Thesis Title Thermal Analysis of Continuous Burning Combustor Using Refined Palm Oil as Fuel

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ABSTRACT

This research is to design and develop a new continuous combustor. Material for combustor chamber is made of stainless steel in order to avoid oxidation at high combustion temperature. Air atomizing nozzle is developed to obtain high efficiency injection fuel with round spray pattern atomization and used high air pressure to assist the atomizing nozzle. The blower compress air into combustor with high mass-flow ratio and pure refined palm oil stearin is used as fuel for generating continuous combustion of hot gas. Investigation involved measurement of that specific gravity, viscosity, pour point, cloud point, flash point and pH both for diesel and pure refined palm oil stearin . The combustor can be applied for agricultural drying purposes. The aim is emphasized on simplicity for construction, inexpensive, good stability and reduce import fuel for continuous combustor. The pure refined palm oil stearin is considered as a renewable source of fuel that can be reproduced domestically. Another main advantage is a clean combustion, as no sulphur content in the fuel. The result of previous investigation showed that the combustor perform well with good combustion stability when use pure refined palm oil stearin with preheated temperature between 90-110°C. If the preheated temperature is not in the required range the combustion, such stability phenomena was unsteady. Moreover if too high the preheated temperature, build up of fuel vapor pressure causes vapor lock in the fuel pipe line.The combustor performance testing was also operated for comparison with diesel. By regulating atomizing air pressure supply between 68.95-275.79 kPa (10-40 psi, Siphon height -0.45 m), correspondingly consumed 0.41-0.58 g/s (1.78-2.50 l/hr.) of fuel. Hot gas produced from

combustion was in range of 200-398^{0}C depending on oxidizing air mass flow regulated between 63.45-106.70 g/s. Consequently, the combustor performance testing was done with palm oil and LPG. By regulating atomizing air pressure between 68.95-275.79 kPa (10-40psi, Siphon height - 0.45 m) and regulating LPG pressure 6.8 kPa (1 psi), result showed that 0.11-0.19 g/s of fuel consumption, hot gas produced from combustion was in the range of 308-498^{0}C depending on oxidizing air mass flow regulated between 69.50-106.70 g/s. The LPG mass flow was regulated 0.000489 kg/s in order to sustain the combustion stability.