



1st International Conference on Energy Materials

Imidazolium-based ionic liquids as demulsifier for water-crude oil emulsion

Asiah Nusaibah Masri^a, Aliyu Adebayo Sulaimon^{a,b*}, Muhammad Zuhairi Zakaria^b, Akintola Sarah Abidemi^c

^aCentre of Research in Ionic Liquid (CORIL), Universiti Teknologi PETRONAS, 32610 Seri Iskandar, Perak, Malaysia

^bDepartment of Petroleum Engineering, Universiti Teknologi PETRONAS, 32610 Seri Iskandar, Perak, Malaysia

^cDepartment of Petroleum Engineering, Faculty of Technology, University of Ibadan, 200132, Ibadan, Nigeria.

Abstract

Most of the crude oils in the world are produced as water-crude oil emulsions. Removal of water from the emulsions is one of the major issues in industry and the process is completed before transportation and refining. One of the methods to remove water is through demulsification. In the present study, ionic liquids, non-volatile and non-toxic solvents, are used as demulsifiers. Three ionic liquids (ILs), namely 1-ethyl-3-methylimidazolium acetate (EMIM-AC), 1-butyl-3-methylimidazolium chloride (BMIM-Cl) and 1-butyl-3-methylimidazolium hydrogensulfate (BMIM-HSO₄), were evaluated to treat a heterogeneous mixture of crude oil and water. The bottle tests were conducted at 60 °C and a salinity of 50,000ppm. Response surface methodology (RSM) was used to study the effect of IL type, its concentration, and residence time towards demulsification efficiency. The developed correlation gave a high correlation coefficient, R² of 0.924. Analysis shows that the IL concentration gives the highest influence on the demulsification efficiency, followed by the residence time and the type of ionic liquid. Among the three ILs investigated, 1000ppm BMIM-HSO₄ achieved the highest demulsification efficiency, where complete separation (100% demulsification efficiency) was attained within 30 minutes. BMIM-Cl achieved 72% efficiency after an hour while the EMIM-AC reached maximum separation after 52 minutes with 45% efficiency.

[copyright information to be updated in production process]

Keywords: Crude oil; demulsifier; ionic liquid; response surface methodology.

Nomenclature

Adeq precision	Adequate precision
Adj R-squared	Adjusted correlation coefficient
ANOVA	Analysis of variance
BMIM-Cl	1-butyl-3-methylimidazolium chloride
BMIM-HSO ₄	1-butyl-3-methylimidazolium hydrogen sulfate
DMSO	Dimethylsulfoxide
EMIM-AC	1-ethyl-3-methylimidazolium acetate
HNMR	Proton nuclear magnetic resonance
IL	Ionic liquid
Pred R-squared	Predicted correlation coefficient
R-squared	Correlation coefficient
SS	Sum of Squares