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Application of Nuclear Magnetic Resonance (1H-NMR) in the Analysis of Catalytic Aquathermolysis : Colombian Heavy Oil Case

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Abstract

The enhanced oil recovery by steam injection was considered a process that only generated physical recovery mechanisms. However, there is evidence of the occurrence of a series of chemical reactions which are called aquathermolysis. These reactions can be favored by the addition of a catalyst during steam injection, in this way it is possible to generate the original oil in situ upgrading through the production increase of molecules of lower molecular weight. Therefore, this research has focused on the experimental evaluation of the catalytic aquathermolysis on a Colombian heavy oil The effect of three different catalyst, reaction time and temperature were evaluated. The changes on the Colombian heavy oil were quantified through nuclear magnetic resonance 1H-NMR. The average number of aliphatic carbons in alkyl chains, the number of substituted rings and the aromaticity factor were established as average structural parameters in order to simplify the samples compositional analysis. Firstly, each catalyst develops a different reaction mechanism. The aromaticity factor has an increasing order from the used salts in the order Mo > Fe > Ni. However, the upgraded oil obtained with iron naphthenate tends to form a higher content of mono-aromatic In the other hand, the results obtained from the second experimentation phase suggest that the upgraded oils have a smaller difference in the length of alkyl chains in the range of 240 to 270 ° C. This parameter has lower values at 300 ° C, which indicates that the cleavage reactions of alkyl chains govern at higher reaction temperatures. The presence of condensation reactions is supported by the behavior of the aromaticity factor and the bridge carbons production between aromatic rings (RCH2).

Biography:

Petroleum engineer and Master of science in hydrocarbons engineering with experience in reservoir engineering, EOR, numerical reservoir simulation, laboratory equipment operation and research. She has been involved in the Recobro Mejorado research group from the Universidad Industrial de Santander for more than six years. She has worked in topics like the effect of catalytic aquathermolysis on the enhanced recovery of heavy oils during steamflooding processes, economic evaluation of enhanced oil recovery projects, steamflooding in medium and light oil fields, the effect of the viscosity variation of heavy oil on the injection rate in steam injection processs, and the use of analytical characterization techniques such as nuclear magnetic resonance

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