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CO_2/hydrocarbon selectivity of phosphonium based ionic liquids

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Abstract (less than 300 words)

Carbon dioxide (CO_2) separation is critical in the petrochemical industry for natural gas purification and coal gasification. Chemical/physical absorption, adsorption, and membrane separation have been attempted for CO_2 separation from CO_2-hydrocarbon gas mixtures. The conventional physical absorbents such as Selexol and Rectisol absorb a large amount of CO_2 and a significant amount of hydrocarbons such as methane (CH_4), therefore, their CO_2/hydrocarbon selectivities are not so high. Ionic liquids (ILs) are expected to be a promising alternative to the conventional physical absorbents because of their comparable CO_2 solubilities and high CO_2/CH_4 selectivities ranging from 10 to 20 [1].

In the previous study, trihexyl(tetradecyl)phosphonium bis(trifluoromethanesulfonyl)amide ($[P_{66614}][TFSA]$) and trihexyl(tetradecyl)phosphonium perfluorooctanesulfonate ($[P_{66614}][PFOS]$) were chosen as the ILs with superior CO_2 absorption by predicting Henry's law constants of CO_2 in 68775 ILs using conductor like screening model for realistic solvation (COSMO-RS) method [2]. Based on the prediction results, CO_2 solubilities of the selected phosphonium based ILs were measured at 313.15 K and 333.15 K [3].

In the present study, hydrocarbon such as CH_4, ethane (C_2H_6), and ethylene (C_2H_4) solubilities in $[P_{66614}][TFSA]$ or $[P_{66614}][PFOS]$ were measured at 313.15 K and 333.15 K by using a magnetic suspension balance. Henry's law constants of CO_2 or hydrocarbon were calculated from the experimental solubility data at pressures lower than 0.4 MPa. Furthermore, CO_2/hydrocarbon selectivities of ILs were obtained from the ratio of CO_2 and hydrocarbon experimental solubility data.

References

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