UNIVERSITI TEKNOLOGI MARA

CO-LIQUEFACTION OF RUBBER SEED AND MUKAH BALINGIAN COAL FOR BIO-CRUDE PRODUCTION

SITI NUR AIN BINTI MOHD HASSAN

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ABSTRACT

Research and development in the field of biofuel showed that certain biomass exhibit qualifying properties that can reduce or replace fossil fuel and sustain chemical feedstock production. One of the most reasonable sources of vegetable oil for large-scale production of bio-crude (biofuel), if the primary concerns are to be eradicated, is rubber seed, which are currently underutilized. The biomass samples were collected from Kedah, Malaysia and coal samples were obtained from Sarawak. All samples were examined for their physical and chemical characteristics using TGA, CHNS, and bomb calorimeter. This study evaluates the potential of rubber seed shell (RSS) and rubber seed kernel (RSK) as raw materials for co-liquefaction with Mukah Balingian (MB) coal. Among the two biomass samples, RSK is suggested to be the most suitable for bio-crude production. This study conducts liquefaction processes using MB coal and rubber seed. The individual liquefactions of MB coal and RSK show that RSK gives much higher liquefaction conversion than MB coal at the same liquefaction condition. The co-liquefaction behaviors of MB coal and RSK were investigated. In co-liquefaction, the largest enhancements in conversion of 72.8% and oil+gas yield of 66.5% were obtained at 70:30 (RSK:MB) blending ratio among different blends, respectively, at 400 °C temperature and 75 min of reaction time. The conversion and oil+gas yield obtained from the co-liquefaction under the varied conditions showed an increase and was comparable to that of MB coal liquefaction alone. The increase in conversion and oil+gas yield might be due to the ability of the biomass to release hydrogen and cap the coal radicals instantaneously. Gas Chromatography Mass Spectrometer showed the detail chemical composition of the oils obtained from the liquefaction processes. The reaction parameters were optimized for maximum production of product yield during the co-liquefaction processes by using Response Surface Methodology (RSM) method. From RSM, it was observed that RSK blending ratio plays an important role in comparison to heat and reaction time in contributing to high conversion. As a conclusion, these new approach of feedstock on co-liquefaction could be promising in enhancing coal conversion and product distribution under less severe liquefaction conditions. This study supports the production of bio-crude from rubber seed as a viable alternative to other conventional fuel.

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