SIIC039

A COMPARATIVE STUDY ON CHEMICAL CHARACTERISTICS OF WASTE COOKING OIL BIODIESEL SYNTHESIZED USING NANOHYBRID CATALYST AT LOW METHANOL

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Abstract:
Biodiesel is considered among the developed biofuels as a promising replacement for fossil diesel, which can minimize greenhouse gas and pollutant emissions. Due to the decreasing trend in economic oil reserves, environmental problems triggered by the use of fossil fuel, and the price of petroleum products that costing a bomb on the global market, biodiesel production from waste cooking oils (WCO) for diesel substitute is particularly important. Nanohybrid catalyst has already been identified as an excellent biodiesel synthesis catalyst. Nevertheless, the alcohol to oil molar ratio is considered to be the most crucial in the biodiesel production dynamics. The present review paper briefly cover the effect of different process conditions, type of catalyst used, low methanol-to-oil molar ratio (< 6), reaction time, the chemical component which includes flash point, pour point, cloud point (CP), cetane number (CN) and the optimum process condition for the waste cooking oil (WCO) biodiesel production. The recent advancements involving nanohybrid catalyst for enhancing the overall quality of biodiesel have been discussed. Twenty-two papers are used as the main references to identify the type of nanohybrid catalyst used and the optimum process conditions for the waste cooking oil (WCO) biodiesel production at low methanol to oil molar ratio. In conclusion, all the catalyst investigated in this present review paper shown the positive result where the quality of the biodiesel produced meets the ASTM D6751 standard. Graphical representation in this present review paper shows that among all the catalysts investigated in this present review paper, the Na_2SiO_3 nanohybrid catalyst has great potential to be used as a low-cost catalyst in waste cooking oil (WCO) biodiesel production as Na_2SiO_3 nanohybrid catalyst yield 77.33 % biodiesel at 65 °C, 180 minutes reaction time and 6:1 methanol to oil molar ratio.

***Keywords*:**
Biodiesel; Biofuel; Waste cooking oil; Nanohybrid catalyst; Methanol-to-oil molar ratio

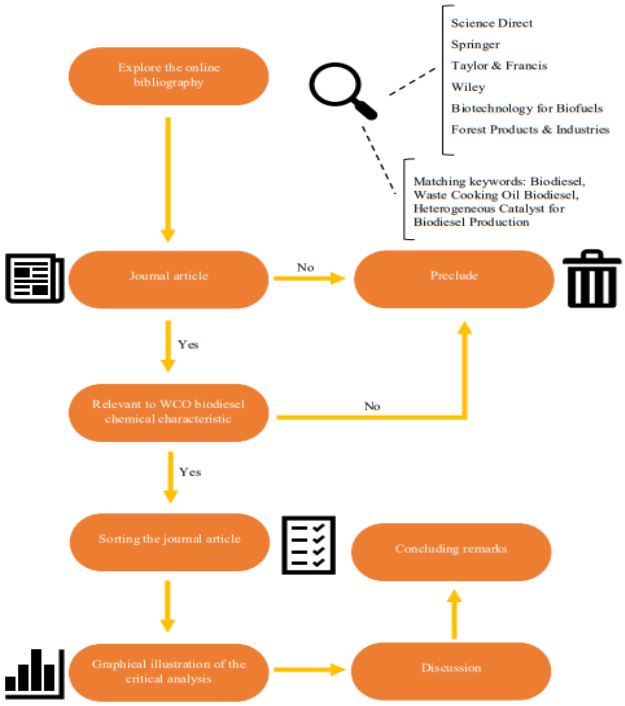
Objectives:

- To compare the process conditions for the production of biodiesel and the characterization of the chemical component which includes flash point, pour point, cloud point (CP) and cetane number

(CN) of the biodiesel fuel produced at different process conditions by nanohybrid catalyst with low methanol-to-oil molar ratio.

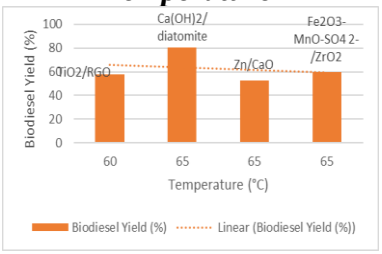
- To find the optimum process condition for the production of biodiesel.

Methodology:

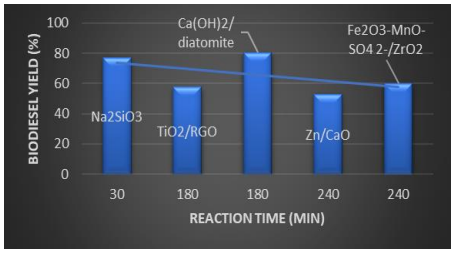


Results:

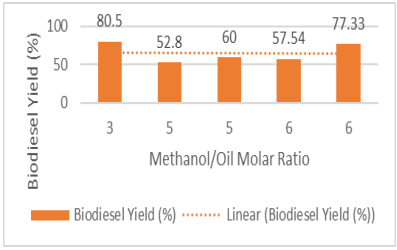
Temperature



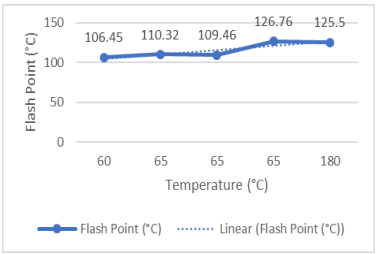
Reaction Time



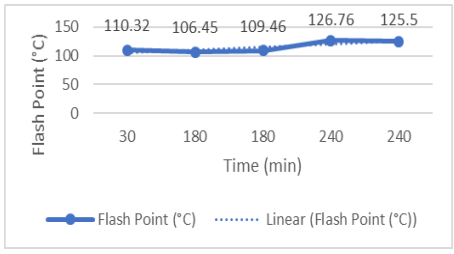
Methanol-to-oil Molar Ratio



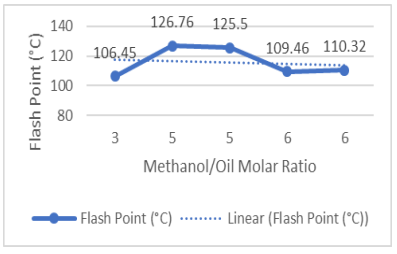
Flash Point - Temperature



Flash Point - Reaction Time



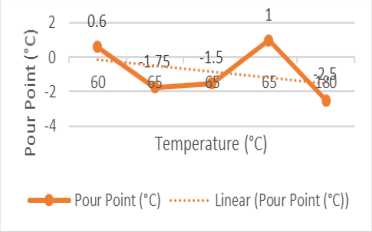
Flash Point - Methanol-to-oil Molar Ratio



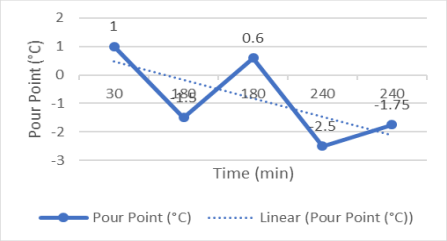
Pour Point - Temperature

Pour Point - Reaction Time

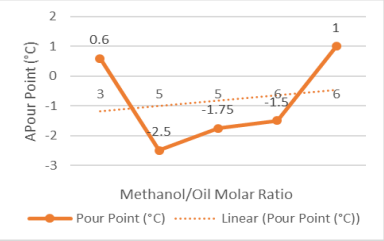
Pour Point - Methanol-to-oil Molar Ratio



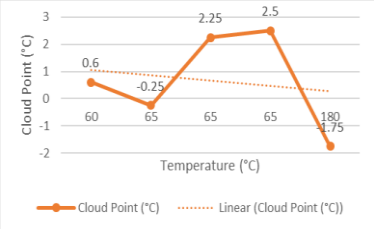
Cloud Point - Temperature



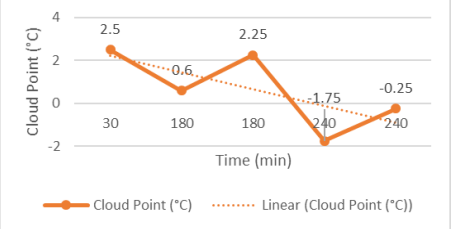
Cloud Point - Reaction Time



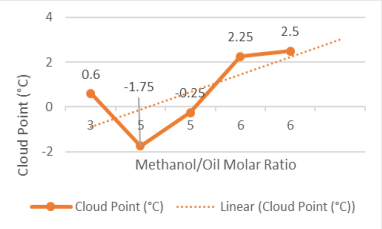
Cloud Point - Methanol-to-oil Molar Ratio



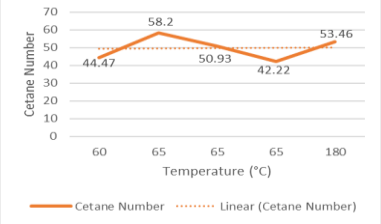
Cetane Number - Temperature

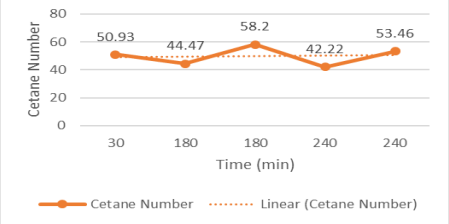


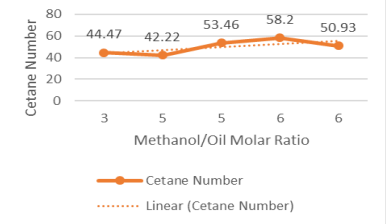
Cetane Number - Reaction Time



Cetane Number - Methanol-to-oil Molar Ratio







Conclusion:

It is observed that waste cooking oil (WCO) biodiesel synthesis using $Ca(OH)_2$/diatomite nanohybrid catalyst gave the optimum yield of 80.5 % at 60 °C, 180 minutes and 6:1 of methanol-to-oil molar ratio. Although Ca(OH)2/diatomite nanohybrid catalyst gave the optimum yield of 80.5 %, one of the chemical characteristics compared do not meet ASTM D6751 standard. The cetane number for biodiesel synthesis using Ca(OH)2/diatomite nanohybrid catalyst 44.7 which is lower than ASTM D6751 standard range (48 to 65). The findings from this comparative study indicate that biodiesel synthesis using Na_2SiO_3 nanohybrid catalyst is considered promising choice in terms of cost reduction for waste cooking oil (WCO) biodiesel production. Na_2SiO_3 nanohybrid catalyst have greater process conditions compared to Ca(OH)2/diatomite nanohybrid catalyst. Waste cooking oil (WCO) biodiesel synthesis using Na_2SiO_3 nanohybrid catalyst gave the optimum yield of 77.33 % at 30 minutes of reaction times compared to Ca(OH)2/diatomite nanohybrid catalyst that required 180 minutes.