Effects of temperature and presure on the pyrolysis of agriculture wastes

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ABSTRACT

This study investigated the effects of temperature and pressure on the pyrolysis of rice straw and oil crops (soybean, sunflower and rapeseed) stubble converting to the biodiesel fuel. The flash pyrolysis experiments were performed under the conditions of high-pressure and low-to-medium temperature range to produce a higher liquid product yield and to reduce the energy consumption. Besides, the feasibility for reusing the pyrolysis products and residues were evaluated in this study. The subjects in this study include measuring the basic properties of the samples, exploring the effects of temterature and pressure on the percentages of gases, liquid, and solid products, and analyzing the species and concentrations of pyrolysis products. For the analysis of samples, it indicates that a higher ash content of rice straw and rape result in a lower liquid product yield but a higher solid pruduct yield. For lower fixed carbon content, a lower heat value was measured of rape sample. The possible species for pyrolysis of the cellulosic materials were estimated with TA/MS, they are methane, water, carbon monoxide, ethylene, carbon dioxide, propane, etc. Under the nitrogen conditions, the four cellulosic materials samples were pyrolyzed with different temperatures and pressures. The results indicates that the yield of solid product decreases with temperature, while that of liquid and gas product increase with temperature. In addition, the yield of solid and liquid products increase with pressure, while that of gas decrease pressure. For the analysis of products, the fixed carbon in the solid products increases with temperature due to the decomposition of volatiles in solid residues. It results in a higher puduct yields of gases and liquid. Since the liquid products contain a large amount of water, the heating value of liquid would be low or even undetectable. The gas product contains several components like: methane gas, ethylene, hydrogen, carbon monoxide, carbon dioxide and other species.

Keywords : rice straw、oil crops、pyrolysis、biodiesel fuel、pressure

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