

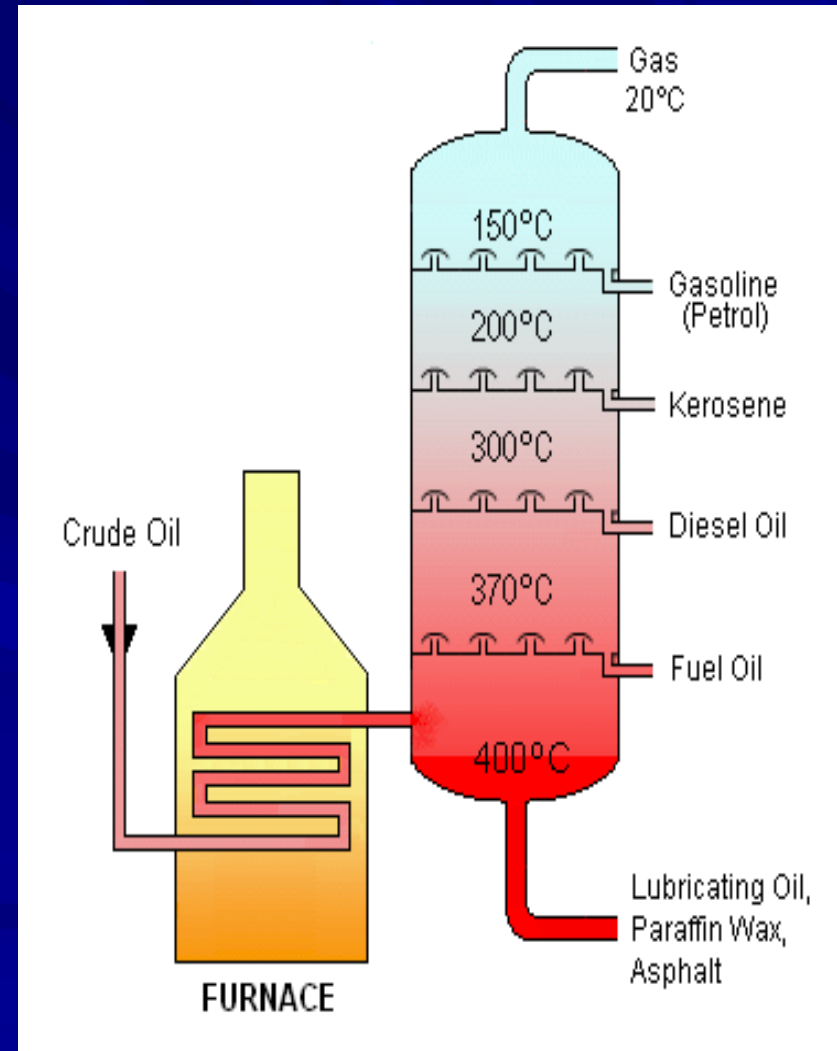
# Testing evaporative fractionation as a mode of reservoir alteration in selected Malay Basin Oils

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# INTRODUCTION

- In Malay Basin, the nature of accumulated hydrocarbons is variable both laterally and vertically.
- Oils from different reservoirs are not uniform in a particular field and oils in the same reservoir in different fields are also not uniform. This variation of the composition of oil can be ascribed to variations of organic facies in the source rock or it can be possible by in-reservoir alteration. So far it has been justified by assuming facies variation in source rocks.

# INTRODUCTION

- However, compositional change can also occur by evaporative fractionation. In which injected gas over oil can dissolve some compounds of oil and remove as the gas escapes.
- This process cause generation of two different liquids: (1) High gravity retrograde condensate in shallower reservoir and (2) low gravity residual oil in the original reservoir.

# PROBLEM STATEMENT

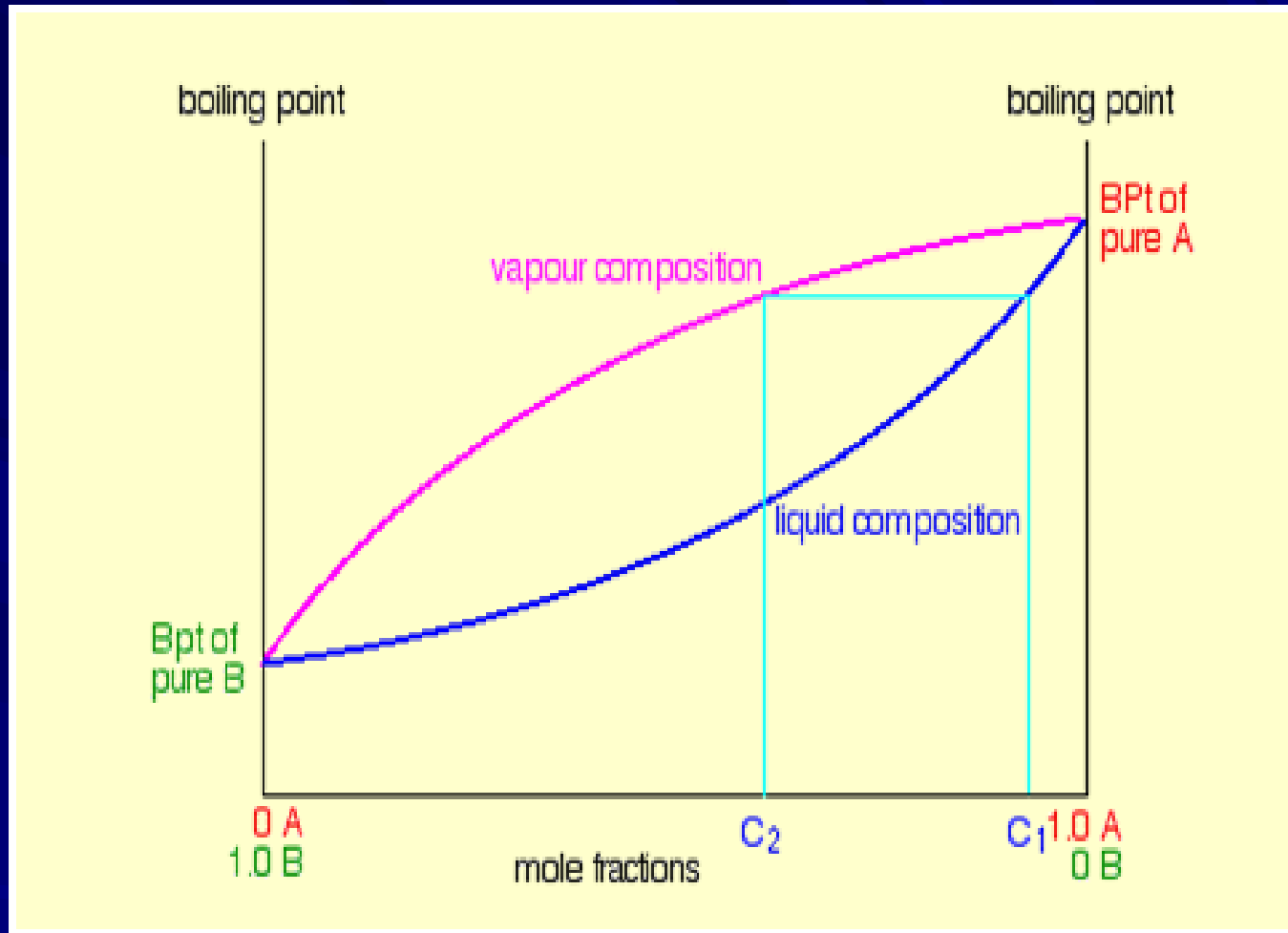
There is appreciable vertical and lateral variations in composition for Malay Basin Oils. So far it is ascribed to the organic facies variation without any conclusive evidence. However, evaporative fractionation also can change oil characters by redistribution of compounds in distillates and residues. It is necessary to experimentally verify the nature of distributed hydrocarbons in the Malay Basin using modified evaporative fractionation technique.

# OBJECTIVES

- **Compositional variations of selected Malay Basin Oils to be tested using modified evaporative fractionation technique.**
- **Trend of variations in terms of paraffinicity and aromaticity with pressure and temperature to be established.**

# LITERATURE REVIEW

- Evaporative fractionation is defined as the vaporization process of gas-carrying oil in the gas phase vertically through faults, fractures, and other permeable pathways and being trapped as condensate in the shallower reservoir, in order to emphasize that it involves a fractionation process that can form aromatic condensates.
- It is also known as geologic process of reservoir alteration of crudes during which lighter fraction of oil is evaporated and condensed in the shallower reservoirs (Thompson, 1987)



**Phase behaviour of a mixture of two ideal liquids  
at 1atm. pressure**



# LITERATURE REVIEW

- The process involves (i) a charge of gas (generally dry) entering an existing oil accumulation, (ii) the gas then equilibrates with the light components of the reservoir oil, and then (iii) the gas is vented from the accumulation, taking with it dissolved components that originally were part of the oil accumulation.
- The migrating gas may then condense out a liquid (or “retrograde condensate”) in a shallower reservoir.
- Therefore, this process is the cause of two new fluids: (1) High-gravity retrograde condensate in a shallower reservoir, and (2) Lower gravity, more aromatic residual oil (in the original reservoir) depleted in the light paraffin’s and enriched in the other fractions and this process known as fractionation

# LITERATURE REVIEW

- Oils in Malay Basin maybe classified into three groups which are Group E, Group I and Pre-Group I.
- Each of the oil characteristics in Malay Basin has different types of oil and it is not uniform.
- Group E is different from Group I and Pre-Group I. There is no sufficient types of group that mention in Malay Basin's oil.

# METHODOLOGY

Literature Review

Fieldwork & Sampling

Laboratory & Data Analysis

Results & Discussion

Reports

# Fieldwork & Sampling

- Collecting the oil sample from each of Dulang, Angsi and Sabah area
- Each of the oil is based on their vertical variations.
- Sabah oil is sampled to get a comparison of the characteristics of oil in Malay Basin with Sabah Basin.

# Dulang

- Dulang is belonging to Group E oils in Malay basin that are geographically restricted to the basin centre.
- Gas that produced is known to be high in CO<sub>2</sub>.
- Located approximately 130 km offshore Kuala Terengganu in a water depth 76 m in South China sea.
- Reservoir sands are of late Miocene age and exhibit a complex stratigraphic layering within an elongated anticline divided by numerous faults.
- Dulang's well contains oil only.

# Angsi

- Angsi is belonging to Pre-group I oils in Malay basin.
- Located 170 km off east coast of peninsular Malaysia, southern region of Malay basin with water depth of 69 m.
- The geochemical characteristics vary only little and this variation is considered to be due to a combination of differing maturity of the oils and of post-accumulation processes such as evaporative fractionation.
- Angsi's well contains oil and gas.

# Sabah

- Crude oils in Sabah basin are generally light, slightly waxy and have low sulphur.
- Located 58 km (36 mile) off west coast of east Malaysia.
- The crude oil is dredge in 12,000 m depth with pressure 1250 psi and temperature 90°F.
- Sabah's well contain oil.

# Laboratory & Data Analysis

- Put the oil samples in the fractionating instrument and heat at different temperature to generate excess vapour pressure.
- At this extra pressure, vapour will equilibrate with the liquid and some molecules will be withdrawn from the liquid to vapour phase.
- This vapour when condensed, generates a different liquid from the original and also changes the composition of the original.





Pressure reactor

# Parameter

Designation	Definition	Property assessed
A	Benzene/n-hexane	Aromaticity (fractionation)
B	Toluene/n-heptane	Aromaticity (fractionation)
X	Xylene (m & p)/n-octane	Aromaticity (fractionation)
C	(n-hexane + n-heptane) / (cyclohexane + methylcyclohexane)	Paraffinicity (maturity)
I (isoheptane value)	(Methylhexanes (2- & 3-)) / (dimethylcyclopentanes (1c3-, 1t3-, & 1t2-))	Paraffinicity (maturity)
F	n-heptane / methylcyclohexane	Paraffinicity (maturity)
H (heptane value)	100 n-heptane / ( $\Sigma$ cyclohexane through methylcyclohexane) <sup>a</sup>	Paraffinicity (maturity)
R	n-heptane / 2-methylhexane	Extent of branching
U	Cyclohexane / methylcyclopentane	Extent of branching

Source: Thompson 1987

# Results & Discussions

- Analysis of parafinicity and aromaticity in condensed vapour and the residual liquid.
- Plot of parafinicity and aromaticity ratios at different P/T conditions.
- The purpose of this graph to get a trend line of oil in Malay Basin.
- To understand the behavior of oil in different temperature and pressure.

# CONCLUSION

- **Paraffinicity and aromaticity changes with evaporative fractionation.**
- **Nature of the Malay Basin Oils are variable laterally and vertically**

Thank you