SIIC004

A REVIEW: STUDY ON SYNTHESIS OF BIODIESEL FROM WASTE COOKING OIL USING NANOHYBRID CATALYST WITH LOW METHANOL TO OIL RATIO

Nurul Syafiqah Hamran[1] and Prof. Madya. Dr Abdul Hadi Zainal[2]
[1]Faculty of Chemical Engineering, Universiti Teknologi MARA Pulau Pinang, 13500 Permatang Pauh, Pulau Pinang Malaysia
[2] Faculty of Chemical Engineering, Universiti Teknologi MARA Pulau Pinang, 13500 Permatang Pauh, Pulau Pinang Malaysia

**Corresponding author: hadi9598@ uitm.edu.my*

Abstract:
Biodiesel can act as an alternative fuel to reduce the emission level of some pollutant. Manufacturing biodiesel from Waste Cooking Oil (WCO) is one of another succesful way to reduce the cost of raw materials and has many environmental benefits. However, the sustainable of biodiesel production is quiet challenging due to difficulty in securing cheap raw material. To reduce the cost, low ratio of methanol to oil used is suggested to limit the methanol user but the influence and effect to the yield need to study. This literature study aim were to determine on the yield of biodiesel synthesis from waste cooking oil using heterogeneous (nanohybrid) catalyst with low methanol to oil ratio by transesterification process and to determine the suitable ratio of low methanol to oil and the highly reactive nanohybrid catalyst which lead to high yield of biodiesel. For this study review, the online researches of the synthesis biodiesel yield by heterogeneous (nanohybrid) catalyst and the effect on the molar ratio methanol to oil data was collected from the relevant publish papers to compare the yield of biodiesel produce and their effect to the molar ratio methanol to oil. When the data processing is complete, the detail were go through and known as data analysis to make discussion and conclusion. Result obtained proved that nanohybrid catalyst can produce high yield of biodiesel above 90% in low ratio of methanol to oil. A very synergetic effect was noted in catalytic activity when hybrid (mixed) catalyst was used. The suitable low molar ratio of methanol to oil is 6:1 compare to 3:1 since stoichiometric molar ratio of alcohol to oil for the transesterification is 3:1. The biodiesel properties such density, flash point and kinematic density are following the ASTM D-6751 and EN-14214 requirement.

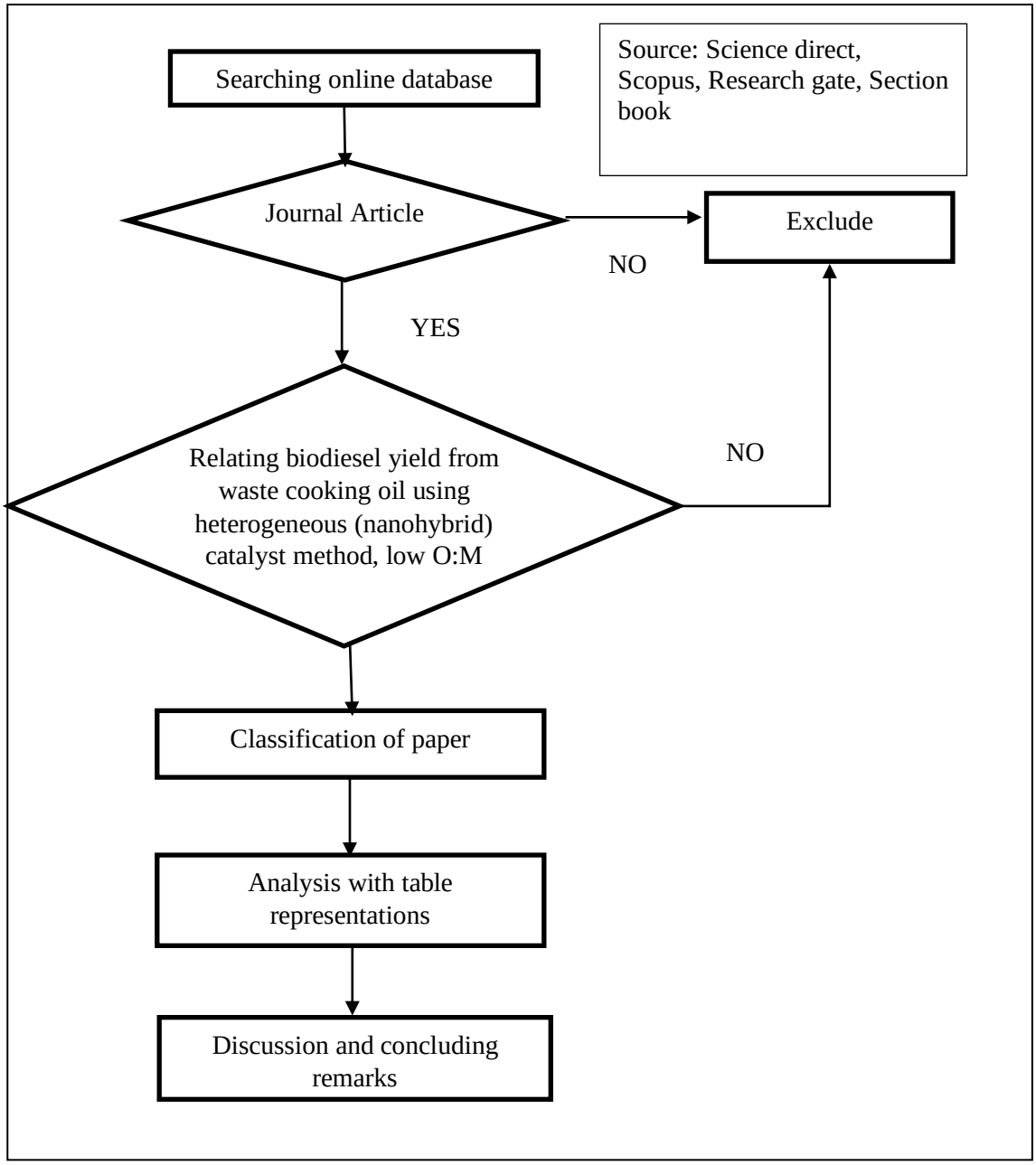
***Keywords*:**
Waste cooking oil; Biodiesel; Transesterification; Hybrid catalyst; Methanol to oil molar ratio.

Objectives:

- To literature study and determine the yield of biodiesel synthesis from waste cooking oil using heterogeneous (nanohybrid) catalyst at methanol to oil ratio by transesterification process.

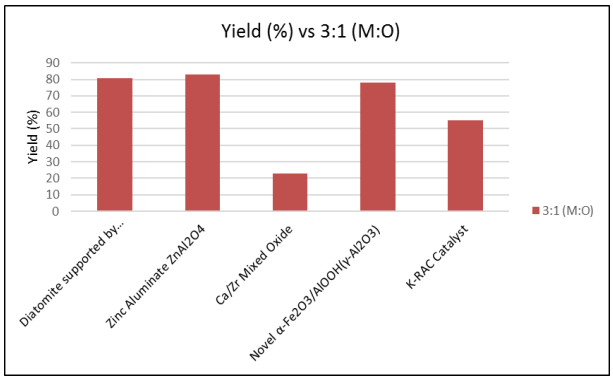
- To determine the suitable ratio methanol to oil, effect of reaction temperature and the highly reactive heterogeneous (nanohybrid) catalyst which lead to high yield of biodiesel.

Methodology:

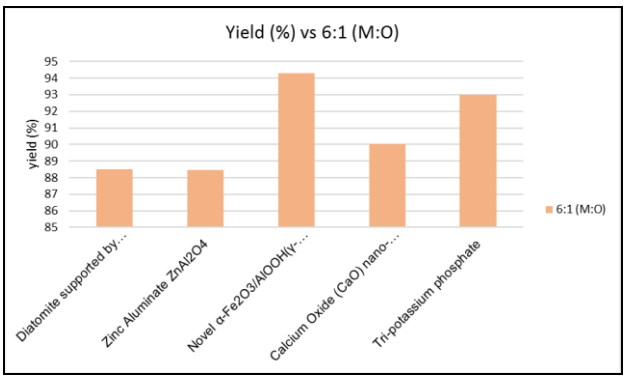


Results:

Effect of Methanol to Oil Ratio at 3:1



Effect of Methanol to Oil Ratio at 6:1



Physicochemical Properties of Biodiesel by Various Catalyst

Properties Catalyst	Density (kg/m^3)	Flash point (℃)	Kinematic viscosity (mm^2/s)	References
Diatomite supported by CaO/MgO	876	133	3.12	[23]
Zinc aluminate $ZnAl_2O_4$ nanoparticles	818.4	117	5.15	[24]
Novel α-Fe_2O_3/AlOOH(γ-Al_2O_3)	900	156	4.3	[26]
Calcium Oxide (CaO) nano-catalyst	879.8	96	5.2	[27]
Tri-potassium phosphate (K_3PO_4)	887	190	3.82	[30]

Conclusion:

Based on this literature study on the yield biodiesel synthesis from waste cooking oil using nanohybrid catalyst with low methanol to oil ratio, conclusion and recommendation were made. Nanohybrid catalyst can be used in the biodiesel production by transesterification process. A very synergetic effect was noted in catalytic activity when hybrid (mixed) catalyst was used. Novel α-Fe_2O_3/AlOOH(γ-Al_2O_3) catalyst is one of the good results highly reactive catalyst which lead to produced high yield of biodiesel which is 94.3% at 60 ℃ for 3h reaction time at 6:1 methanol to oil ratio. Next, in this literature study, the suitable low methanol to oil ratio that can be used is 6:1. This ratio is recommended than 3:1 since stoichiometric molar ratio of alcohol to oil for the transesterification is 3:1, so in practice, to shift the reaction toward completion, the molar ratio should be higher than that of stoichiometric ratio.