An Experimental and Modeling Approach to Estimate the Minimum Miscibility Pressure of Nitrogen Using Dead Oil Measurements

Ahmad Saleh Yousef Suleiman

Abstract

In this study, the Vanishing Interfacial Tension (VIT) technique was used to determine the Minimum Miscibility Pressure (MMP) of 5 crude oil samples (Dead Oil) using pure Nitrogen (N2) as injected gas. This technique is used to measure the Inerfacial Tension (IFT) for each oil sample in Nitrogen. The NMMP can be estimated when there is no interface between Oil & Gas (i.e. IFT is zero).

As the experimental NMMP's are based on dead oil samples, and due to the risk involved with Live oil, a new approach was done by using existing 30 experimental data sets available in the literature. The new correlation (SQU-NMMP model) was generated based on 20 data sets. The other 10 data sets were used to validate the SQU-NMMP model and other correlation models. The average error of SQU-NMMP model was 2.4% compared with 4.3% for Sebastian & Lawrence's model. Normalization was applied on each sample's fraction to convert it into dead condition. Then a coefficient was calculated for each sample by dividing the NMMPDead sample over the NMMPLive sample. The standard deviation was obtained for the calculated coefficients to be 0.2 with an average coefficient equal to 1.33. The VIT experiments have been conducted to estimate the NMMP of the 5 dead oil samples. The NMMP was also calculated by [CMG WinProb software] version 2015.10.5612.22665 and then results were compared with the experimental NMMP's which resulted with an average absolute error of 4.8%, and showed good agreements. The study has developed an SQU-NMMP model successfully and was applied over the 5 dead oil samples to obtain Live MMP for each one and compared to published models and proved that the SQU-NMMP estimates with less error.

An SQU-NMMP calculator was built for calculating the NMMP using different correlations, and to obtain the best correlation in agreement with the experimental NMMP.