UNIVERSITI TEKNOLOGI MARA

PRODUCTION OF BIOFUEL VIA CO-CRACKING OF RICE WASTE AND SEWAGE SLUDGE

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Thesis submitted in fulfilment of the requirements
for the degree of
Master of Science

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Candidate's Declaration

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

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ABSTRACT

Economic development and rising standards of living in Malaysia have led to increase in the quantity of waste generation. It is estimated that over 9 million tonnes of rice waste are generated annually from rice milling industry. The total production of domestic sewage sludge in Malaysia is 3.2 million cubic meter per year. Normally rice wastes are used as animal feed, composting, burned as thermal energy for drying purposes and the others are burned on the field. Generally, most of the sewage sludge waste was disposed by sanitary landfills, agriculture decomposition, incineration and dumping into the sea. The utilization of the two sources of waste via energy recovery has the potential to solve waste management problem and also generate useful energy. Pyrolysis is one of the thermochemical process which can convert biomass into energy. The thermal degradation will produce three main products consists of char (solid), bio-oil (liquid) and gas. In this study fast pyrolysis of two different rice husk, rice straw and treated sewage sludge samples were performed in fast pyrolysis reactor. The pyrolysis process was conducted at several temperature ranged 500 to 650 °C. The process was maintained at nitrogen flow rate of 50 ml/min^{-1} (at room temperature and atmospheric pressure) and heating rate of 30°C min^{-1}. In this study, the optimum operating temperature was 600 °C. The optimum bio-oil of individual of RH-A, RH-B, RS-A, RS-B, TSS-C and TSS-D samples were 33.49 ± 0.16 wt%, 35.46 ± 0.38 wt%, 29.37 ± 0.59 wt%, 25.74 ± 0.83 wt%, 21.53 ± 0.58 wt% and 24.56 ± 1.39 wt% respectively. Instead of using one type of feedstock, the co-cracking process of more than 2 types of feedstock was applied, in order to maximize the utilization of waste at optimum bio-oil production. Moreover, it could solve and reduced the amount of unutilized waste, which was in abundance. Proximate and ultimate analysis of the individual feedstock was also carried out. The bio-oil produced from optimum temperature was analyzed by GC-MS and FTIR. The bio-oil from fast pyrolysis was dominantly contained phenol, aromatic, nitrogenated compound, alkenes and alkanes with potential added value.

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