lignin conversion to phenolic compounds are widely recognized. However, their high price, resulting from significant shortcomings of the lignocellulosic biorefinery processing, as well as the inherent difficulty of separating the resulting structurally similar phenolic compounds, creates a significant drawback while simultaneously highlighting the need for more effective purification methods and downstream processes. As such, in this work we propose to determine an efficient process to separate a synthetic, representative mixture of lignin's oxidative depolymerization liquor, composed of five aromatic monomer compounds: vanillin, vanillic acid, syringaldehyde, acetovanillone, and p-hydroxybenzaldehyde. Arizona biphasic systems were employed to achieve this goal. These highly tunable liquid biphasic systems composed by various proportions of heptane, ethyl acetate, methanol and water were shown to be highly effective in the fractionation of the established representative phenolic mixture and particularly suitable for a later application in Centrifugal Partition Chromatography (CPC). Furthermore, a modification of these systems was also performed by substituting heptane for limonene and methanol for ethanol, significantly increasing the sustainability of the process while preserving the separation efficiency previously achieved.

FIGURES

FIGURE 1

FIGURE 2

KEYWORDS
Lignin | Phenolic monomers | Arizona biphasic systems | Purification

BIBLIOGRAPHY