

**BIODIESEL PRODUCTION FROM CRUDE PALM OIL  
(CPO) USING IMMOBILIZED LIPASE OF  
*Pseudomonas cepacia***

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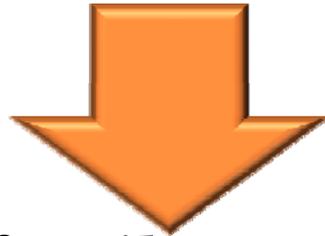
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# TREND TO BIOFUEL

- Decreasing of reserve fossil energy source
- Increasing of environmental attention



Shift of the using fossil energy source to bio fuel source

- Some kinds of biofuel
  - Biogas
  - Bioetanol
  - Biokerosin
  - Plant Pure Oil, and
  - **Biodiesel**



# WHAT IS BIODIESEL ?

- Alkyl ester derived from alcohol and alkylglycerol (tri-, di-, or monoglyceride)
- Methanol is mostly used in biodiesel production because it is cheap

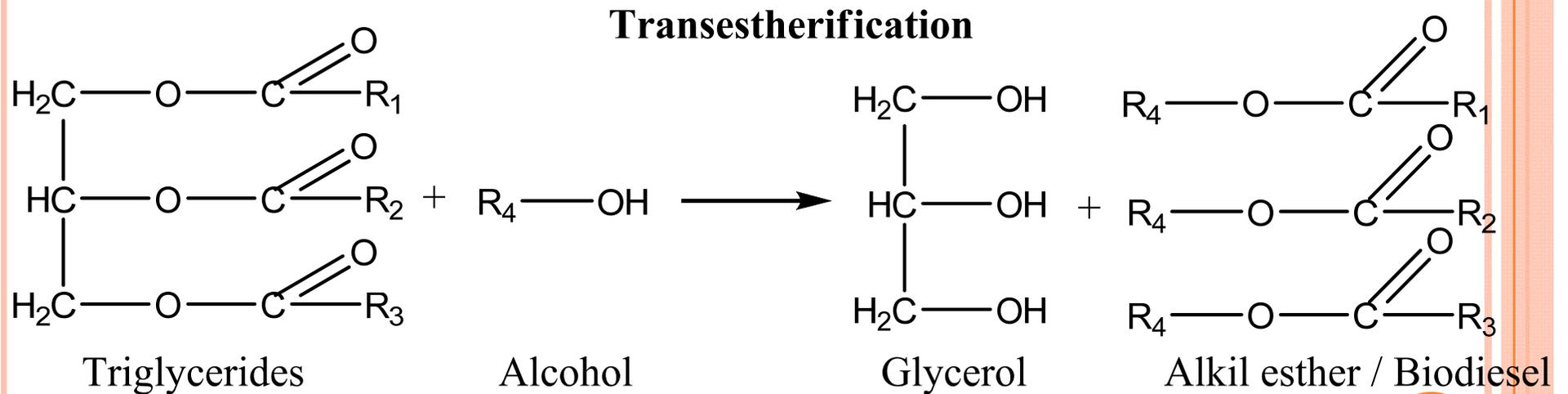
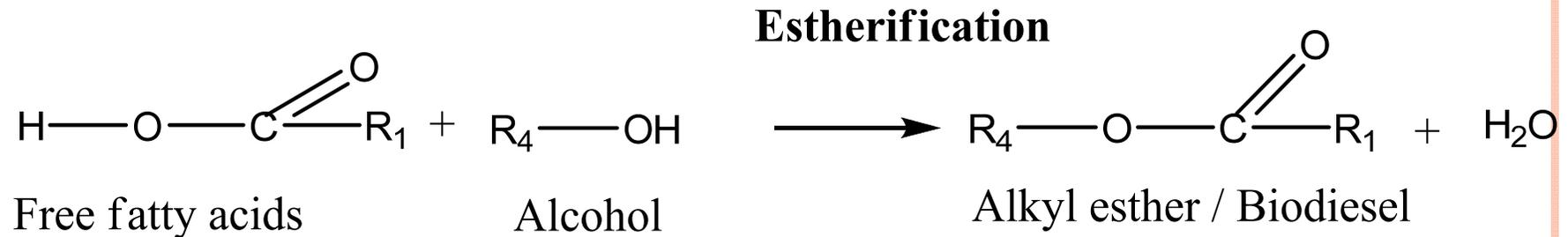


# PRODUCTION OF BIODIESEL

- Nowadays dominated by chemical reaction by basic catalyze
  - Disadvantages :
    - Difficulties of removing of catalyze and soap residues
    - Waste water treatment is needed
    - High cost for adsorbent
- Other method
  - Enzymatic process by lipase
    - *Still constrain by high cost for lipase*
  - Katalis padat
  - *Supercritical methanol*



# BIODIESEL SYNTHETIC REACTION



# ENZYMATIC PROCESS OF BIODIESEL

- Research for biodiesel production by enzymatic reaction become international trend in the last decade
- It has been established in pilot plant scale in Europe
- How is in Indonesia?
  - There is no report about biodiesel synthesis by enzymatic reaction research before
  - Mega diversity of biological sources
    - Raw Materials (plant oil and alcohol)
    - Microbes



# RESEARCH DESIGN

- Condition of production process
    - Types of raw materials
    - Ratio of oil and alcohol
    - Environment process
    - Enzymes
      - Easy to handle
      - Reuseable
  - Isolation of lipolytic microbes which has esterase activity
  - Lipase production
- 

# MATERIAL AND METHOD

## ○ Materials

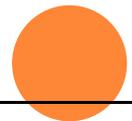
- Crude Palm Oil (CPO)
- Methanol
- *Pseudomonas cepacia* lipase

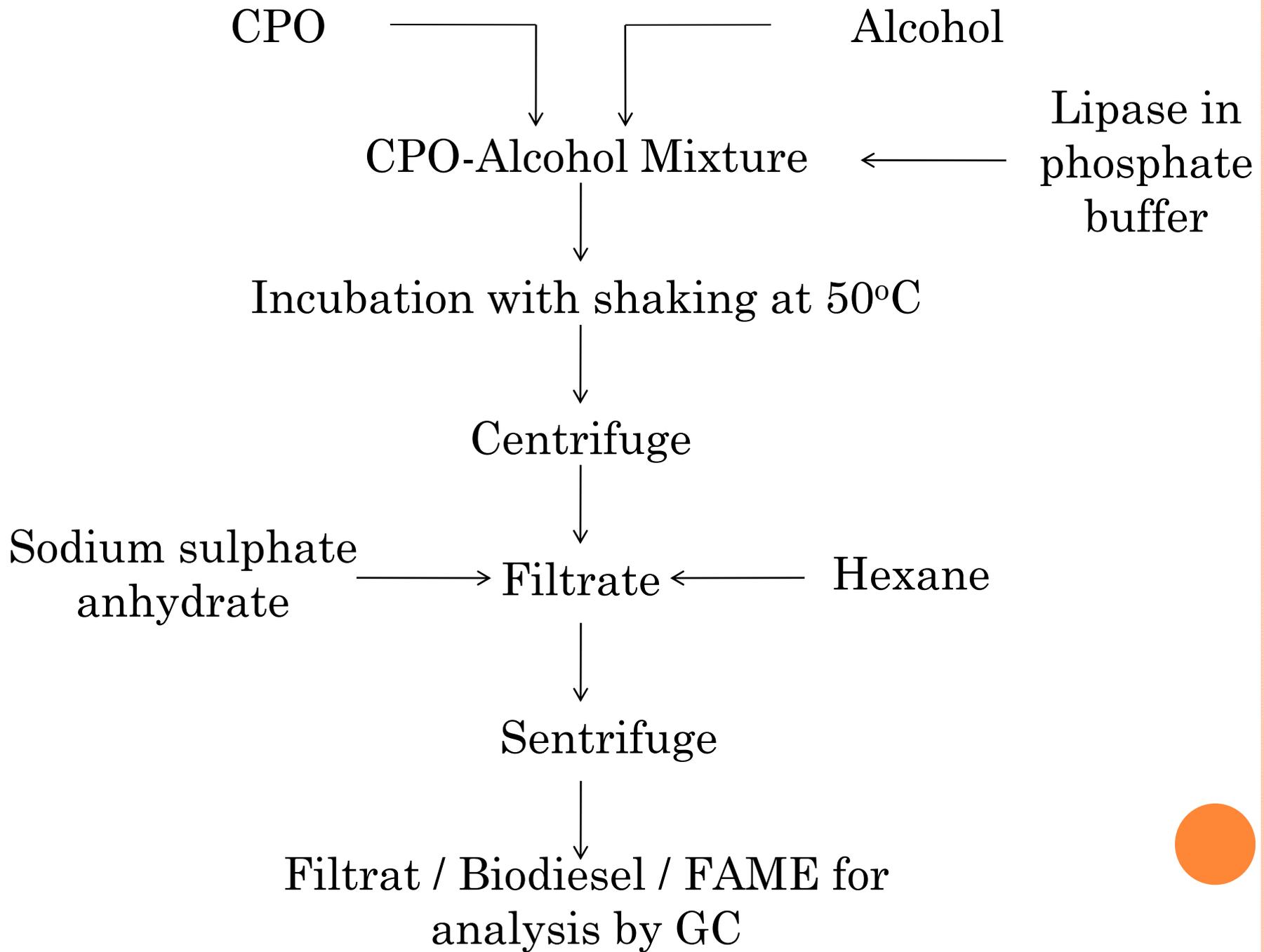
## ○ Research Procedure

- Methanolysis activity assay of *Pseudomonas cepacia* lipase
- Determination of molar ratio between CPO dan methanol
- Immobilization of lipase
- Biodiesel production method using immobile lipase produced

# CHARACTERISTICS OF CRUDE PALM OIL (CPO)

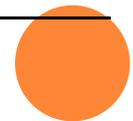
<b>Characteristics</b>	<b>Value</b>
Melting point	31-41 °C (average 35 °C)
Saturated fatty acids	49.9 %
Miristyc acid (C14:0)	1.0 %
Palmityc acid (C16:0)	44.3 %
Stearic acid (C18:0)	4.6 %
Unsaturated fatty acids	50.1 %
Oleic acid (C18:1)	38.7 %
Linoleic acid (C18:2)	10.5 %





# EFFECTS OF MOLAR RATIO BETWEEN OIL AND METHANOL IN FAME SYNTHESIS

<b>Molar ratio CPO : Methanol</b>	<b>Yield of FAME (%)</b>	
	<b>CPO</b>	<b>Commercial plant oleic oil (Bimoli)</b>
1 : 3	0.81	4.23
1 : 6	2.76	4.55
1 : 9	3.33	1.15

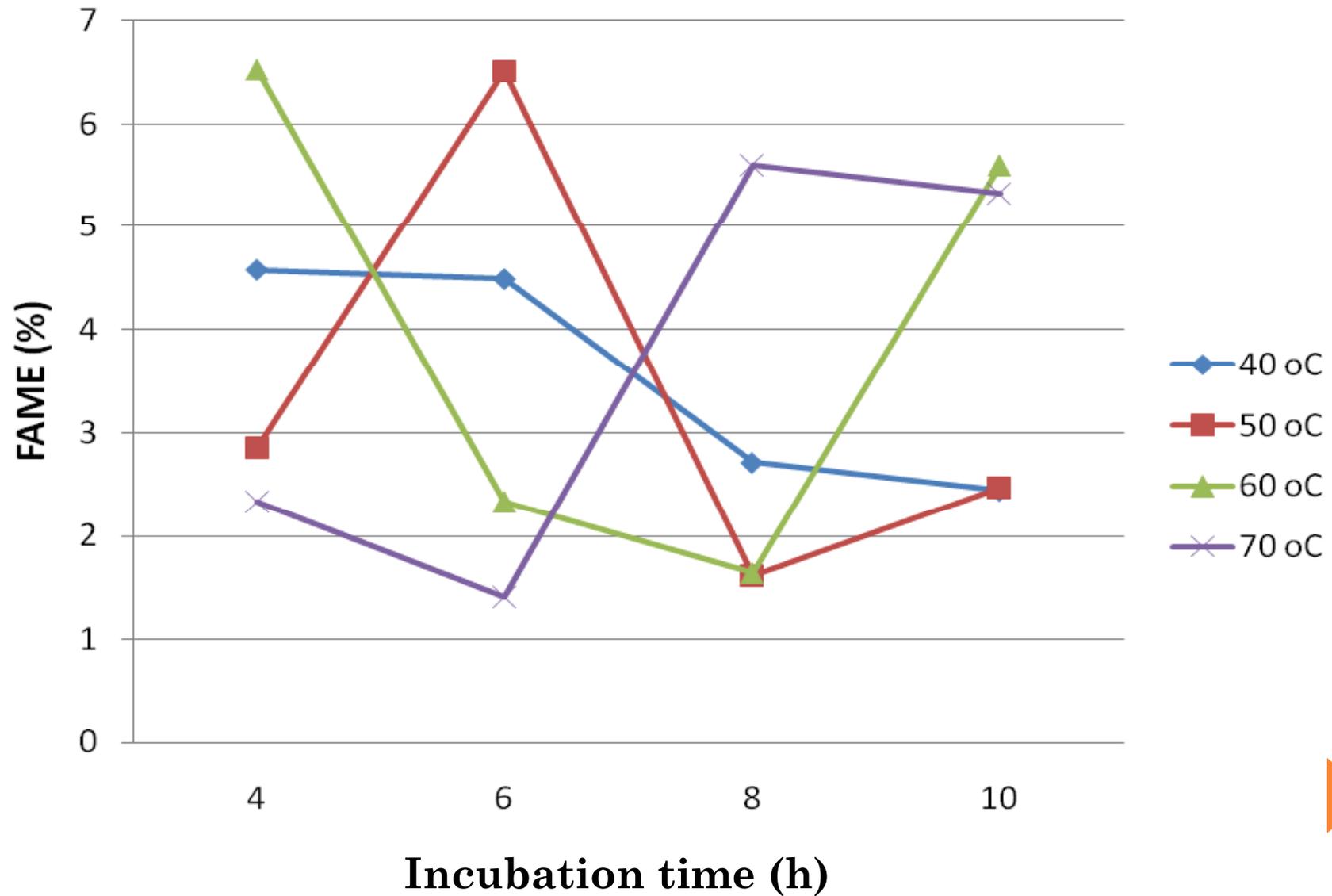


# MATRIX CAPACITY IN PROTEIN BINDING

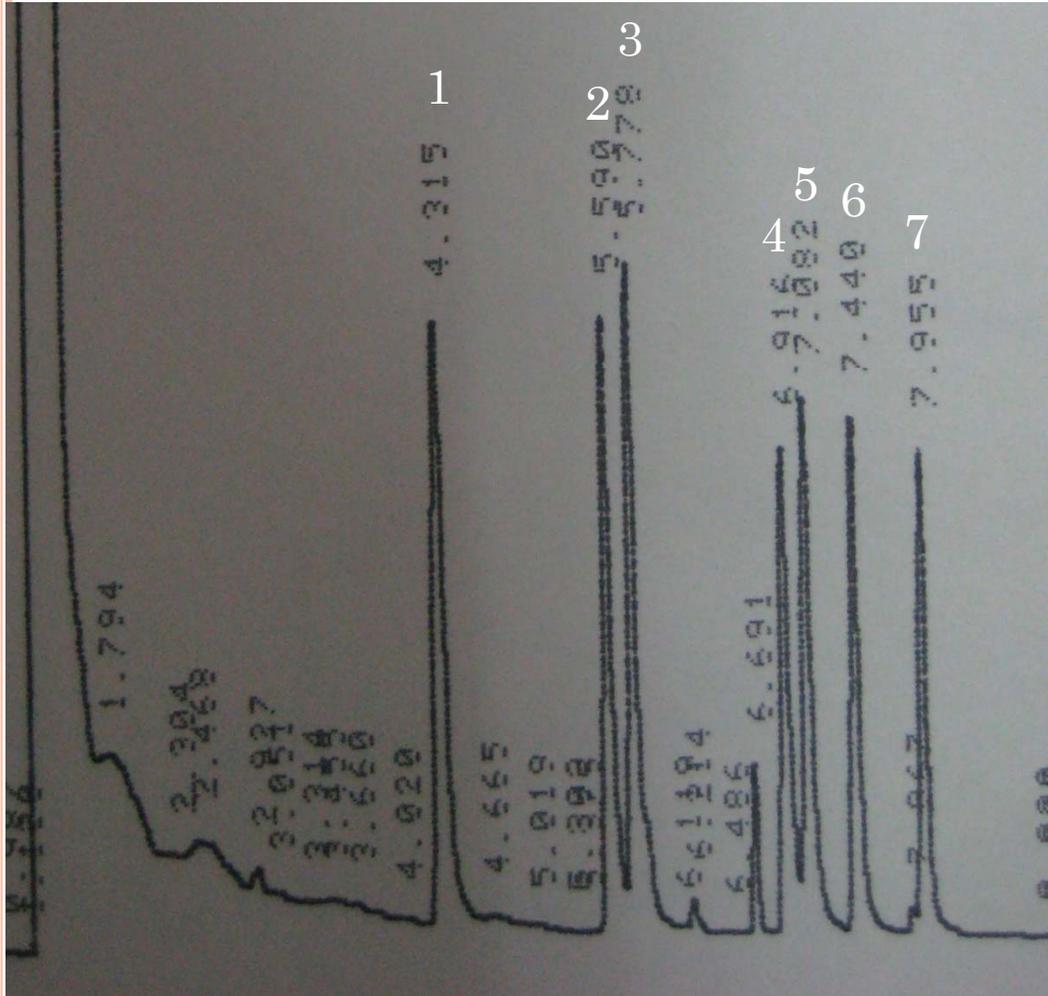
<b>Type of Matrixes</b>	<b>Protein content in enzyme solution (mg/mL)</b>		<b>Protein binded into matrix (mg/mL)</b>
	<b>Before</b>	<b>After</b>	
Caolin	1.7274	0.3690	1.3584
Celite	1.7106	0.9559	0.7547



# EFFECT OF TIME AND TEMPERATURE INCUBATION FOR BIODIESEL/FAME SYNTHESIS



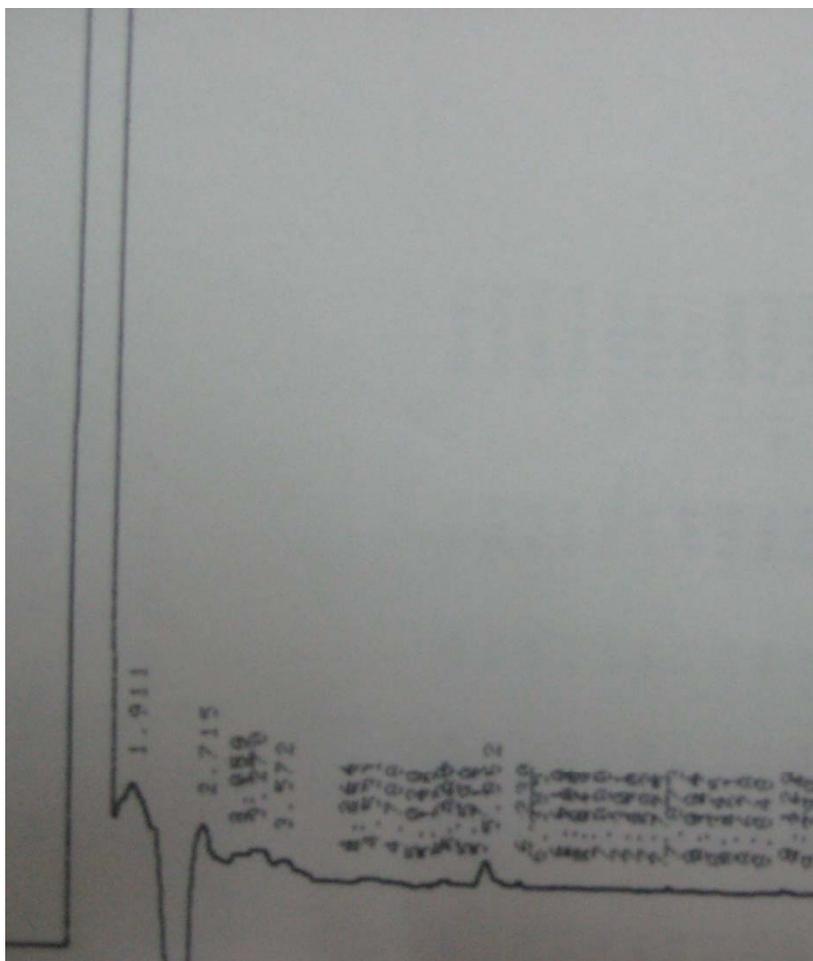
# STANDAR FAME



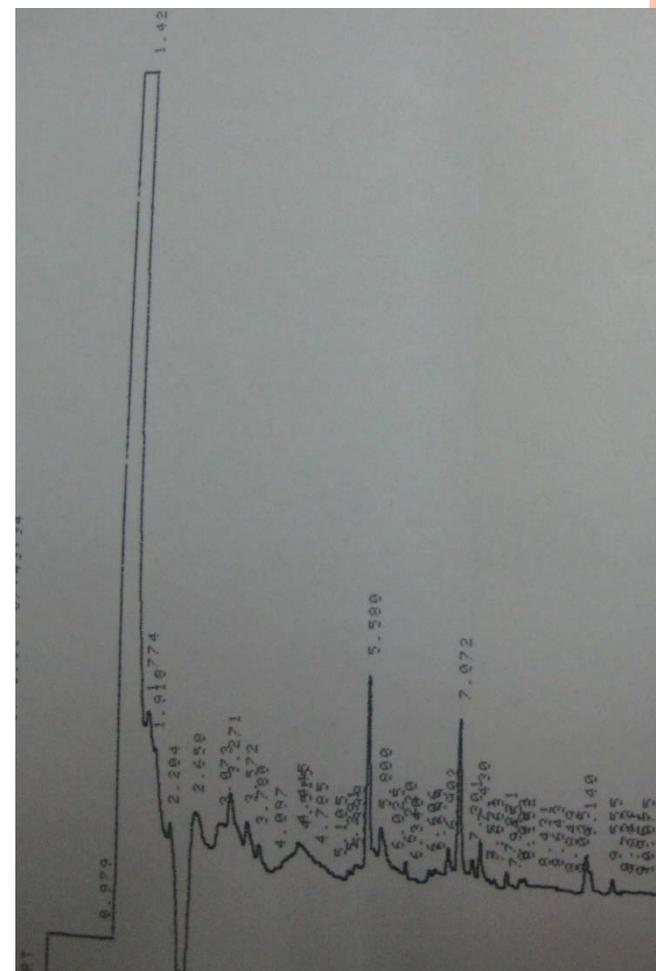
1. Methyl miristic C14:0
2. Methyl palmitic C16:0
3. Methyl palmitoleic C16:1
4. Methyl stearic C18:0
5. Methyl oleic C18:1
6. Methyl linoleic C18:2
7. Methyl linolenic C18:3



# FAME IN RBDPO AND CPO

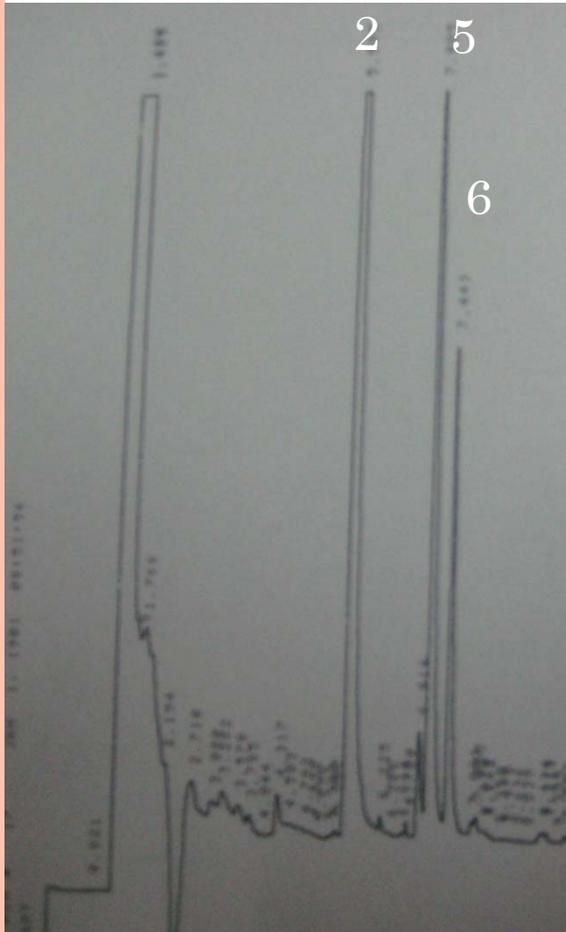


**Palm Oleic Oil (RBDPO, BIMOLI)**

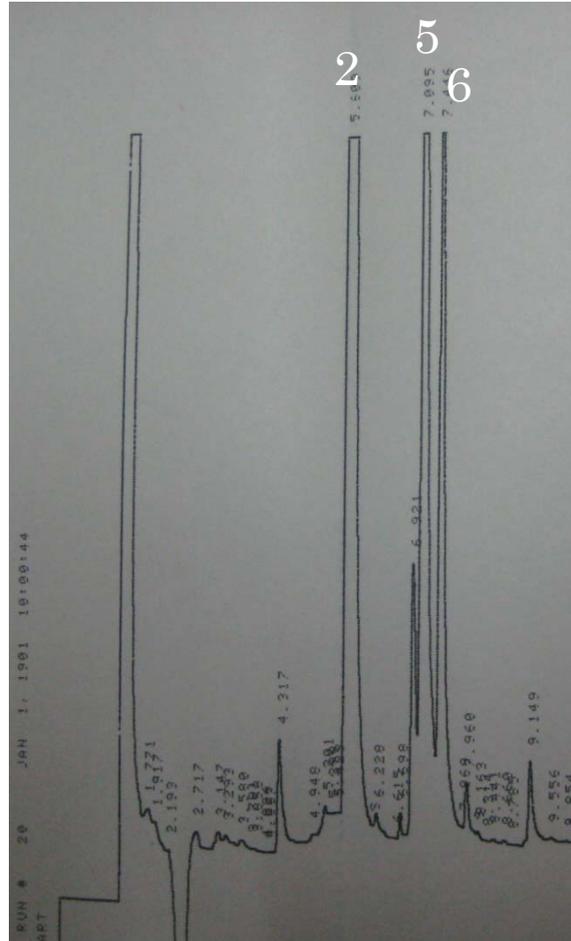


**C P O**

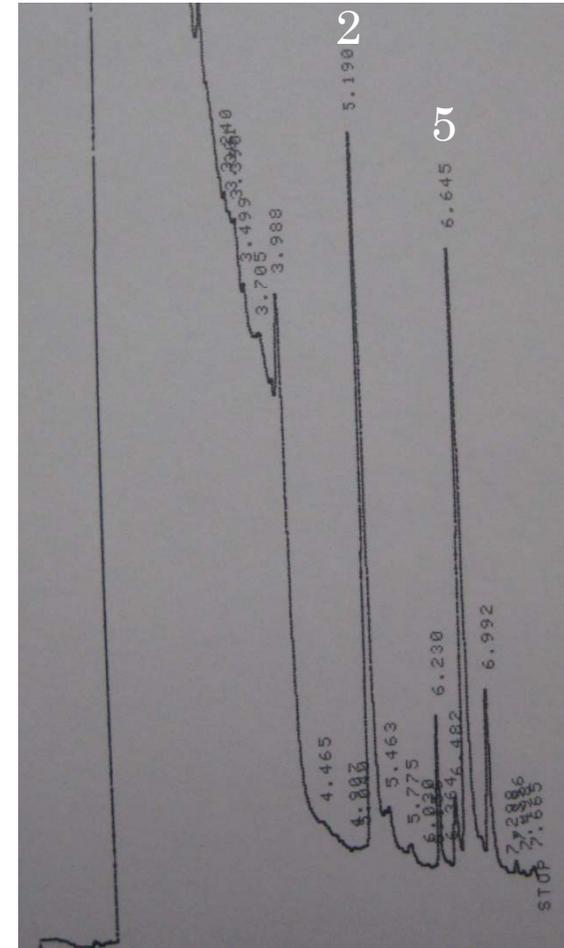
# FAME YANG TERBENTUK DARI



**Minyak Goreng  
(BIMOLI) dengan  
enzim powder**



**CPO dengan enzim  
powder**



**CPO dengan enzim  
amobil**

# DISCUSSION

- CPO can be used as alkyl glycerol source in biodiesel / FAME syntheses by enzymatic process
- Lipase from *Pseudomonas cepacia* is able to be applied as catalyst in biodiesel/FAME syntheses from CPO
- Yield of biodiesel/FAME was still very low
- Emulsifier application was not successful
- Isolation of lipolytic microbes which has esterase activity is in progress









**TERIMA KASIH**

