Biodiesel Production from Waste Cooking Oil Using Commercial CaO Catalyst in Stirred Reactor with Magnetic Bar

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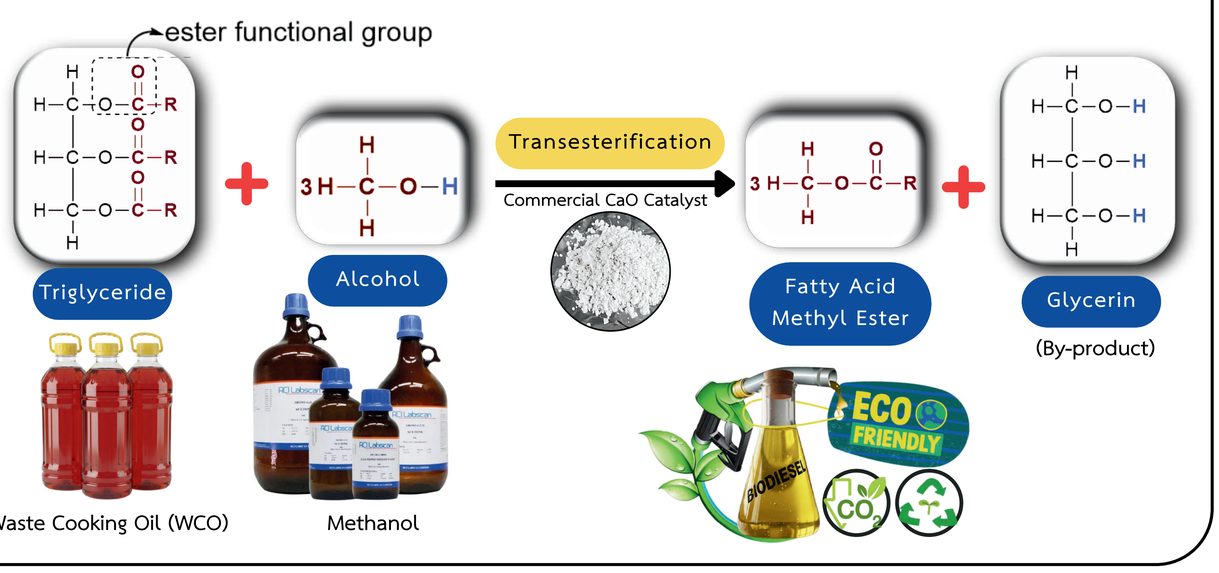
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ABSTRACT

This research project investigated the biodiesel production via transesterification from Waste Cooking Oil (WCO) using a commercial CaO heterogeneous catalyst. The uncalcined and calcined CaO commercial catalysts were prepared and characterized by SEM-EDS, BET surface area and pore analyzer, and Laser particle size analyzer. For biodiesel production, the effects of molar ratio of methanol to WCO (5:1, 10:1, and 15:1) and amount of catalyst (0.25, 0.50, and 1.00 wt.%) were investigated. The reaction was carried out under a control condition at a temperature of 65 °C and a reaction time of 3 hour. The obtained biodiesel product from transesterification reaction was analyzed for methyl ester (ME) content using a Gas Chromatograph (GC). The experimental results showed the optimum methanol-to-WCO molar ratio and catalyst amount were 5:1 and 0.5 wt.%, respectively. This operating condition gave the best biodiesel production from WCO with an average methyl ester content of 86.50%.

INTRODUCTION



OBJECTIVE

- To study the production of biodiesel from WCO via the transesterification reaction using commercial CaO catalyst, with varying the effects of methanol-to-WCO molar ratio and catalyst amount

EXPERIMENTAL

Catalyst Preparation



Commercial CaO Catalyst

WCO Preparation

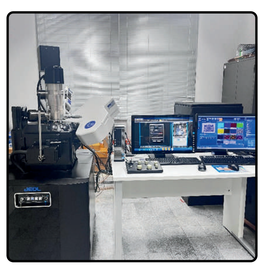


Vacuum Filtration

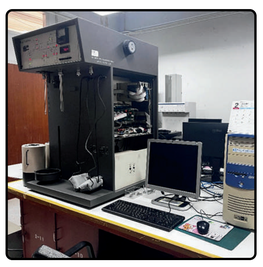
Catalyst Charaterization



Particle Size Analyzer

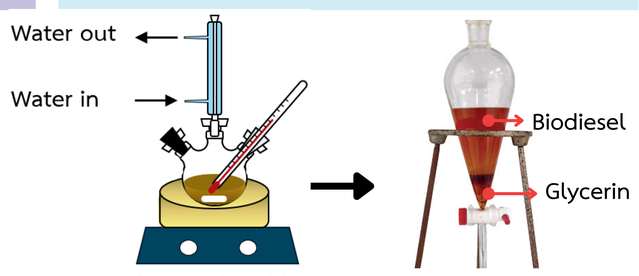


SEM-EDS



BET Surface Area and Pore Analyzer

Biodiesel Production



Control Condition
- Reaction temperature 65°C
- Reaction time 3 hr

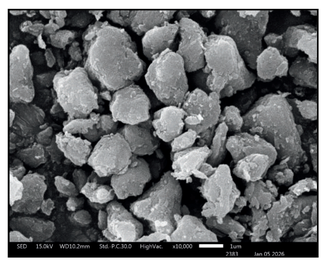


Gas Chromatograph

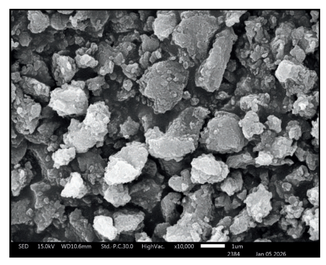
RESULTS & DISCUSSION

CATALYST CHARACTERIZATION

SEM: SURFACE MORPHOLOGY

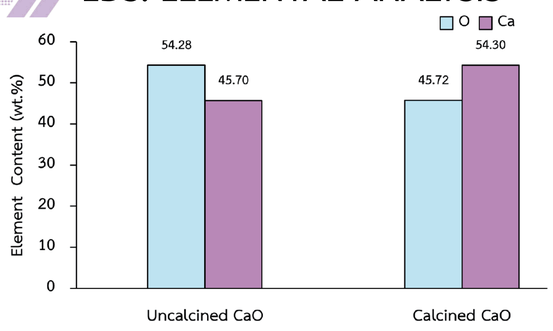


Uncalcined Com. CaO Catalyst



Calcined Com. CaO Catalyst

EDS: ELEMENTAL ANALYSIS

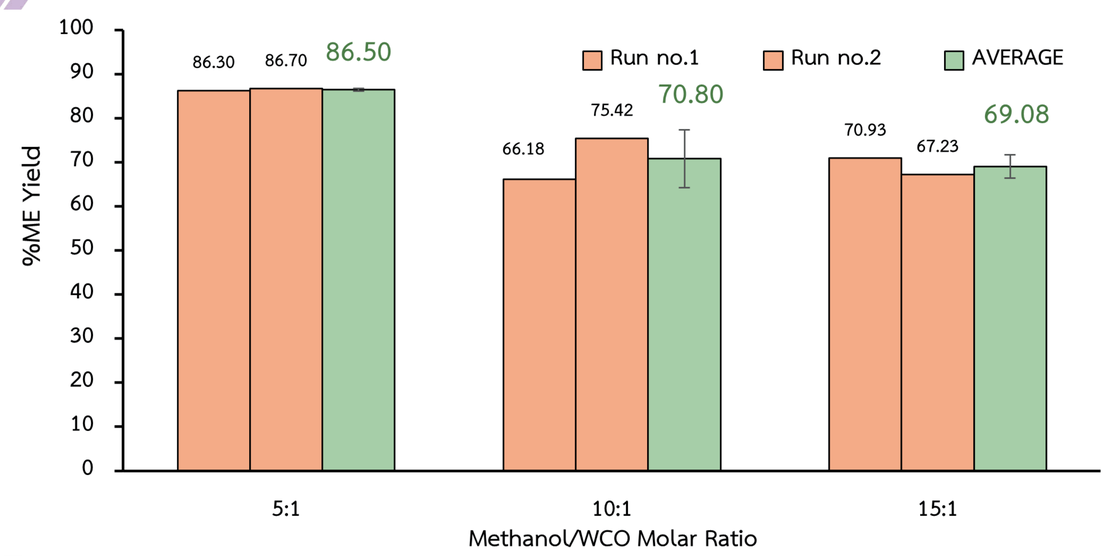


BET SURFACE AREA, PORE VOLUME & SIZE

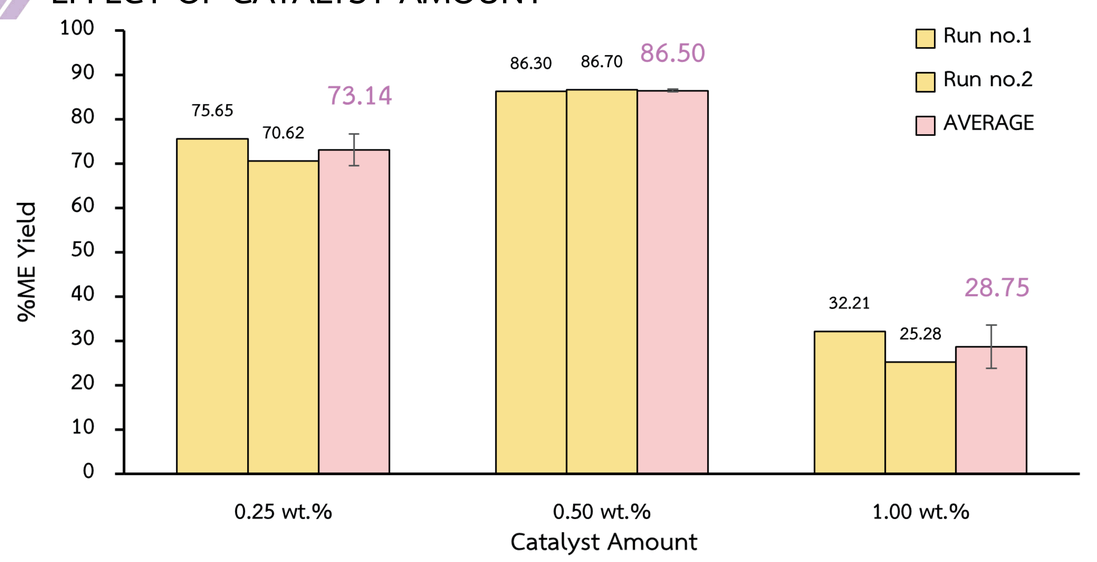
Sample	Surface Area (m^2/g)	Pore Volume (cm^3/g)	Average Pore Diameter (Å)
Com. CaO (Uncalcined)	10.96	0.049	90.07
Com. CaO (Calcined)	11.88	0.074	124.60

BIODIESEL PRODUCTION

EFFECT OF METHANOL/WCO MOLAR RATIO



EFFECT OF CATALYST AMOUNT



Best Condition

Methanol/WCO Molar Ratio	5:1
Catalyst Amount	0.50 wt.%



Best Result

ME Yield	86.50%
Biodiesel	76.98 mL
Glycerin	5.05 mL

CONCLUSION

- The optimal methanol-to-WCO molar ratio and catalyst amount were 5:1 and 0.50 wt.% for calcined com. CaO catalyst, performing the highest ME yield of 86.50%.

REFERENCE

Gouran A., Aghel B., and Nasirmanesh F., Biodiesel production from waste cooking oil using wheat bran ash as a sustainable biomass, Fuel, 295 (2021), 120542.