422d Thermodynamic Model for the Solubility of Light Hydrocarbons in Aqueous Sodium Chloride Solutions up to 600 K and 2 Kilobars, and 5 Nacl M

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The solubility of at methane, ethane, and propane in aqueous sodium chloride solutions at high pressures, temperatures, in high ionic strength solutions has been correlated. We used Henry's Law to reproduce experimental data in the aqueous-rich phase, and the Soave-Redlich-Kwong equation of state for the hydrocarbon-rich phase. In our model, the chemical potential of the solute in brine is related to the chemical potential of the solute in the water through the salting-out coefficient. These coefficients are obtained from Perturbation Theory considerations, the salting-out coefficient of methane, and the shift in the hydrocarbons' boiling temperature from the boiling temperature of methane. However, the idea is originally from Pawilkowski and Prausnitz (Pawilkowski, E. and Praunitz, J. 1983, Estimation of Stechenow costants for non-polar gases in common salts at moderate temperatures. *Ind.Engng.Chem.Fundam*,v.22, p. 86-90). The model reproduces all crucial phenomena, including three phase equilibria, of binary (gas-water) and ternary (gas-salt-water) vapor-liquid mixtures below the critical point of water. The experimental data reproduced is from more than 25 different sources, and covers a P-T space up to 2000 bars and temperatures over 600 K. The error in the predictions is less than 7%. At saturation pressure, the methane-water and ethane-water solubility minima occurs at 367 K, whereas the propane-water's occurs at 375 K. We predict that the solubility of these gases in NaCl brines, also at saturation pressure, have their maximum at these same temperatures, regardless of the salt concentration. Our model represents an easy mean to estimate the phase behavior and solubility of light hydrocarbons in the presence of NaCl in solution, at temperatures, pressures, and salt concentrations where no experimental data is available.