
Shape-Selective Sorbents Based on Clay Minerals: A Review¹

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Abstract: A review is presented of work carried out over the last 40 years on non-porous sorbents and on microporous shape-selective sorbents derived from palygorskite, smectite, and vermiculite. Among such materials four kinds of behavior were observed. In some systems uptake was restricted to external surfaces; in others, intercalation also occurred but only above threshold pressures. If the interlayer region was completely filled by long-chain organic cations, imbibition was possible, but in amounts which were very strongly dependent upon the cohesive energy density of the sorbate. Finally, in certain permanently expanded derivatives of layer silicates intercalation proceeded without any threshold pressure, just as in zeolites.

In this latter group, micropores existed which sometimes resulted in shape-selective sorption and molecule sieving. The micropores in clay minerals were modified by varying the size and shape of the interlayer cations, their charge, and the charge density of the siliceous layers. The interplay of these factors was investigated and the micropore sorbents were shown to be highly effective in the separation of mixtures.

Key Words: Adsorption • Imbibition • Intercalation • Palygorskite • Porosity • Shape-selective • Smectite • Vermiculite

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