150f Multicomponent Adsorption of C1-C4 Hydrocarbons on Activated Carbon

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Natural Gas (NG) has been considered a potentially viable and ecologically preferable fuel as compared to other liquid fossil fuels. However, its high transportation cost and reduced energy density in standard temperature and pressure conditions (STP) inhibit its commercial use in a larger scale. Numerous studies have reported the advantages of storing and transporting natural gas in the adsorbed form (ANG). Depending on its origin, natural gas is composed of around 90% methane, the remaining components being ethane, propane, butane, carbon dioxide, nitrogen, among other higher molecular weight alkanes. Most studies assume natural gas to behave essentially as pure methane regarding equilibrium and kinetic adsorption properties. This consideration simplifies experiments and calculations, although it has been already shown that this assumption does not represent well the real nature of natural gas adsorption. The objective of this work is to compare pure component adsorption data of the light alkanes that constitute NG, and then obtain equilibrium adsorption parameters to be used in isotherms models for multicomponent systems. The Extended Langmuir Model, Ideal Adsorption Solution Theory (IAST) and Group Contribution Theory (GCT) were used to predict multicomponent adsorption equilibrium isotherms. A volumetric/chromatographic apparatus was used to determine binary isotherms for a range of compositions of different mixtures and the experimental data was compared to the predicted data using parameters from pure component experiments.