World Academy of Science, Engineering and Technology
International Journal of Chemical and Materials Engineering
Vol:14, No:04, 2020

Effect of Naphtha in Addition to a Cycle Steam Stimulation Process Reducing the Heavy Oil Viscosity Using a Two-Level Factorial Design

Authors : Nora A. Guerrero, Adan Leon, María I. Sandoval, Romel Perez, Samuel Munoz

Abstract : The addition of solvents in cyclic steam stimulation is a technique that has shown an impact on the improved recovery of heavy oils. In this technique, it is possible to reduce the steam/oil ratio in the last stages of the process, at which time this ratio increases significantly. The mobility of improved crude oil increases due to the structural changes of its components, which at the same time reflected in the decrease in density and viscosity. In the present work, the effect of the variables such as temperature, time, and weight percentage of naphtha was evaluated, using a factorial design of experiments 23. From the results of analysis of variance (ANOVA) and Pareto diagram, it was possible to identify the effect on viscosity reduction. The experimental representation of the crude-vapor-naphtha interaction was carried out in a batch reactor on a Colombian heavy oil of 12.8° API and 3500 cP. The conditions of temperature, reaction time, and percentage of naphtha were 270-300 °C, 48-66 hours, and 3-9% by weight, respectively. The results showed a decrease in density with values in the range of 0.9542 to 0.9414 g/cm³, while the viscosity decrease was in the order of 55 to 70%. On the other hand, simulated distillation results, according to ASTM 7169, revealed significant conversions of the 315°C+ fraction. From the spectroscopic techniques of nuclear magnetic resonance NMR, infrared FTIR and UV-VIS visible ultraviolet, it was determined that the increase in the performance of the light fractions in the improved crude is due to the breakdown of alkyl chains. The methodology for cyclic steam injection with naphtha and laboratory-scale characterization can be considered as a practical tool in improved recovery processes.

Keywords : viscosity reduction, cyclic steam stimulation, factorial design, naphtha
Conference Title : ICPPI 2020 : International Conference on Petrochemistry and Petrochemical Industry
Conference Location : Paris, France
Conference Dates : April 16-17, 2020

Open Science Index, Chemical and Materials Engineering Vol:14, No:04, 2020 publications.waset.org/abstracts/122135.pdf