507b Packing Induced Selectivity Effects in the Liquid Phase Adsorption of Alkane/Alkene Mixtures on Nay

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The liquid phase batch adsorption experimental technique was used to gain a more profound insight into packing induced selectivity effects in the liquid phase adsorption of alkane/alkene mixtures on zeolite NaY. The adsorption of alkenes with (hexene, octene, decene, dodecene) from hexane, heptane, octane, decane, dodecane and tetradecane as bulk phases was measured at room temperature. Already at low concentrations, the alkenes are selectively adsorbed from their binary mixture with an alkane. In the investigated alkene concentration range between 0 and 20 mol%, a maximum pore filling of 0.32 ml/g is reached depending on the chain length of both the alkene and the alkane. Two remarkable effects were observed: (1) shorter alkenes are preferentially adsorbed compared to longer alkenes, (2) the adsorption of the alkene depends strongly on the chain length of the alkane solvent. With shorter alkanes, the alkene selectivity decreases. However, the shorter the alkene, the smaller the influence of the alkane solvent. Column breakthrough experiments with ternary mixtures containing two alkenes with different chain length and an alkane as “solvent” demonstrated that the shortest alkene in the mixture is selectively trapped in the adsorbent pores, while the long alkene elutes more rapidly. This effect becomes more pronounced at higher alkene concentration. These observations can be explained by a more favorable packing of smaller molecules compared to larger molecules inside the supercages of NaY.