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Removal of BTEX and hexane by organo-zeolites: The influence of surfactant carbon chain length on the sorption process

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ABSTRACT

The synthetic zeolite Na-P1 and natural clinoptilolite are modified using dodecyl trimethyl ammonium bromide (DDTMA), didodecyl dimethyl ammonium bromide (DDDDMA), tetradecyl trimethyl ammonium bromide (TDTMA), ditetradecyl dimethyl ammonium bromide (DTDDMA), hexadecyl trimethyl ammonium bromide (HDTMA), dihexadecyl dimethyl ammonium bromide (DHDDMA), octadecyl trimethyl ammonium bromide (ODTMA) and dioctadecyl dimethyl ammonium bromide (DODDMA) in amounts of 1.0 of the external cation exchange capacity of the zeolites. The sorption performance of the zeolites and organo-zeolites for aqueous benzene, ethylbenzene, toluene, p-xylene (BTEX) and hexane are evaluated. After modification, the organo-zeolites show good performance for the removal of BTEX and hexane from the aqueous solution. The results show that the modification of the zeolites by surfactants with double-carbon chains (DDDDMA, DTDDMA, DHDDMA and DODDMA) improves the sorption properties for benzene, ethylbenzene and toluene. In the case of ethylbenzene, the sorption results are twice as high for the modified zeolites compared to the unmodified zeolites. Based on the experimental data, the removal efficiencies follow the order of hexane > ethylbenzene > toluene > p-xylene > benzene. Hexane was adsorbed in the greatest quantity on the zeolite (~75–80%) and all organo-zeolites (~90–95%). Benzene was adsorbed in the lowest quantity on the zeolite (40–50%) and the organo-zeolites (30–40%). Simultaneously, it is shown that the sorption efficiency increases with increasing carbon chain length. The sorption efficiency depends on the chemical properties of the various organic compounds and the duration of the sorption process.

Keywords: Adsorption; Zeolite Na-P1; Clinoptilolite; BTEX removal; Hexane removal; Surfactants

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