

CHROMATOGRAPHIC DETERMINATION OF ADSORPTION ISOTHERMS AND ISOSTERIC HEATS OF ADSORPTION ON MOLECULAR SIEVES (ZEOLITES)

PART 1—ADSORPTION OF BUTANE ON NaX ZEOLITES

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The application of the principles of gas/liquid & gas/solid chromatography for the determination of adsorption isotherms (Hayes, 1969) is discussed. The present study has involved the use of these principles to determine some adsorption characteristics of butane on NaX zeolite. Such determinations are important in zeolite catalysis because the constant pore size of zeolites confer on them the advantage of exerting selective action on the type of molecule that can enter a pore and have access to an active centre.

The chromatographic method employed in the present study involved the injection of varying (known) amounts of the gas into the adsorbent column through a sampling valve. Computerised determination of the chromatographic parameters of peak area & retention time together with the peak height enabled the partial pressure of the adsorbate and the amount adsorbed to be evaluated. Adsorption isotherms were thus constructed and isosteric heats of adsorption deduced by applying Clausius-Clapeyron equation to the gas/solid equilibrium.

The butane / NaX system (over the temperature range 423-454 K) gave rise to sharp & symmetrical peaks on chromatographic analysis. From the linear adsorption isotherms thus obtained, Henry Law constants were evaluated. A sensibly constant isosteric heat of $85 \pm 5 \text{ kJ mol}^{-1}$ was obtained for the system. The adsorption is therefore independent of inter adsorbate interaction even at high coveragges.

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References

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