

Adsorption isotherms of water vapor on Zeolite 3A, Zeolite 13X, and Dealuminated Y Zeolite

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Water vapor removal from various gas streams is important in many industrial fields because it can lead to reducing the process efficiency and product quality. On the other hand, in VOC removal, water vapor removal is not needed, but water adsorption lead to reducing the process efficiency. In the study, the adsorption isotherms of water vapor on zeolite 3A, zeolite 13X, and dealuminated Y zeolite (DAY) were measured using a volumetric method. Equilibrium experiments were conducted at 293, 303, and 313K and at relative humidity up to 0.95. The experimental data were correlated by Aranovich–Donohue (A–D) and Frenkel–Halsey–Hill (FHH) models, using Langmuir, Toth, UNILAN, and Sips isotherms. Additionally experimental data which were measured at relative humidity up to 0.3 and each temperature were correlated by Sips model. Also isosteric heats of adsorptions were estimated by using Clapeyron–Clausius equation. The order of adsorbed amount of water was zeolite 13X>zeolite 3A>DAY, while the order of heat of adsorptions was zeolite 3A>zeolite 13X>DAY. The adsorption isotherms on zeolite 13X and zeolite 3A were type II of isotherm of the BDDT classification and H3 type of classification of Giles et al, as DAY was type II of the BDDT classification and L2 type of classification of Giles et al.