

Molecular Interaction Study on a New Application of Ionic Liquids as Dissolver Toward Carbonate Scale

(Kajian Interaksi Molekul terhadap Aplikasi Baharu Cecair Ion sebagai Pelarut kepada Skala Kalsium Karbonat)

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ABSTRACT

Latest advances of ionic liquids (ILs) have allowed to a new application on the dissolution of calcium carbonate (CaCO₃) scales where the CaCO₃ scale deposition have seriously severe threat in the petroleum field. In this study, the molecular interaction between CaCO₃ and ILs n-pyridinium chloride [NPy][Cl] was studied experimentally in order to get a better understanding during the dissolution of scale. NMR and FTIR spectroscopy was used to study the molecular interaction between CaCO₃ and [NPy][Cl] solution during the dissolution process. To further evaluate the result, the simulation study using Gaussian software was utilized to predict in detail the molecular interaction between [Npy][Cl] and CaCO₃. The finding from this study showed that the metal complex was formed via ligand after dissolution scale process. Based on the findings, it can be clinched that [Npy][Cl] has potential to be used as a scale dissolver in the oilfield, especially in dissolving calcium carbonate scales.

Keywords: Calcium carbonate; dissolution; ionic liquids; molecular interaction

ABSTRAK

Kemajuan terkini cecair ion (ILs) telah membolehkan aplikasi baharu terhadap pembubaran mendakan pelarutan kalsium karbonat (CaCO₃) dengan mendakan CaCO₃ memberi ancaman yang buruk dalam bidang petroleum. Dalam kajian ini, interaksi molekul antara CaCO₃ dan ILs n-piridinium klorida [NPy][Cl] telah dikaji untuk mendapatkan pemahaman yang lebih menyeluruh semasa pembubaran mendakan. Spektroskopi NMR dan FTIR digunakan untuk mengkaji interaksi molekul antara larutan CaCO₃ dan [NPy][Cl] semasa proses pembubaran. Untuk penilaian selanjutnya, kajian simulasi menggunakan perisian Gaussian telah digunakan untuk meramal secara terperinci interaksi molekul antara [Npy][Cl] dan CaCO₃. Hasil daripada kajian ini menunjukkan bahawa kompleks logam terbentuk melalui ligan selepas proses mendakan pelarutan. Berdasarkan hasil kajian, dapat dipastikan bahawa [Npy][Cl] berpotensi untuk digunakan sebagai pelarut mendakan dalam medan minyak, terutamanya dalam melarutkan mendakan CaCO₃.

Kata kunci: Cecair ion; interaksi molekul; kalsium karbonat; pembubaran

INTRODUCTION

The petroleum production growth in oil field varies depending on geological factor and operational challenges faced in the oil and gas sector. Scale formation

is the critical issue and known as one of the main flow assurance obstacles which influencing production in the oil and gas industry. Scales formation mainly causes the decline of oil production, increasing the oil production