USQ Combustion Meeting
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PREMIXED COMBUSTION OF COCONUT OIL IN A HELE-SHAW CELL

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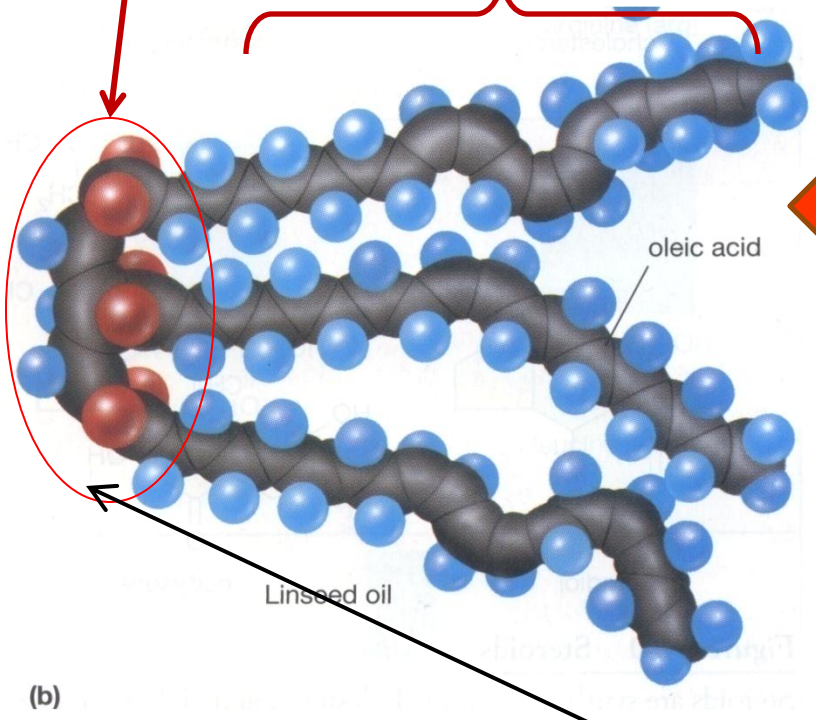
OUTLINE OF PRESENTATION

- INTRODUCTION
- EXPERIMENTS
- RESULTS AND DISCUSION
- CONCLUSION

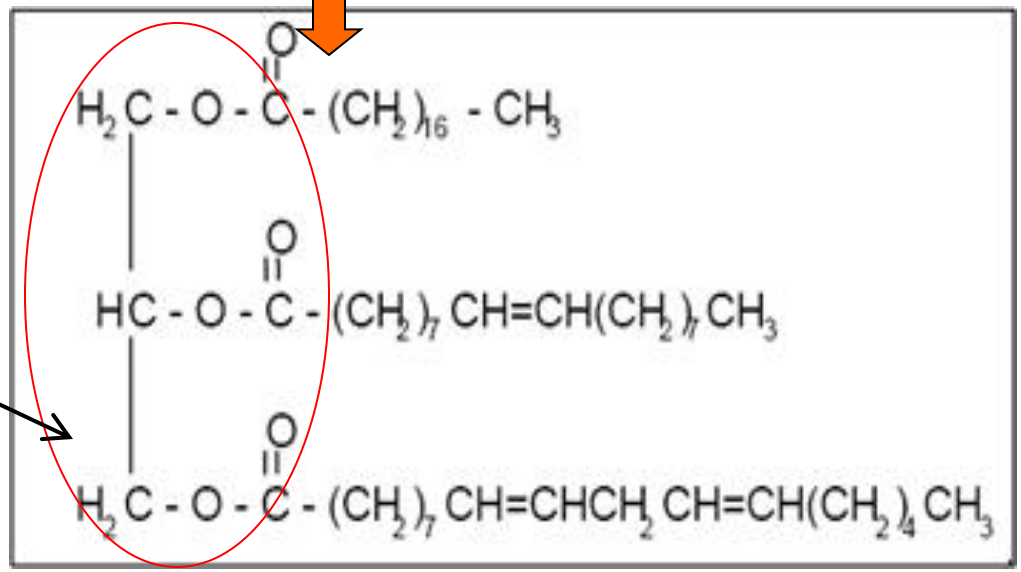
MOLECULAR STRUCTURE

Glycerol

Fatty acid



Coconut oil



Audesirk T. and Audesirk G. Biology, Life on Earth, 4th ed. Prentice Hall International p.45 (1996)

COCONUT OIL

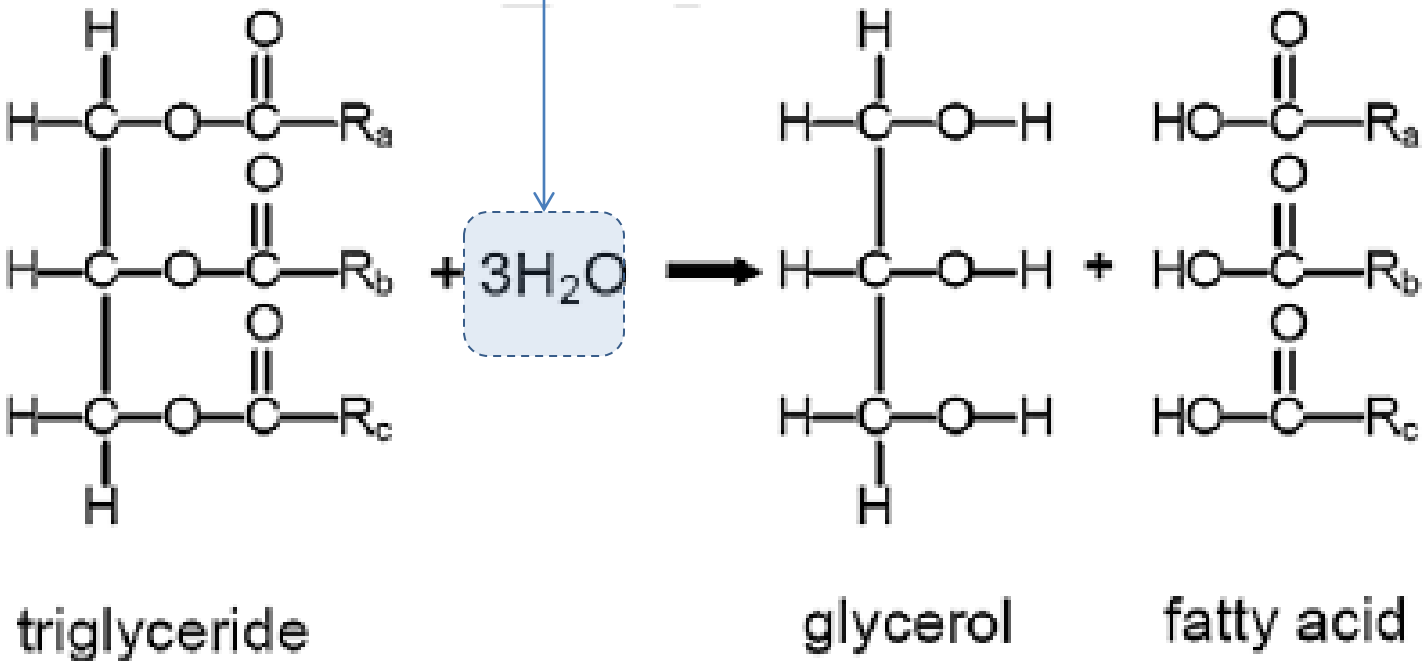
- Energy content: **3,607 kJ (862 kcal)/100g**
- Viscosity : 10 x fossil diesel fuel
- Comonly be used for Diesel Engine (Stright Vegetable Oil)

FUTURE GOAL

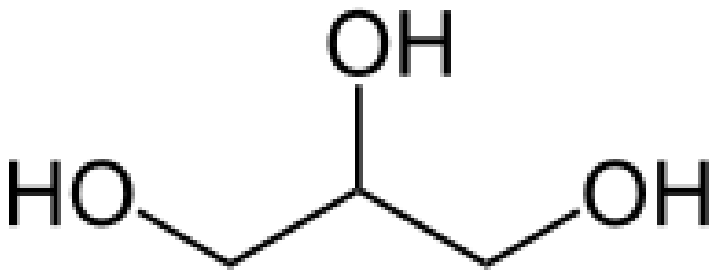
- **To promote premixed combustion technology for coconut oil**

HYDROLYSIS REACTION OF TRIGLYCERIDE

COMBUSTION REACTION: $a\mathbf{C_xH_yO_z} + b\mathbf{O_2} \rightarrow c\mathbf{CO_2} + d\mathbf{H_2O}$



GLYCEROL



Molecular formula: $C_3H_8O_3$

hygroscopic

Flash point: **160 °C** (closed cup)

176 °C (open cup)

Boiling point: **290 °C**

Molar mass: 92.09 g mol^{-1}

Main Fatty acid in coconut oil

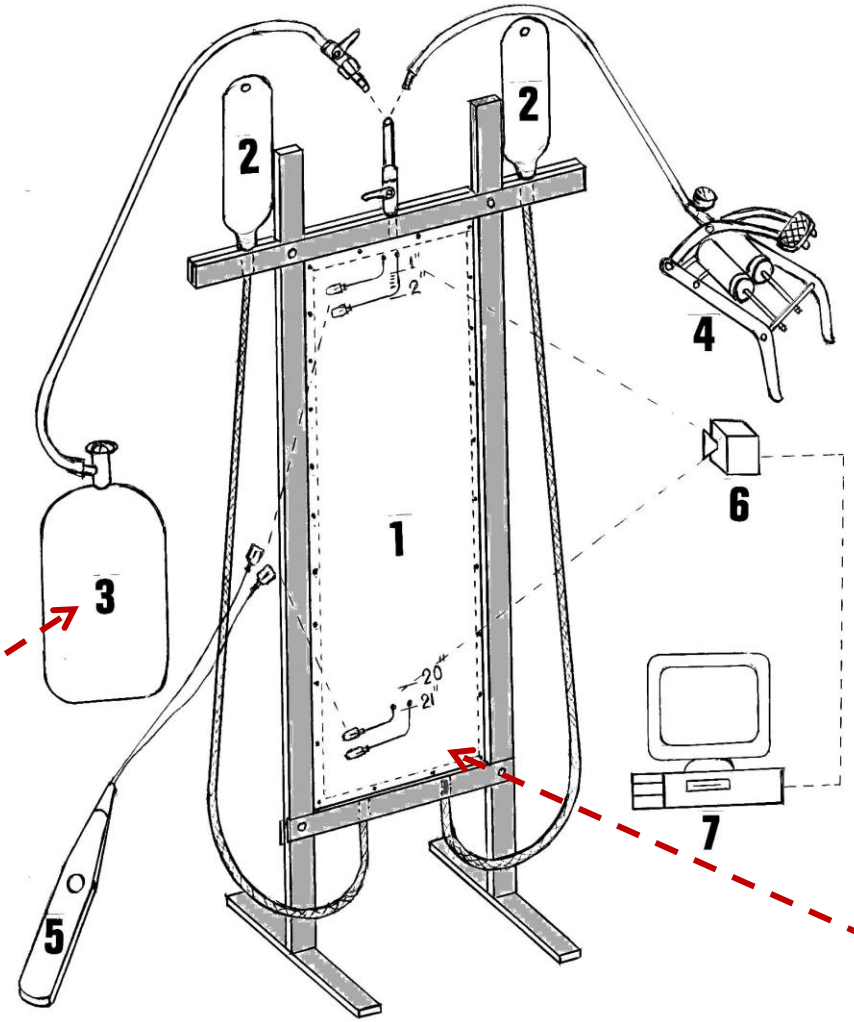
Fatty Acid	Composition/ Molecular Formula	%	Flash point (°C)
Lauric acid	C 12:0 / **$C_{12}H_{24}O_2$**	45.1 - 53.2	**≥110**
Myristic acid	C 14:0 / **$C_{14}H_{28}O_2$**	16.8 - 21.0	-

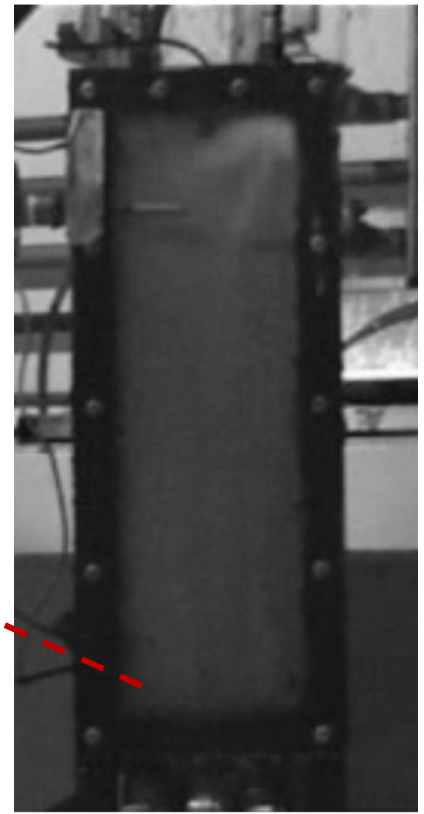
RESEARCH OBJECTIVE

- To elucidate **Combustion Behavior** of **MULTI COMPONENTS** FATTY ACIDS AND GLYCEROL IN COCONUT OIL

EXPERIMENT

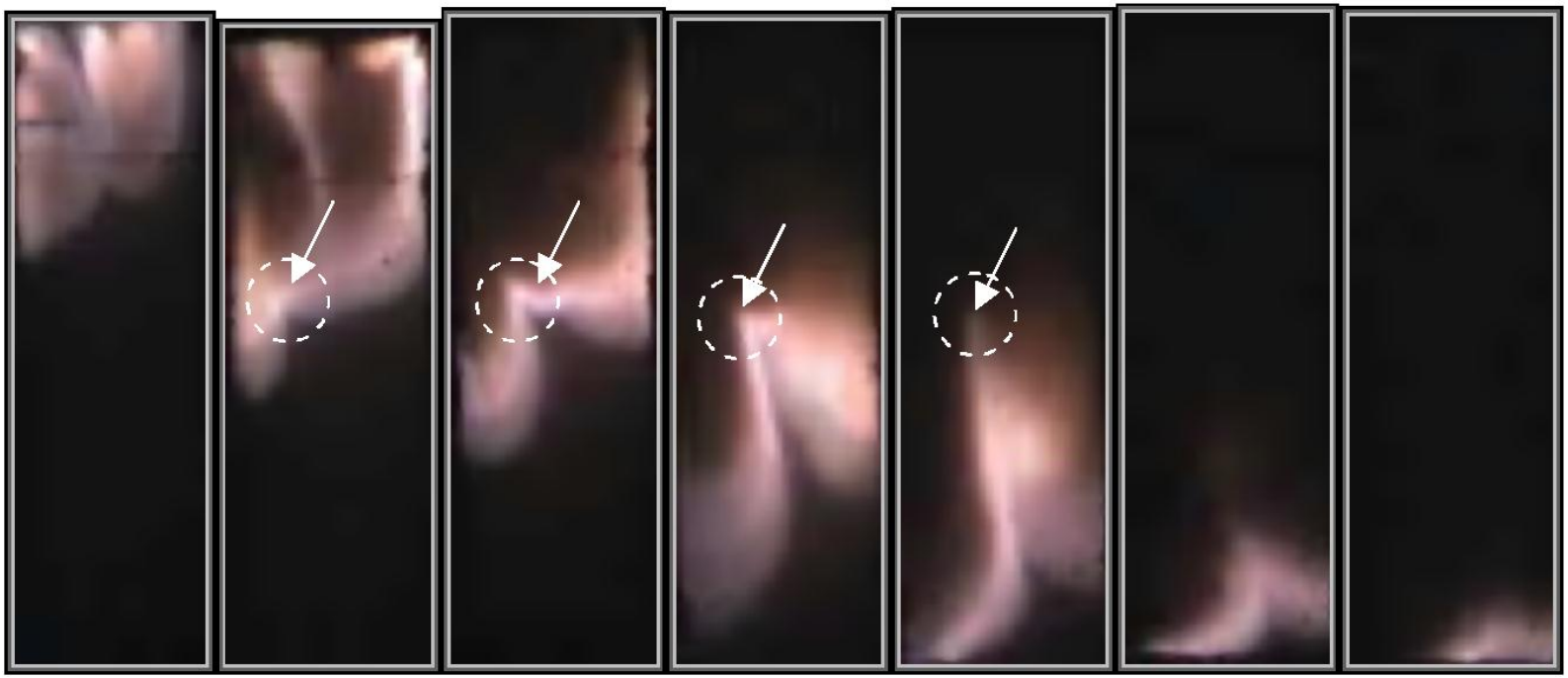
AFR= 5.3 to 7.4



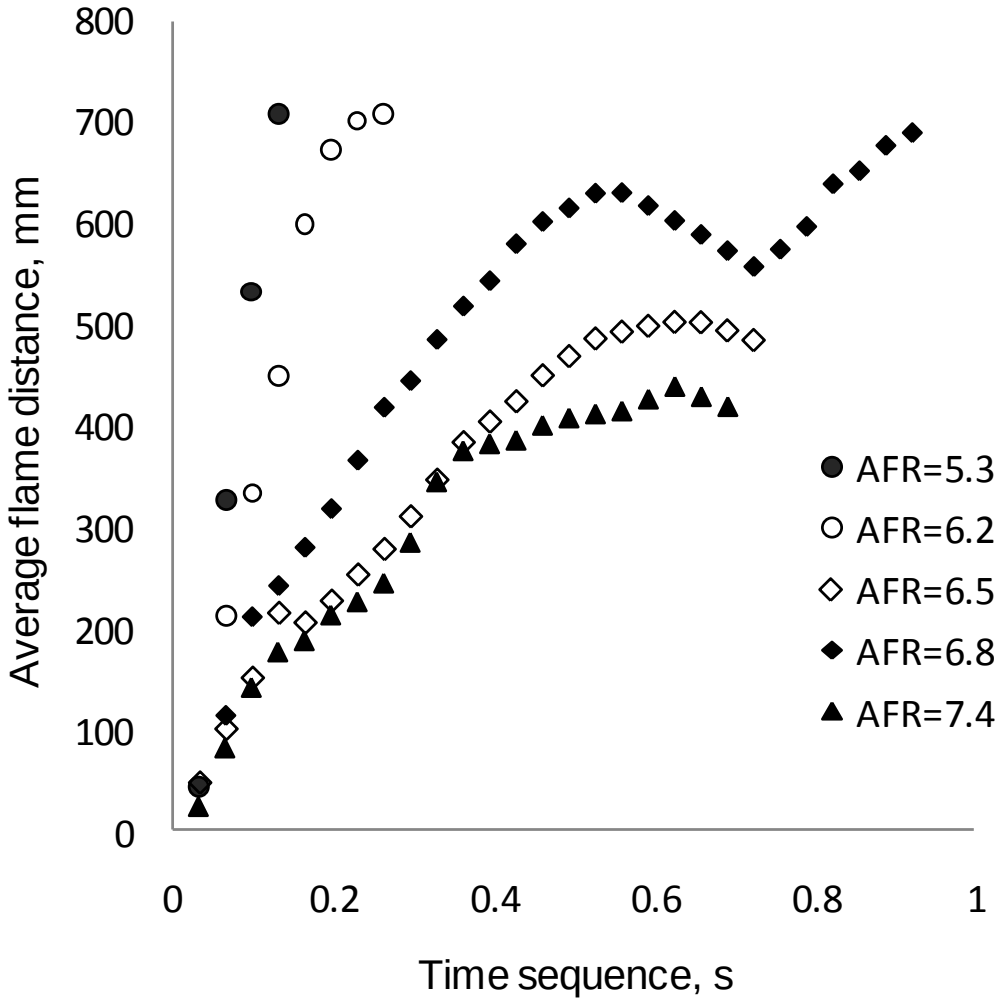


Downward flame propagation (AFR = 5.3)

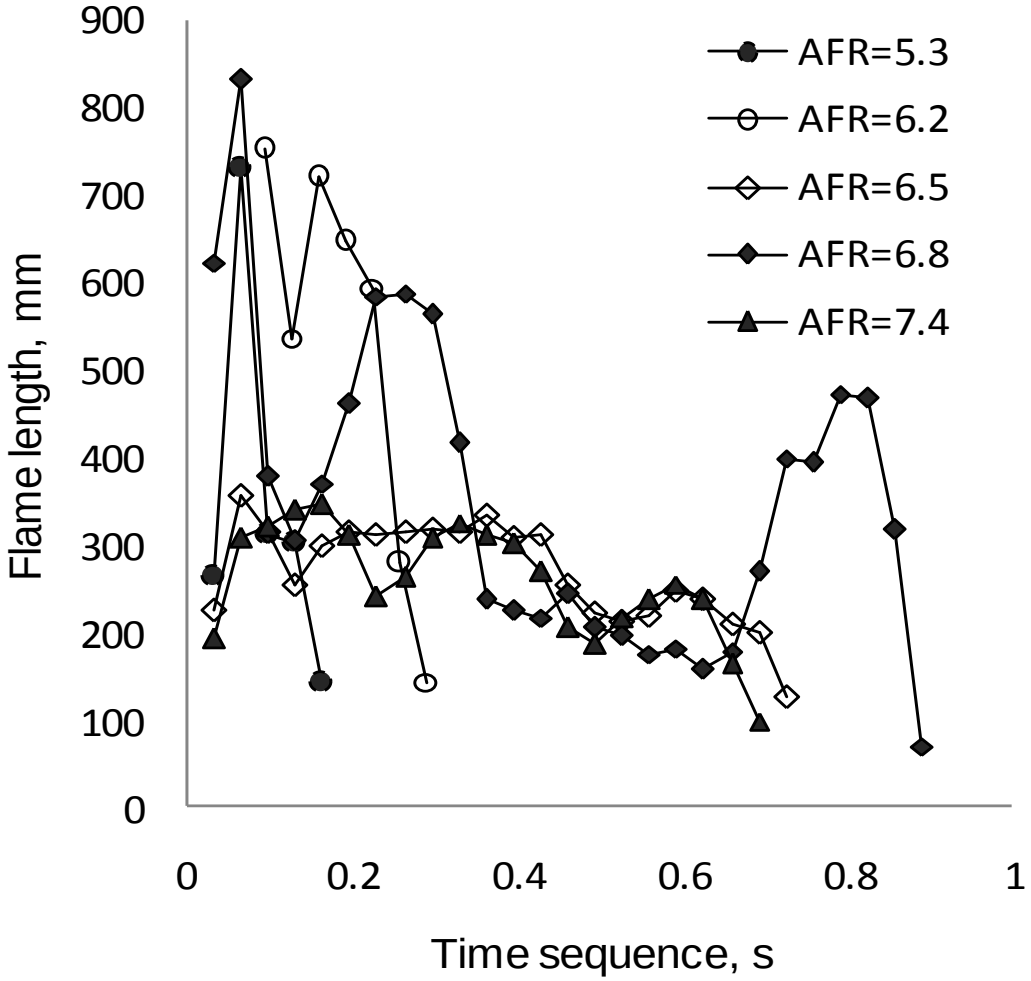
Downward flame propagation (AFR = 6.2)



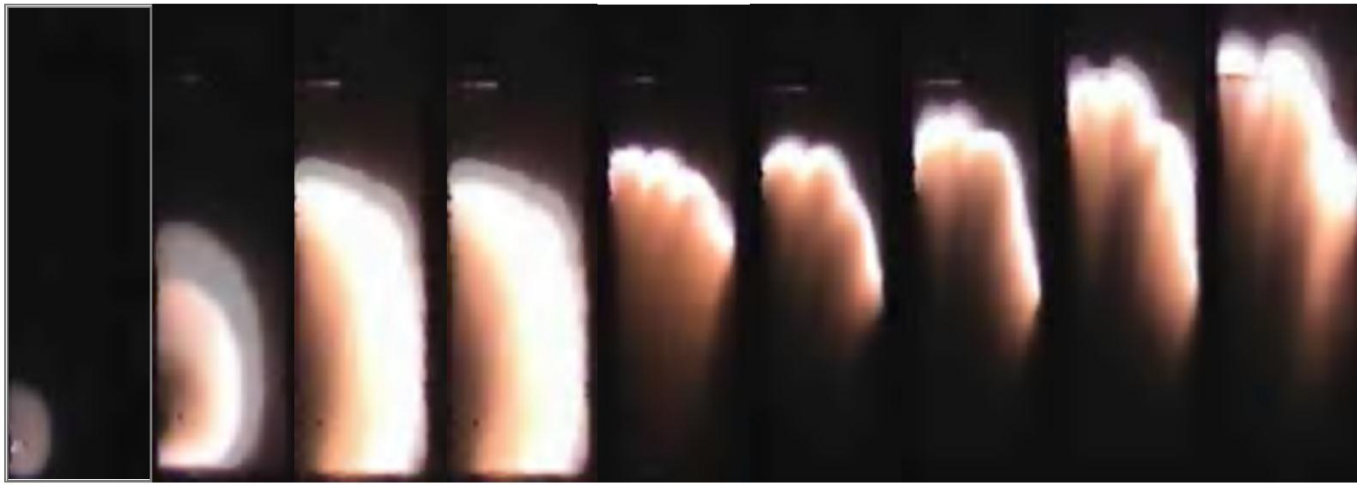
Average Flame Distance in Downward Propagation



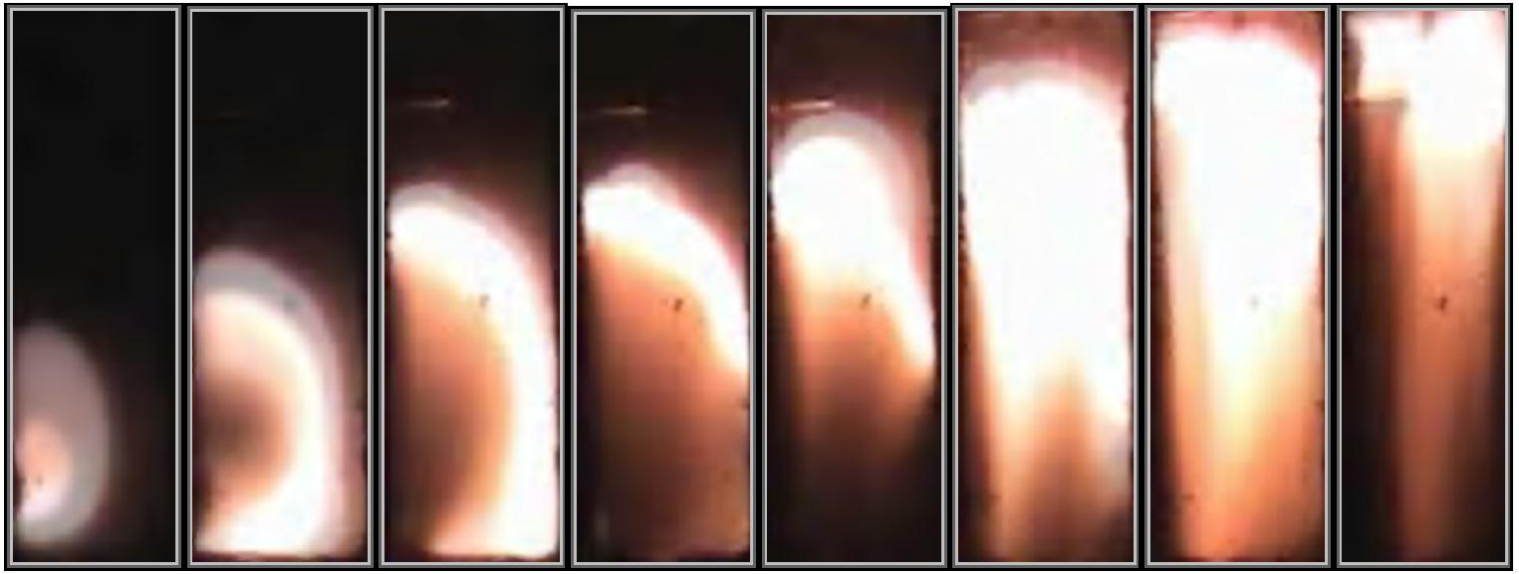
Flame Length in Downward Propagation



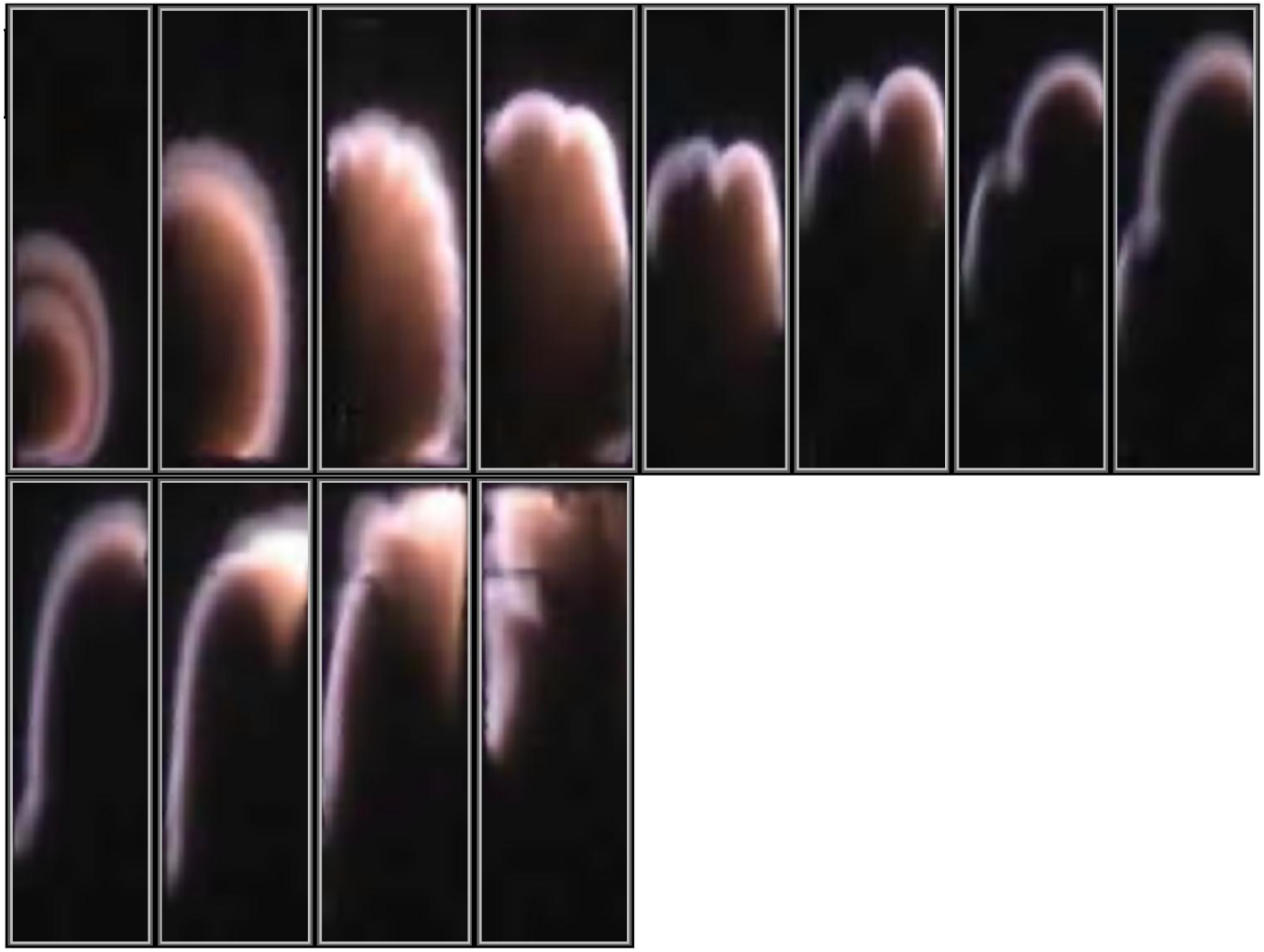
Upward Flame Propagation (AFR = 5.3)



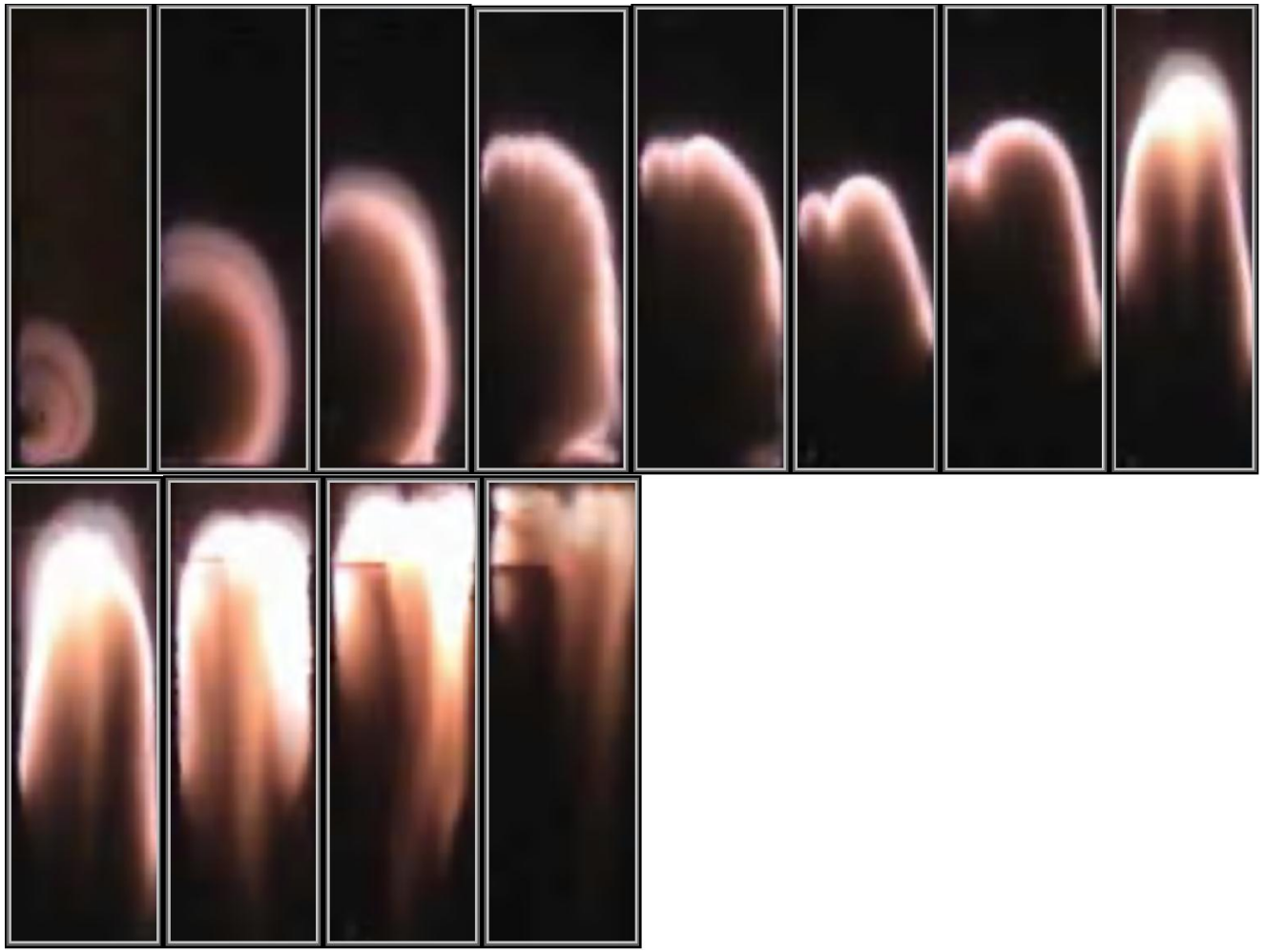
Upward Flame Propagation (AFR = 6.2)



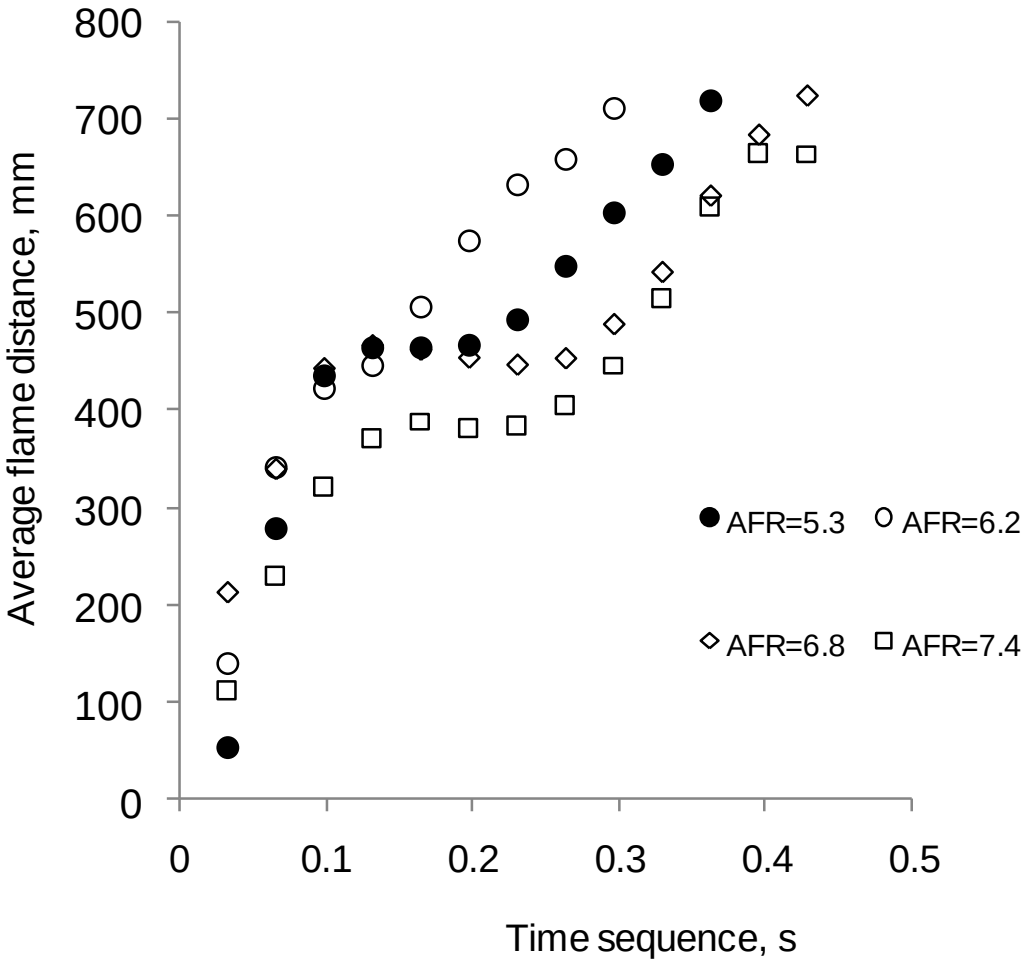
Upward Flame Propagation (AFR = 6.8)



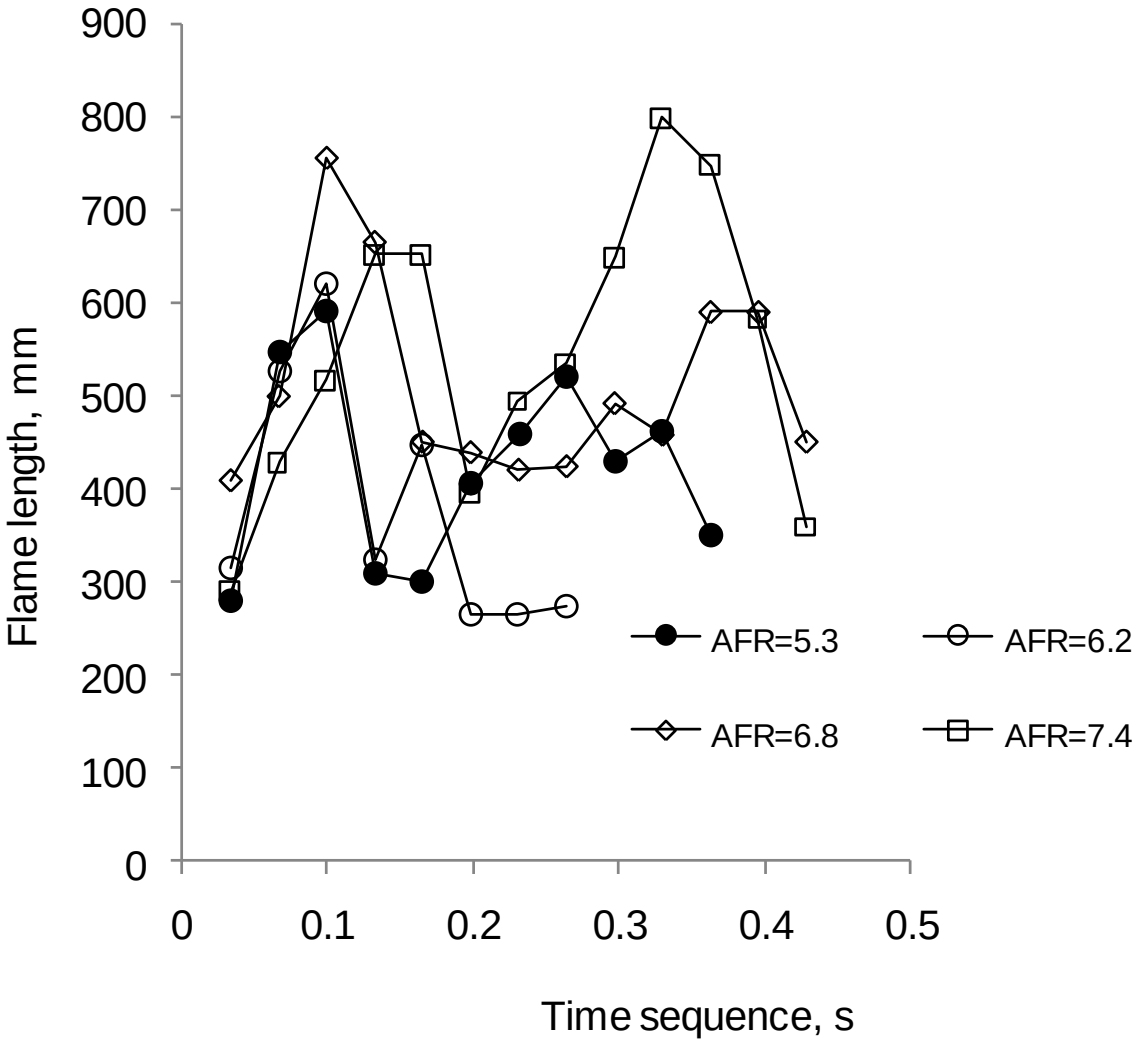
Upward Flame Propagation (AFR = 7.4)



Average Flame Distance in Upward Propagation



Flame Length in Upward Propagation



CONCLUSION

- Coconut oil tends to **break** into **glycerol** and **fatty acid**. Fatty acid burns first and glycerol does later.
- Fatty acid combustion produced **separated flame** which is clearly visible at lean mixture
- The ignition of glycerol needs substatial heating that **slows down flame** propagation and tends to **EXPLODE**