THE EFFECTS OF ORGANOSOLV FRACTIONATION PROCESS ON THE PROPERTIES OF SWITCHGRASS LIGNIN AS A PRECUSOR FOR CARBON PRODUCTS

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Abstract

We have investigated organosolv fractionation of switchgrass in order to produce lignin as a precursor for carbon products. The fractionation was accomplished with an organic solvent-aqueous mixture containing water (50%), ethanol (34%), methyl isobutyl ketone (MIBK, 16%) and 0.06% sulfuric acid. Processing factors were temperature (140 – 180 ^{o}C) and reaction time (10 – 80 min) under 1,700 psi of pressure. After fractionation of switchgrass into solid and solvent fraction, mass balance of cellulose, hemicellulose and lignin was estimated by solid fraction. Mass loss of solid fraction showed a gradual increase by reaction time under different temperature and presented a loss up to 45 % at 140 ^{o}C, 55 % at 160 ^{o}C and 64 % at 180 ^{o}C for 60 min reaction time. Of the solid fraction, cellulose decreased less than 3 % under 140 ^{o}C and 7 % under 160 ^{o}C for 60 min, whereas linearly decreased to 30 % under 180 ^{o}C for 60 min. Hemicellulose fraction significantly decreased for 60 min to 78 % under 140 ^{o}C, 88 % under 160 ^{o}C and 95 % under 180 ^{o}C. Simultaneously, lignin fraction also decreased to 72 % under 140 ^{o}C, 87 % under 160 ^{o}C, whereas significantly decreased to 87 % for 30 min and did not decreased by time under 180 ^{o}C. Surface functionality of solid fraction also showed a significant decrease with increasing reaction time. Lignin extracted from the liquid fraction was characterized by TGA and showed a typical shape of herbaceous biomass lignin. Characteristics of lignin surface functionality in lignin by FTIR showed that lignin produced at 180 ^{o}C contained slightly higher carbonyl group that derived from oxidation of phenylpropane unit in the lignin. S/G ratio calculated by FTIR was not significantly different at both temperatures. We concluded with the suggestion that optimized operation conditions to produce lignin and cellulose for organosolv fractionation were 160 ^{o}C for 60 min or 180 ^{o}C for 30 min.