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Subcritical and supercritical water gasification of arabinose as a model compound for biomass

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Hydrogen has been identified as the most attractive and developing renewable energy carrier in the world. Researchers are developing a wide range of technologies to produce hydrogen economically from a variety of resources without having a negative effect on the environment. In these resources, biomass being CO_2 neutral and a readily available source of energy is considered to be renewable. For these and other reasons, hydrogen production from lignocellulosic biomasses (waste and residue of plant biomass) instead of conventional production is of great importance. Several processes have been explored to produce hydrogen from the lignocellulosic biomasses. In the last two decades, a novel gasification technology called supercritical water gasification (SCWG) has been developed, in which water having a pressure of over 22.1 MPa and a temperature of over 374°C (i.e. supercritical conditions) is used as the gasifying agent. Since cellulose, lignin, hemicelluloses, and extractive substances show different attitudes in hydrothermal gasification; significant varieties are observed in the gasification yields and product distributions. From this point, in this study, arabinose, as model compounds for the hemicellulose, was studied. Hydrothermal gasification of arabinose could be helpful to understand the influence of biomass components so as to produce a maximum amount of hydrogen from biomass. Gasification of arabinose was carried out in supercritical water at a temperature range 300 to 600°C. Experiments were performed in the absence and presence of KOH with a reaction time of 1 h. The yields of gas, liquid, and solid products were identified with the analyses using gas chromatography (GC), high performance liquid chromatography (HPLC), total organic carbon analyzer (TOC), and solid sample module (SSM). The major gaseous produced were hydrogen, methane, carbon dioxide, carbon monoxide and C_2-C_4 hydrocarbons. The aqueous products composed of carboxylic acids, furfurals, phenols aldehydes, ketones and their alkylated derivatives. Carbon gasification efficiencies were improved by increasing temperature and using catalyst and reached maximum value at 600°C.

Biography

Dilek Selvi Gökkaya received her MSc in 2009 from Ege University (Turkey), worked on hydrothermal gasification of biomass. She is pursuing her PhD at Ege University, where she is working on the investigation of the hemicellulose in the structure of plant biomass and extractive materials behaviour by using of model compounds in supercritical water gasification.

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