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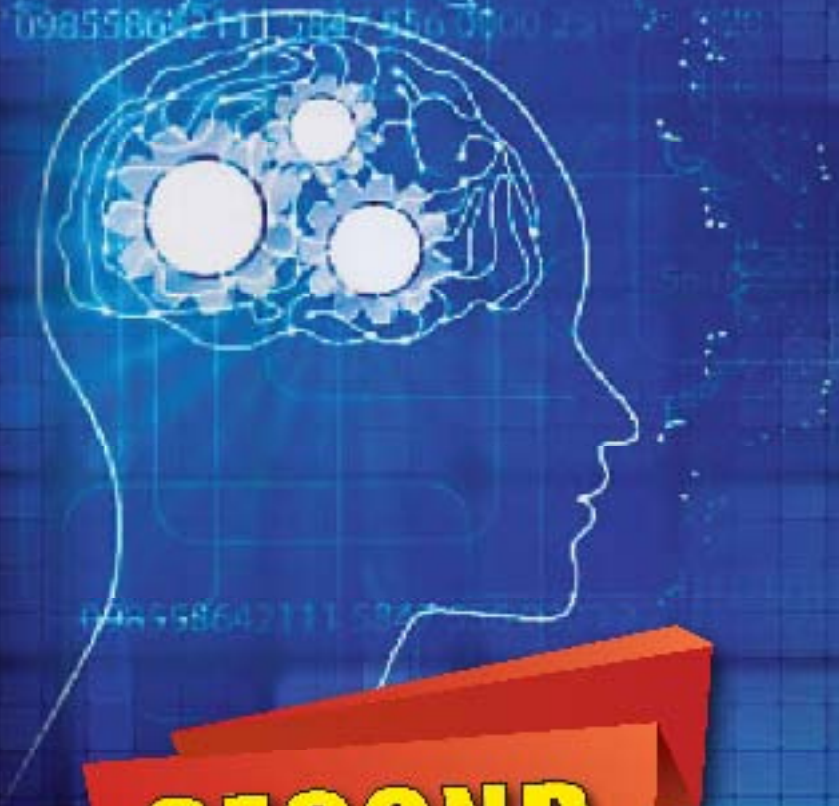

SECOND ISSUE

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7

Name : **Zulkifli Bin Ab Rahman**

Title : **Palm Biomass Downdraft Gasification for Producer Gas Production as Renewable Energy**

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Biomass has been identified as a useful source material for many applications including the production of renewable energy after gasification of the biomass. The most promising future application of the thermal gasification of biomass will require a properly designed biomass gasification generating of tar free producer gas having trouble free operation of gasifier. In the current study, an experimental fixed-bed palm biomass gasification is utilized to investigate the gasification of empty fruit bunches using preheated air from 200^{o}C to 400^{o}C under autothermic conditions. The system consists of a gasifier and a gas cleaning system including cyclone separator, and venturi-wet scrubber. The pre-treated EFB in 2 - 3 cm sizes and 15 % moisture content was initially pyrolyzed and the resulting char was partially gasified in the oxidation zone followed by the combustion of the char residue at the reduction

zone (bottom of gasifier) in an oxidation atmosphere. It was found that the system can be operated stability within the temperature range from 700 - 950^{o}C.This study indicated that under the optimum operating conditions of the gasifier ranging between 1.71 and 2.34 Nm3/kg of air fuel ratios at values between 28.2 to 37.0 kg/h at 15 % moisture content feed rate, which gives the producer gas with a good heating value of about 5.18 MJ/Nm3 at a volumetric flow of 92.47 – 101.78 Nm3/h producer gas. As the temperature is increased from 750 to 860^{o}C, the gas yield increases from 2.6 to 3.2 Nm3/kg of biomass. The maximum temperature of drying, pyrolysis, and throat zones were determined at 125^{o}, 350^{o} and 900^{o}C respectively but the throat temperature fell to about 880^{o}C at the optimum level. The carbon conversion efficiency and cold gas efficiency could reach 88 % and 76 %, respectively. The maximum total concentration of combustible fuel gas (H2 + CO + CH4) was 32.6 % with concentrations of H2, CO and CH4 were at 10.9 %, 18.5 % and 3.2 %, respectively. The majority of the material balance for most of the runs were fairly consistent and satisfactorily over a wide range of different operating conditions. The above results indicate that the proposed innovative design for palm oil mill biomass gasification is quite promising and it could be potential as an alternative energy resource in the future.