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The Mechanism Study of Degradative Solvent Extraction of Biomass by Liquid Membrane-Fourier Transform Infrared Spectroscopy

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Abstract : Degradative solvent extraction is the method developed for biomass upgrading by dewatering and fractionation of biomass under the mild condition. However, the conversion mechanism of the degradative solvent extraction method has not been fully understood so far. The rice straw was treated in 1-methylnaphthalene (1-MN) at a different solvent-treatment temperature varied from 250 to 350 ^oC with the residence time for 60 min. The liquid membrane-Fourier Transform Infrared Spectroscopy (FTIR) technique is applied to study the processing mechanism in-depth without separation of the solvent. It has been found that the strength of the oxygen-hydrogen stretching (3600-3100 cm⁻¹) decreased slightly with increasing temperature in the range of 300-350 ^oC. The decrease of the hydroxyl group in the solvent soluble suggested dehydration reaction taking place between 300 and 350 ^oC. FTIR spectra in the carbonyl stretching region (1800-1600 cm⁻¹) revealed the presence of esters groups, carboxylic acid and ketonic groups in the solvent-soluble of biomass. The carboxylic acid increased in the range of 200 to 250^oC and then decreased. The prevailing of aromatic groups showed that the aromatization took place during extraction at above 250 ^oC. From 300 to 350 ^oC, the carbonyl functional groups in the solvent-soluble noticeably decreased. The removal of the carboxylic acid and the decrease of esters into the form of carbon dioxide indicated that the decarboxylation reaction occurred during the extraction process.

Keywords : biomass waste, degradative solvent extraction, mechanism, upgrading
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