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PHYSICOCHEMICAL PROPERTIES OF WASTE PALM OIL OBTAINED FROM DIFFERENT TYPE OF FRIED CHIPS AND PROPOSED OF SLEEVE TYPE WASTE HEAT RECOVERY DEVICE VIA SIMULATION METHOD

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ABSTRACT

The growth rate of the world population increases caused in higher demand of conventional fuel. Even so, due to exhaust emission pollution of hydrocarbons an alternative fuel is needed. Vegetable oil such as palm oil has been proven to be an effective alternative fuel for compression ignition (CI) engine. Generally, palm oil is one of the most common cooking oil used in Malaysia. After the cooking process, this vegetable oil is referred as waste cooking oil. Nowadays, improper waste management of WCO continue to pollute the environment especially land and water. Thus, waste cooking oil is the best candidates for an alternative fuel. Usually, the post-cooking process will affects the properties of the waste cooking oil but, up till todays there is still lack of study on the specific food used in WCO. Therefore, this project analyses the effect of physicochemical properties on WCO that was used to fry different type of chips which are sweet potato, banana & tapioca chips. The sample denoted for type 1 is WCOSP, a WCO used to fry sweet potato chips. Followed by type 2 is WCOB, a WCO used to fry banana chips and type 3 is WCOT, a WCO used to fry tapioca chips. The properties were analysed through its viscosity, density and calorific value by using viscometer, analytical balance and bomb calorimeter, respectively. Later on, the collected data from each sample were compared with diesel fuel. In average, among these three samples, WCOT, a WCO used to fry tapioca chips shows the best trend. The WCOT gives viscosity of 5.5353 mm^2/s, density of 885.9 kg/m^3 and calorific value of 42,941 kJ/kg. However, these results are poorer when compared with diesel fuel. Thus in order to increase the properties of WCOs' sample, this project proposed to preheat the mixture before injected to the CI engine. The fuel mixes were preheated before entering the CI engines, this process will help to decrease the viscosity of the fuel samples. Theoretically, the heat produced by the exhaust can be recycled to preheat the WCOs' blend. As a preliminary study, the step of preheating the WCOs' blend using recycle exhaust heat is limited to simulation only. Basically, the plan is to develop a waste heat recovery system that will warm the fuel blend by collecting waste heat from the exhaust pipe. In order to simulate waste heat from exhaust, a sleeve-type waste heat recovery device will be designed. In addition to that, the length of the sleeve is nth times the radius of the exhaust pipe. Five models of heat recovery device 3R, 4R, 5R, 6R and 7R were designed and analysed by using ANSYS software. This is to study the heat used to increase the temperature of the WCOs' blend. Based on these five models, 5R shows the most capable heat recovery device as it gives the most optimum temperature of the diesel fuel during the simulation process however it is expected to give higher pumping rate and higher heat transfer rate when compared to 3R.

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