Preparation of Biodiesel from Palm Oil Catalyzed by Calcium Oxide as Solid Heterogeneous Catalyst

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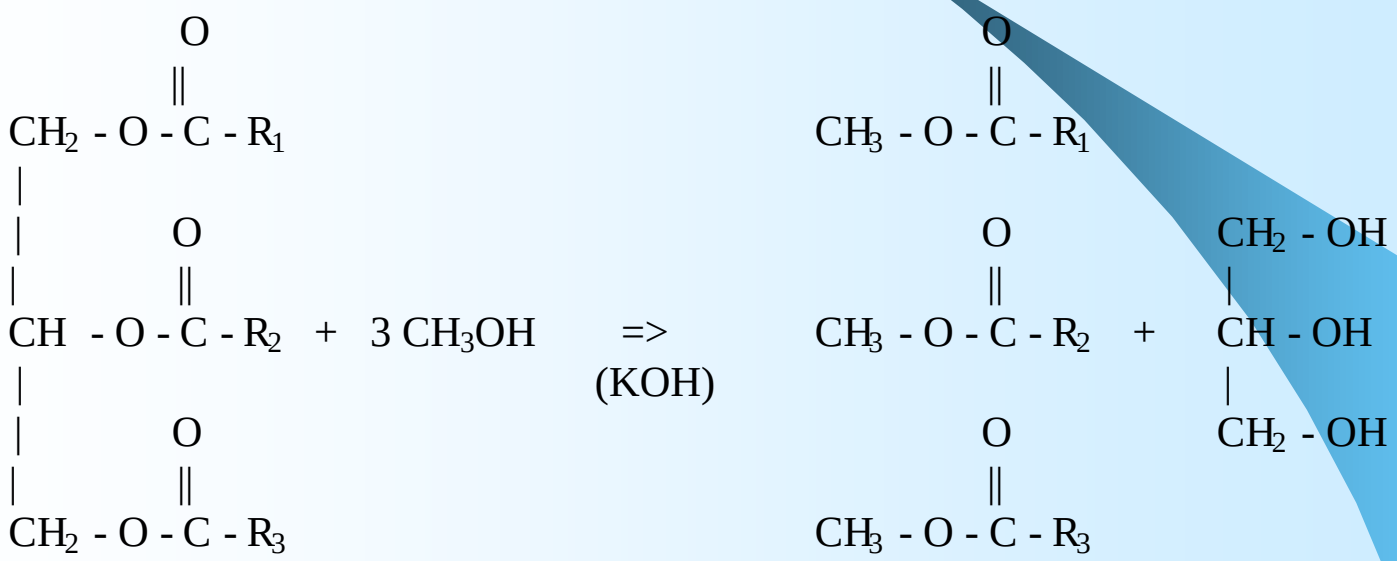
Transesterification Reaction



Triglyceride **methanol** **methyl esters** **glycerin**

Esterification Reaction

$$R-\overset{\overset{\displaystyle O}{\|}}{C}-OH + R'OH \xrightleftharpoons{H^+} R-\overset{\overset{\displaystyle O}{\|}}{C}-OR' + H_2O$$

Carboxylic Acid | Alcohol | Ester | water

FFA + Alcohol $\xrightleftharpoons{H^+}$ Alkyl Ester/ Biodiesel + water

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Palm oil, Jathropha oil and Waste cooking oil, *WCO*

Catalyst Technology in Biodiesel Production

- Homogeneous Catalyst (Base/Alkaline and Acid)

  - Alkaline: corrosive to equipments, react to FFA, expensive in separation steps (downsteram process), catalyst can not be recycle and reuse

  - Acid: corrosive to equipments, toxic, catalyst can not be recycle and reuse and less or no environment friendly.

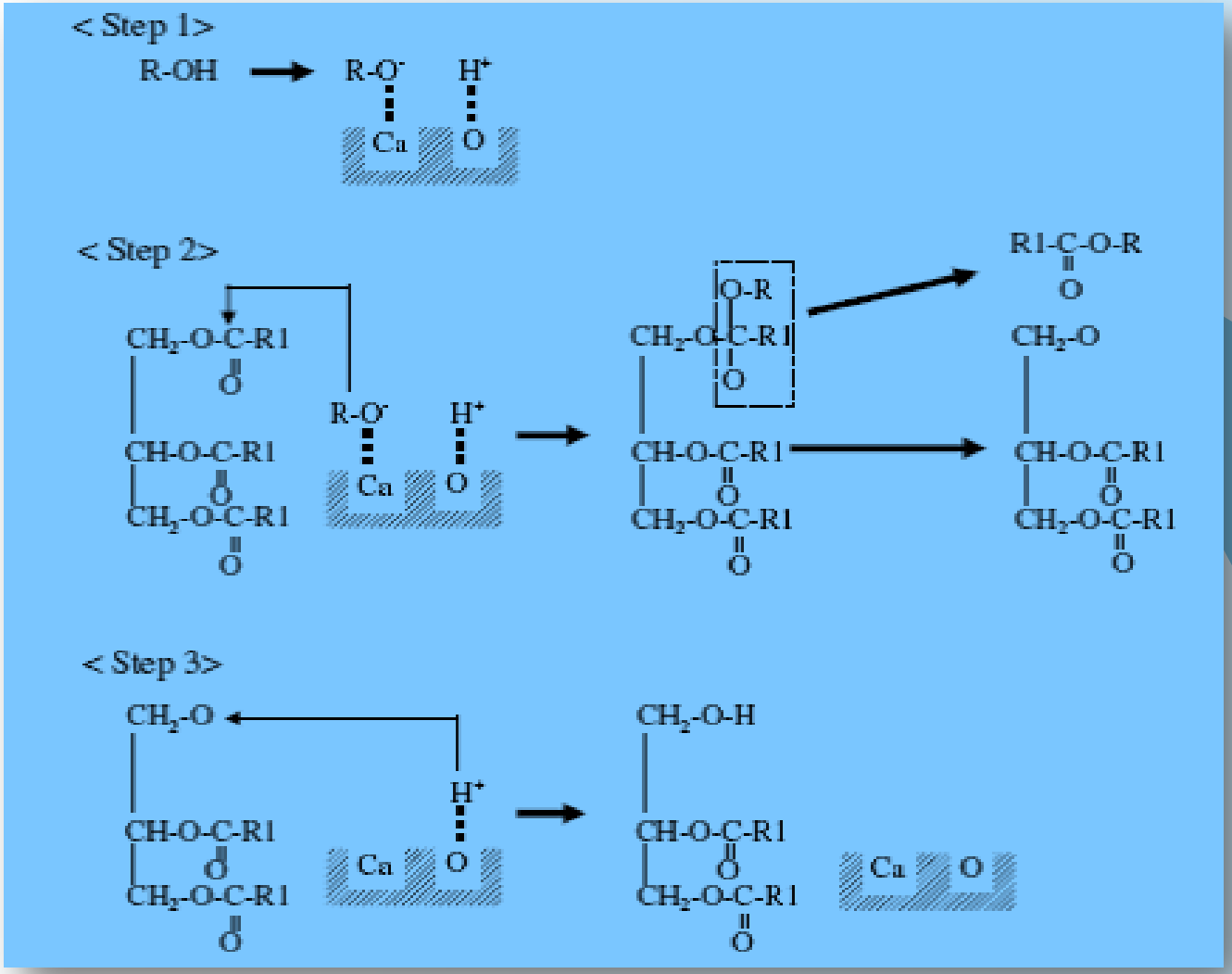
  - Lipase: expensive, adenaturate to alcohol and FFA, adsorp of glycerol
- Heterogeneous Catalyst: non-corrosive, non toxic, easy in separation steps, catalyst can be recycle and reuse

Inovation Process and potential for Development process

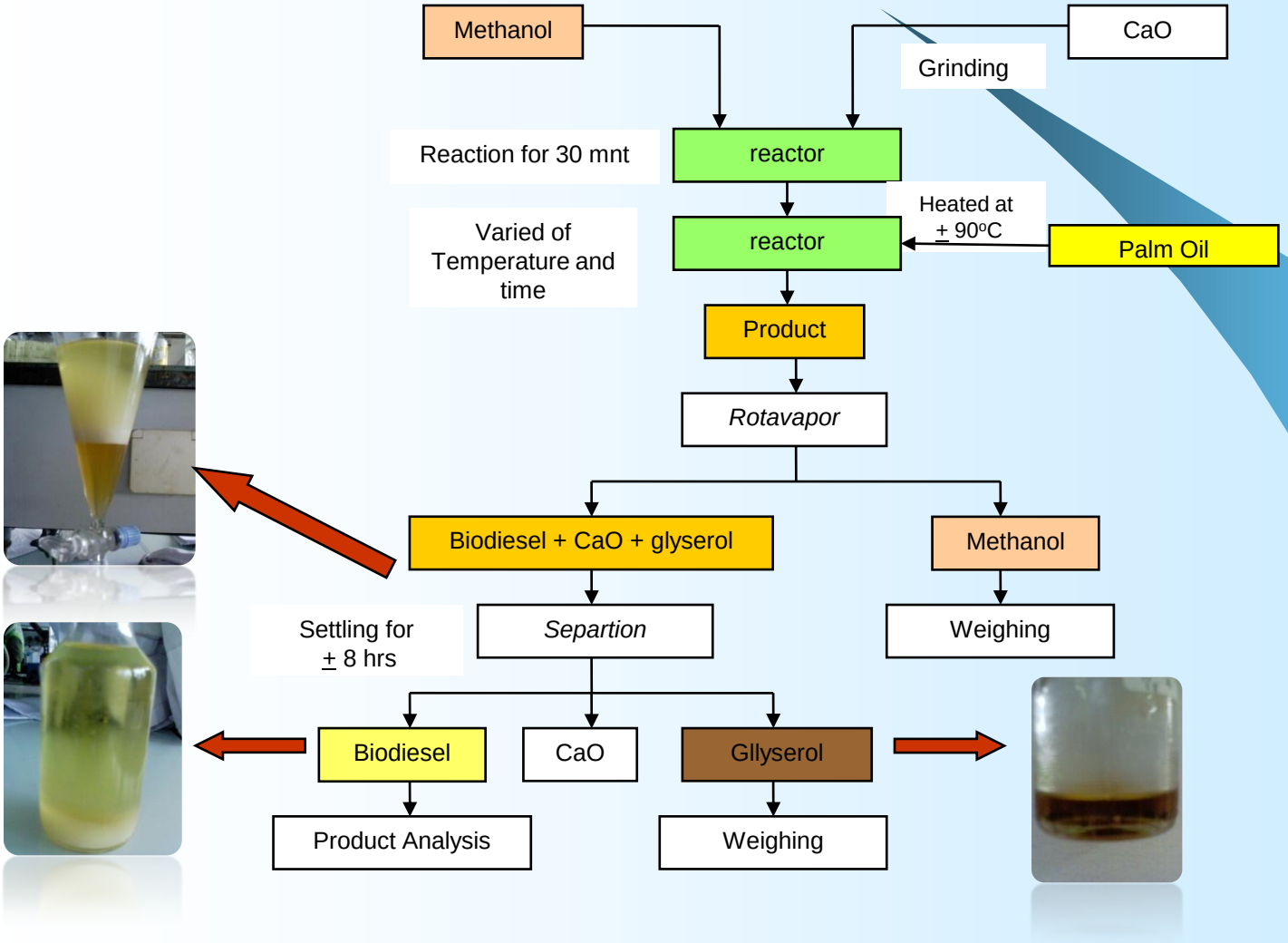
Biodiesel Production by using Heterogenous Catalyst

- Transesterification of Triglyceridee by CaO heterogeneous catalyst
- Liu, et.al (2008), Fuel 87, p1076 – 1082. Transesetrification of soybean oil with metanol using CaO (t = 3 hours; 6% CaO, mol ratio 1:25 and T = 60 C) yield 97%.

Transesterification Mechanism

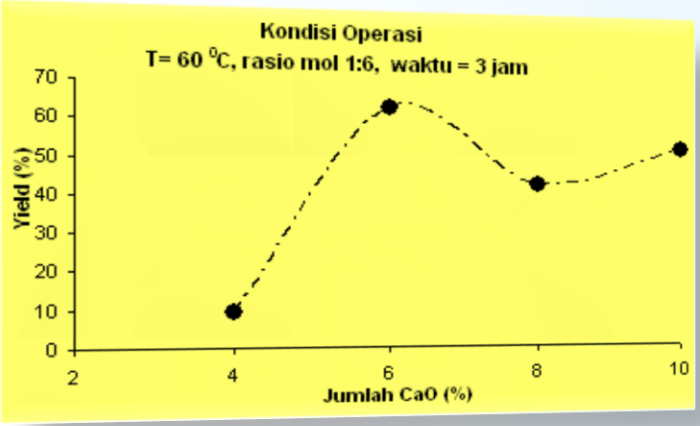


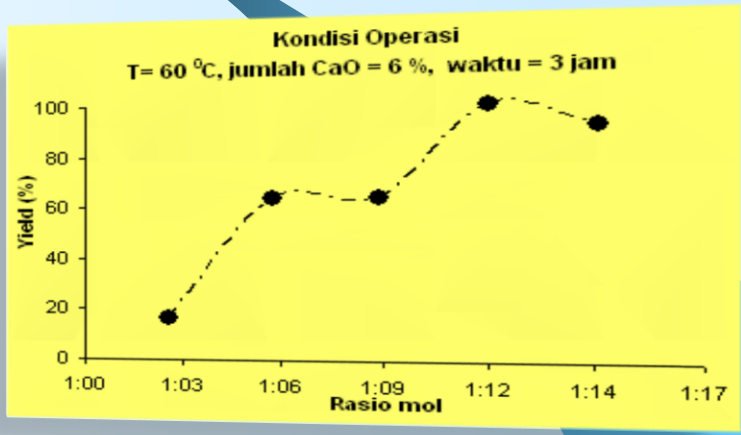
Methodology

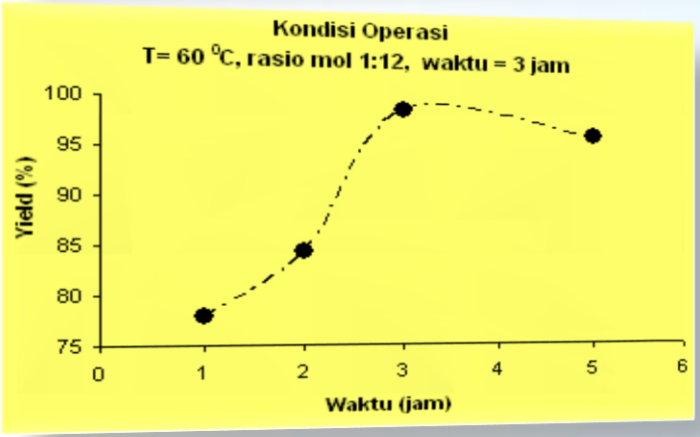


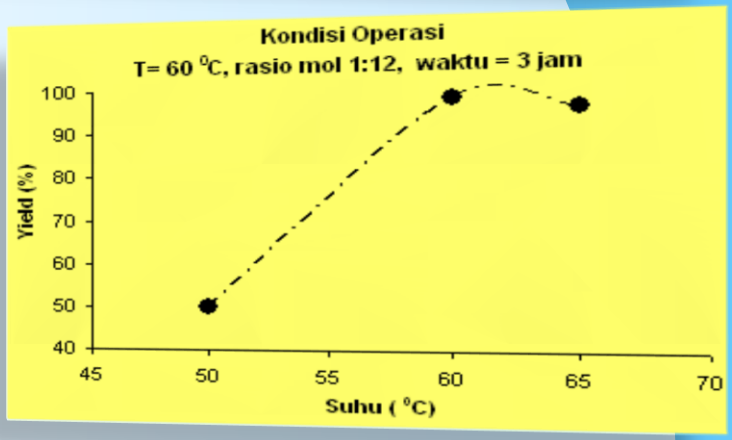
Results

- Process parameter: catalyst dosage, mol ratio, reaction time and temperture



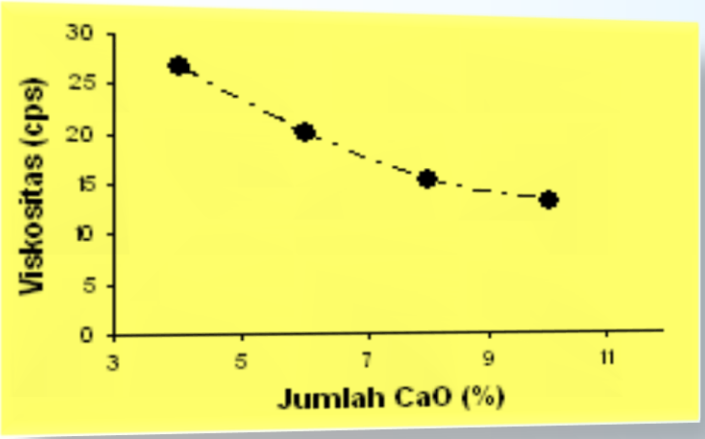


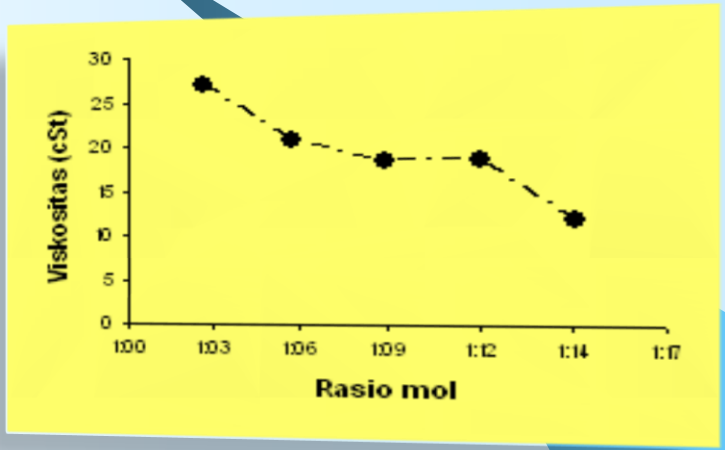


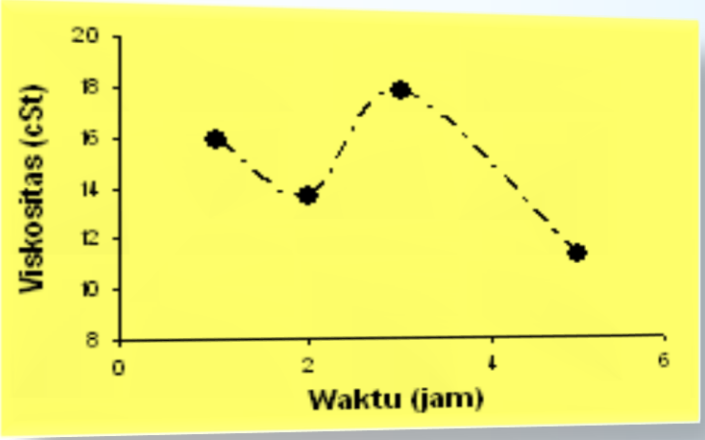


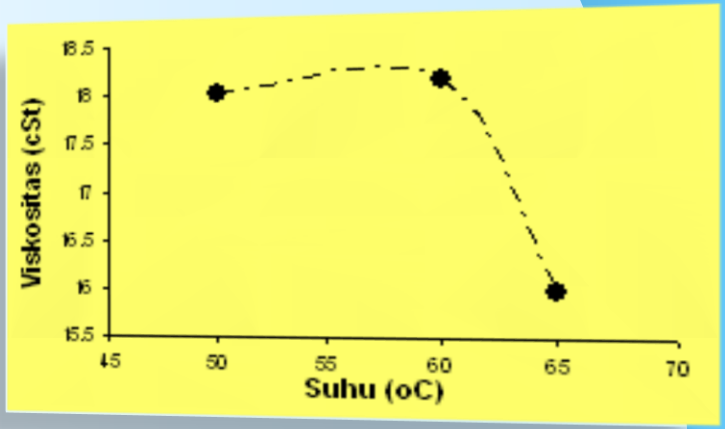
Analysis of product (1)

- Viscosity



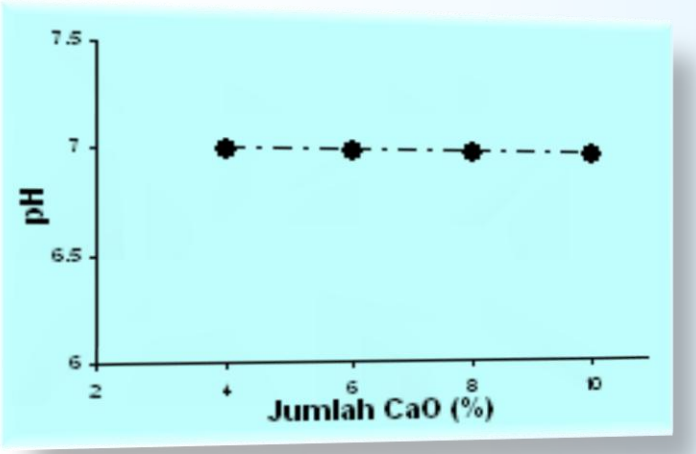


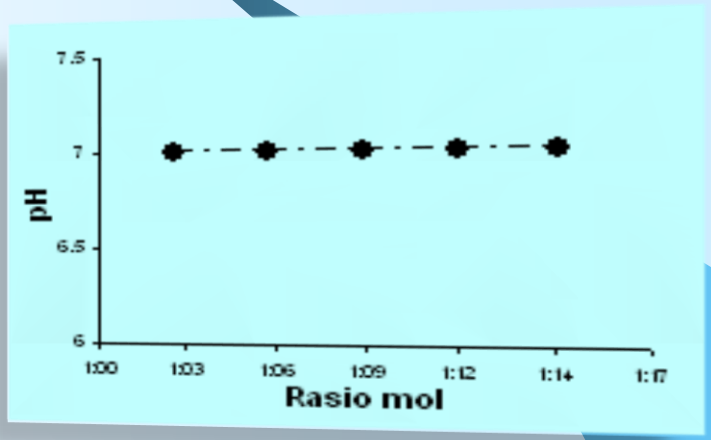


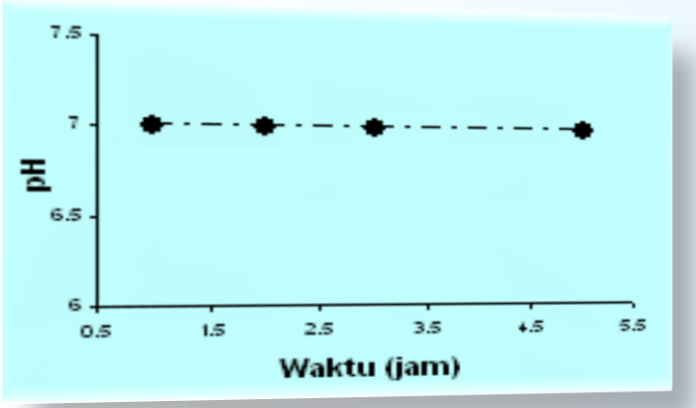


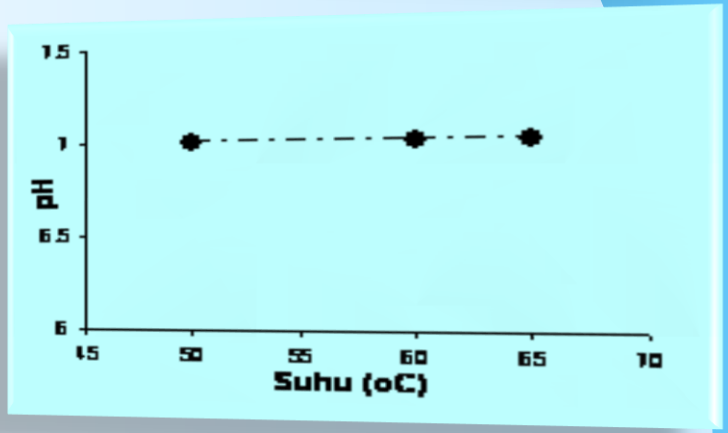
Analysis of product (2)

- pH



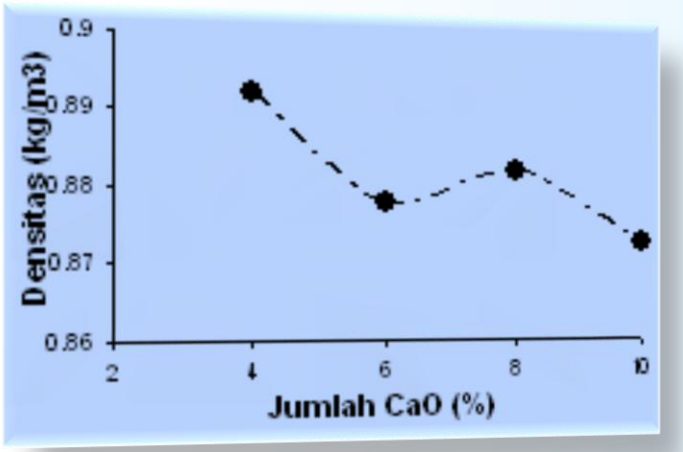


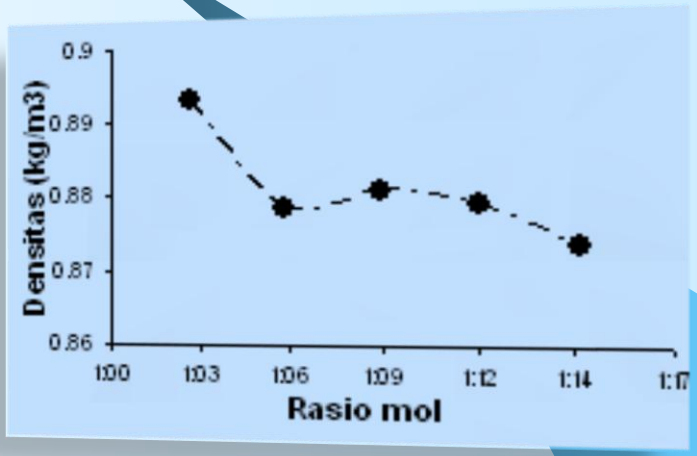


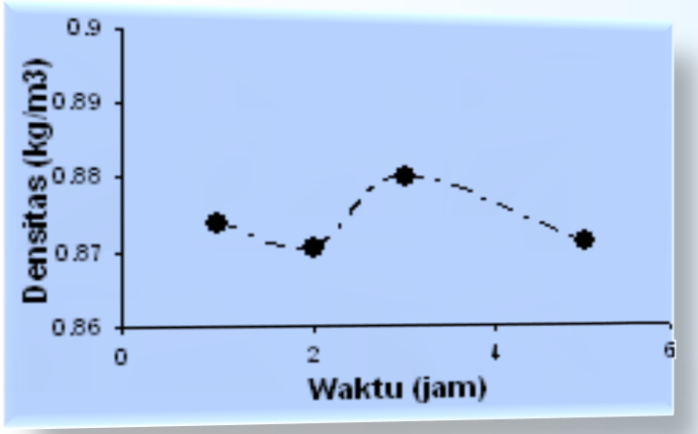


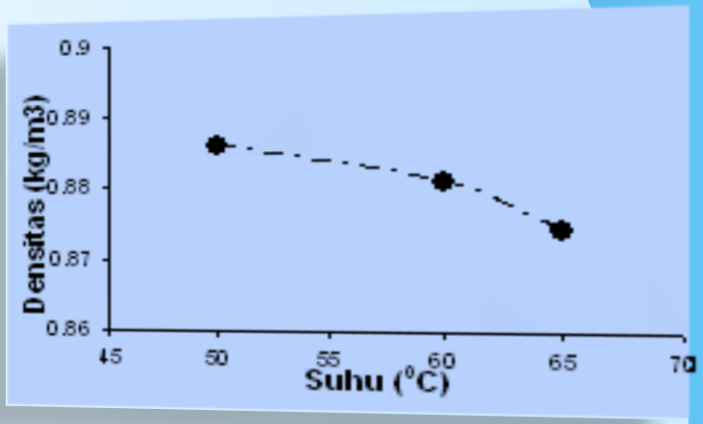
Analysis of product (3)

- Density



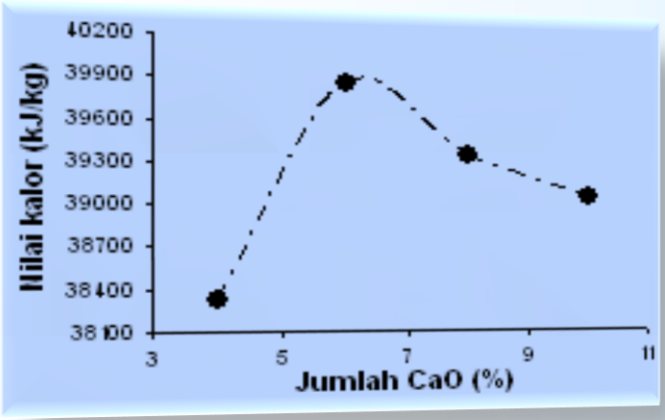


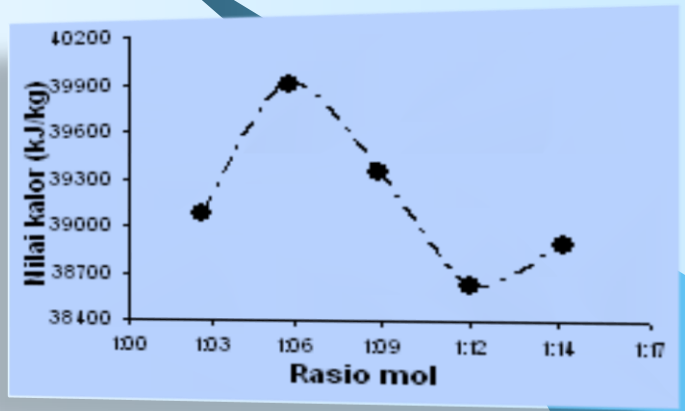


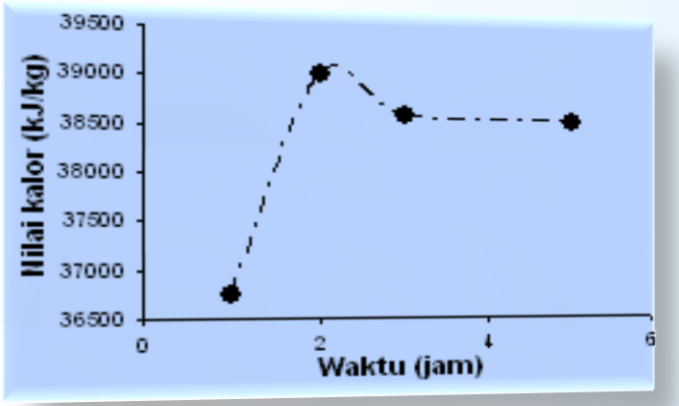


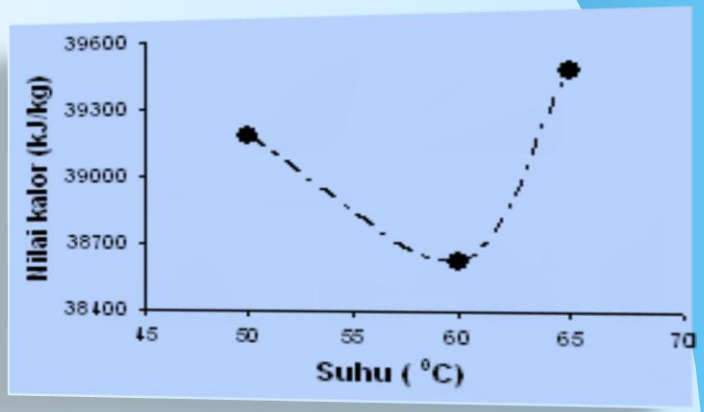
Analysis of product (4)

- Caloric value









Summary

- Transesterification of palm oil with methanol using CaO as heterogenous base catalyst produced biodiesel (methyl esters)
- Optimum parameter for transesterification process consisted of 6% CaO, mol ratio of 1:12, reaction time of 3 hours at 60 C giving yield of 99% of biodiesel.
- Analysis of product indicated that pH, density, *flash point*, and caloric value fitted to the Standadr of Forum Biodiesel Indonesia (FBI-S01-03) as well as European and US standards, whereas viscosity was slightly higher than FBI standard.

Acknowledgements

1. Directorate General of Higher Education (*DIKTI*)-Ministry of National Education Indonesia
2. Chemical Engineering Department – Bandung State Polytechnic (*POLBAN*) Indonesia

THANK YOU
FOR YOUR ATTENTION