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INVESTIGATION OF CH₄ - CO₂ GAS MIXTURE SOLUBILITY IN TETRAHYDROFURAN - SODIUM DODECYL SULFATE AQUEOUS SOLUTIONS

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Abstract

Vapor-liquid equilibrium data for the methane (CH₄) (81.70 %mol) and carbon dioxide (CO₂) (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 CH₄ solubility in the aqueous solutions is approximately one order of magnitude lower than the CO₂ 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 CO₂ solubility in the CH₄ (81.70 %mol) - CO₂ (18.30 %mol) gas mixture in the H₂O and H₂O - 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 H₂O - SDS (0.30 %wt) and H₂O - THF (3.80 %wt) - SDS (0.30 %wt) solutions, the most suitable methods applied were Non-random two-liquid/Wilson (NRTL/Wilson) and Non-random two-liquid - Redlich-Kwong (NRTL-RK) methods, respectively (the relative uncertainties were equal). The average relative uncertainties of these methods were 7.38 and 9.30%. The obtained results will be applied for natural gas purification from CO₂ using the gas hydrate crystallization technology.

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

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