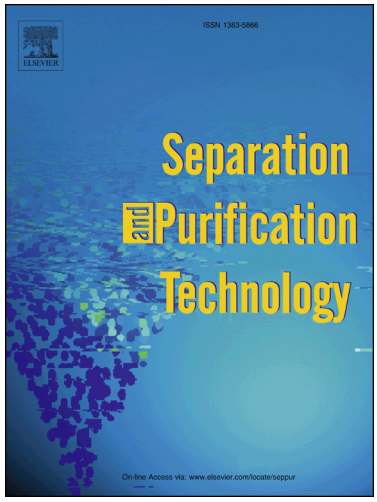

Selective membrane separation technology for biomass valorization towards bio-aromatics

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Abstract

Valorization of biomass calls for development of new and/or optimized process technologies. Cost-effective separation processes are of utmost importance to separate biomass components on an industrial scale. Also the complexity of biomass depolymerization/hydrolysis processes increases even further the need for efficient separation processes. Within this study, the use of commercial nanofiltration membranes and in-house developed Grignard-functionalized ceramic membranes has been investigated for the fractionation of a mixture of lignin derivatives, obtained from the depolymerization of Organosolv lignin according to the derivatization followed by reductive cleavage (DFRC) approach. Gas chromatography coupled with mass spectrometry, liquid chromatography-high resolution -mass spectrometry and gel permeation chromatography have been intensively used for the characterization of the depolymerization mixture before and after membrane separation. Higher permeation fluxes are observed with the modified ceramic membranes (25-30 L/m².h) exhibiting amphiphilic surface properties. Separation of lignin derivatives by molecular weight based on size-exclusion has been observed with the polyamide Desal-5DK membrane, while a separation governed by solute-membrane interactions appears to be possible with the functionalized ceramic membranes, where retentions for individual solutes are highly dependent on the chemistry of the grafted groups. For instance, it has been observed that aromatics such as 2,6-dimethoxy-4-propenylphenol are either rejected by or preferentially transported across the membrane, depending on the chosen membrane functionalization. This offers perspectives towards the development of membrane processes for fine separation of small lignols and to enable the use of these molecules in chemical and materials applications.

Keywords (max 5)

Membrane technology; lignin derivatives; affinity separation; nanofiltration; Grignard-functionalized ceramic membranes