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Liquefaction and Characterization of Bamboo Residues with a Glycerol-based Solvent Using Microwave Energy

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Abstract

American Phyllostachys pubescens bamboo was subjected to a liquefaction process conducted in a glycerol/methanol co-solvent using microwave energy. The effect of various liquefaction conditions, such as the ratio of raw material/solvent, liquefaction temperature, reaction time, and ratio of glycerol/methanol were investigated for impact on the residue content and product characterization The results showed that the minimum residue content was obtained with a raw material to solvent ratio of 1:5. With increased temperature or time, the residue content initially substantially decreased then slightly increased, which indicated that the liquefaction process includes decomposition and recondensation stages. The addition of methanol to glycerol resulted in a higher residue content in the decomposition stage, while in the recondensation stage additional methanol reduced the residue content, indicating that glycerol could be selected as a preferable solvent when liquefaction was conducted under a mild reaction condition. Peaks attributed to the functional groups in hemicellulose and lignin were weak or disappeared in the FTIR spectra of residues from the liquefied bamboo under decomposed conditions, while those in the FTIR spectra of recondensation liquefied residues was intensive. This result indicated that hemicellulose and lignin could easily undergo recondensation in glycerol and sulfuric acid using microwave heating. The cellulose content and crystallinity index of the residue from liquefied wood under decomposed condition was higher than that of the untreated bamboo particles. SEM images showed that the bamboo particles were reduced to small-sized bundles or even single fibers and parenchyma cells. This is consistent with the removal of the FT-IR peaks for the lignin component of the residue, indicating that the lignin was removed.

Keywords: liquefied bamboo residue, glycerol, FTIR, SEM

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Sheldon Q. Shi, Associate Professor, University of North Texas

Poster # 48

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