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Investigation on Thermochemical Behaviour of Malaysian Biomasses via Thermogravimetric Analysis (Tga)

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ABSTRACT – Biomass is a renewable resource with great potential as an alternative to fossil fuels for supplying energy. The flash pyrolysis process has been subject of intense research in the last decades in converting biomass into a convenient and effective fuel. Thermogravimetric analysis (TGA) is used to study the thermal behaviour of carbonaceous materials. In the present study, the characteristics and thermal decomposition behaviour of eight local biomasses (empty fruit bunch (EFB), oil palm trunk (OPT), rice husk, coconut copra, saw dust, coconut shell, bagasse and wood bark) in Malaysia upon fast pyrolysis were studied. The elemental properties of the feedstock were characterized by an elemental analyzer while thermal properties were investigated using thermogravimetric analyzer (TGA). Analysis is carried out in an inert nitrogen atmosphere from ambient temperature to 700 °C. In this work, the particle sizes varied in the range of $0.30 \leq dp < 0.50$ mm at a heating rate of 80 °C/min. Three reaction zones corresponding to moisture evolution, hemicellulose-cellulose degradation and lignin degradation are observed for all the biomass samples. The results show that, Phase I (moisture evolution) was identified between 25 and 137 °C for saw dust as indicated in DTG curve and has highest peak among the samples. Two distinct evolution profiles were observed for coconut shell, coconut copra, bagasse, rice husk and EFB at Phase II (devolatilization). At Phase III (lignin decomposition), it is observed that the lignin gradually degrades over a wide range of temperature (450 –700 °C). However, when the temperature reaches 650 °C, the degradation rates are no longer significant as most volatiles had already been pyrolysed