ABSTRACT

The precipitation and deposition of asphaltene are among the most pressing issues in the petroleum industry. This flow assurance issue may cause formation damage in porous media, the plugging and coking of wellbore and production pipelines and difficulties in the refining process. Such events lead to additional operating costs for the company. Therefore, knowing the conditions at which asphaltene may precipitate and can be stable may enable its management. Existing models of asphaltene stability are dependent on saturate, aromatic, resin and asphaltene (SARA) analysis which can be very expensive and time-consuming. Therefore, using regression analysis as well as MATLAB curve fitting and optimization procedures, a new set of correlations and asphaltene stability envelops (ASEs) based on the newly developed Density-Based Asphaltene/Resin ratio (DBAR), Density-Based Saturate/Aromatic ratio (DBSAr) and the Density-Based Colloidal Instability Index (DBCII) all as functions of oil density have been developed to consistently predict asphaltene stability. The new criteria were developed for the correlations by considering the boundary between stable and unstable regions in their respective plots. The new envelopes showed 83% reliability by accurately predicting asphaltene stability in 24 (eight stable and 16 unstable samples) out of 29 (13 stable and 16 unstable) crude oil samples. The correlation coefficient (R^2), average absolute relative error (AARE) and the root-mean-square error (RMSE) for the new DBAR correlation are 0.9456, 0.8357 and 0.1219 respectively. The DBSAr correlation resulted in R^2 of 0.9437, AARE of 0.1860 and RMSE of 0.2450. For the DBCII, the statistical indicator results were 0.9639 for the R^2, 0.1376 for the RMSE and 0.1038 for the AARE.