Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.27283

Assessment of pre-salt crude oil composition under the influence of water alternating gas injection in the Santos Basin, Brazil

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Crude oil samples from the Santos basin were analyzed by bidimensional gas chromatography coupled with time-of-flight mass spectrometry (GC×GC-TOFMS) to evaluate the light hydrocarbon compositional variations under Water Alternating Gas (WAG) process by comparing crude oil samples. T_0 samples represent the original accumulation without WAG influence, while T_1 samples were collected under the influence of WAG recovery. Two different assessments were realized: (1) T_0 vs. T_1 collected at the same well and (2) T_0 vs. T_1 from nearby wells. Regarding the (1) assessment, subtle compositional differences were observed between T_0 samples from Itapema and Barra Velha formations. Both T_1 samples exhibited an increase on total hydrocarbon concentration and gas-oil ratios. The (2) assessment indicated that samples under WAG influence on multiple wells showed an increase in total hydrocarbon and in the evaluated chemical classes (*iso*-alkanes, monocyclics, polycyclics, and aromatics) concentration. These results indicate an increase in specific chemical classes on light hydrocarbons during gas injection. CO_2 as a supercritical fluid is a nonpolar solvent and has greater affinity for apolar compounds. The increase on light hydrocarbon on the produced oil suggests greater solubility of the petroleum compounds due to the interaction between CO_2 and reservoir oil, as a miscible process. Petrophysical data indicate that this field exhibited temperature and pressure at supercritical CO_2 conditions (>304 K and >1100 Psi), indicating that this reservoir reached the conditions required for miscible WAG.