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INVESTIGATION OF THE CH_4 - CO_2 GAS MIXTURE SOLUBILITY IN THF - SDS AQUEOUS SOLUTIONS

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Abstract

Vapor-liquid equilibrium data for the methane (CH_4) (81.70 mol.%) and carbon dioxide (CO_2) (18.30 mol.%) gas mixture with adding aqueous solutions of 3.80 wt.% tetrahydrofuran (THF) and 0.30 wt.% sodium dodecyl sulfate (SDS) were experimentally determined. The experimental temperatures were 283.15 and 293.15 K. The equilibrium pressures were in the range 0.60–5.04 MPa. It was found that the CH_4 solubility in the aqueous solutions is approximately one order of magnitude lower than the CO_2 solubility. The experimental data of the gas mixture solubility in the aqueous solutions were compared with the simulation results in Aspen Plus V10. The most adequate agreement between the experimental and thermodynamic simulation data of the CO_2 solubility in the CH_4 (81.70 mol.%) - CO_2 (18.30 mol.%) gas mixture in the H_2O and H_2O - THF (3.80 wt.%) solutions was observed using the UNIQUAC and UNIFAC methods, respectively. The average relative uncertainties of these methods were 4.18 and 1.81%. In the case of the H_2O - SDS (0.30 wt.%) and H_2O - THF (3.80 wt.%) - SDS (0.30 wt.%) solutions, the most suitable methods occurred NRTL / Wilson (the relative uncertainties were equal) and NRTL-RK methods, respectively. The average relative uncertainties of these methods were 7.38 and 9.30%. The obtained results will be applied for natural gas purification from CO_2 using the gas hydrate crystallization technology.

Key words: carbon dioxide, methane, sodium dodecyl sulfate, solubility, tetrahydrofuran

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