

**Evaluation on Effectiveness of Ionic Liquids as Kinetic Hydrates Inhibitor
Using Micro Differential Scanning Calorimeter (μ DSC)**

by

Nik Fazril Ain Binti Sopian

Dissertation submitted in partial fulfilment
of the requirement for the
Bachelor Engineering (Hons)
(Petroleum Engineering)

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CERTIFICATION OF APPROVAL

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Petroleum Engineering Programme
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BACHELOR OF ENGINEERING (Hons)
(PETROLEUM ENGINEERING)

Approved by,

(Mazuin Binti Jasamai)

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK

September 2012

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

NIK FAZRIL AIN BINTI SAPIAN

ABSTRACT

Formation of hydrates is a major flow assurance problem especially in deep water environment. Hydrates, formation can cause reduction in flow efficiency of the hydrocarbon transmission due to the plugging form inside the pipeline. Due to flow interruption, high cost of maintenance operations and application of expensive conventional inhibition methods such as gas dehydration, water removal, pressure maintenance and chemical additives causes economic losses to the industry. Common inhibition methods aim to shift the hydrate equilibrium curve using chemical additives or also known as thermodynamic inhibitors (THI) are less favourable as it is needed in large concentration thus associated with large cost expenditure. Therefore, this project aims to see the effective concentration at which ionic liquids perform the best as kinetic inhibitors to delay the hydrate formation time. The 2 ionic liquids tested in this study are 1-butyl-3-methylimidazolium tetrafluoroborate [BMIM][BF₄] and 1-ethyl-3-methylimidazolium tetrafluoroborate [EMIM][BF₄] at 2 different concentrations in carbon dioxide (CO₂) hydrate system with comparison against a blank sample. Micro Differential Scanning Calorimeter (μ DSC) is used to measure the heat flow in the system against time to measure ionic liquid effectiveness to delay hydrate induction time. The result confirmed the hypothesis made as both type of ionic liquid shows a positive result when they are used. The effects of ionic liquid can be clearly seen when the result shows positive increment in the mean induction time for CO₂ hydrates to form. At concentration of 1.0 wt%, [EMIM][BF₄] shows about 6.8% of time delay improvement while [BMIM][BF₄] shows 5.7 % time increment. Comparison against a water-soluble polymer poly (vinylpyrrolidone) (PVP) at 0.1wt% shows that PVP induction time is less than [EMIM][BF₄] but better than [BMIM][BF₄]. The tests results concluded that [EMIM][BF₄] can be a potential CO₂ hydrate kinetic inhibitor at as low as 0.1 wt% concentration and proven to be better than [BMIM][BF₄].

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