

CHAPTER VIII

Sorption of Brilliant Cresyl Blue on different aluminosilicates.

The sorption of two Xanthene Cationic dyes viz. RG and RB have been studied on the Na-form of different aluminosilicates in previous chapters (IV, V, VI). From such study it reflects that although the sorption of the cationic dyes takes place primarily by ion exchange process (1) but has rather been complicated by other factors such as molecular size, molecular geometry (2), dye-dye interaction (3), besides of course the surface characteristics of the sorbent. Also from the structural point of view (pages 46,47) the oxazine dye BB differs from that of RG and RB. The present study discussed below aims to find the adsorption characteristics of BB. On different aluminosilicates and thus to gain an insight into the effect of molecular size, space and charge of the adsorbate ions on exchange processes.

Sorption of BB^+ on Na-montmorillonite at pH 7:

The adsorption of Brilliant Cresyl Blue on Na-montmorillonite is shown in Fig. 63(a). The isotherm belongs to the H or high affinity class of Giles et al (4) indicative of strong adsorbate-adsorbent interaction and of species adsorbed flat on the surface. The adsorption data is seen to fit into linear form of the Langmuir

adsorption equation. The plot of c/x vs C where C is the equilibrium concentration of BB and x is the amount adsorbed per 100 gm of the adsorbent yields a linear graph (Fig. 63(b)). The value of V_m calculated from the slope of the linear graph [Fig. 63(b)] is equal to $.125 \frac{m.eq./g.}{\lambda}$ which is more than cation exchange capacity of the mineral viz. 86 meq/100g and the maximum sorption of the dye corresponding to the flat portion of the isotherm (i.e. 121 meq/100g). The excess uptake of the dye may be explained by assuming multilayer formation of the adsorbed dye molecules due to dye-dye interaction and sorption of aggregated cation (3) on the montmorillonite surface. Upto cation exchange capacity, the adsorption is mostly due to ionic and van der Waals forces and beyond it van der Waals forces predominates. The Langmuir bonding constant of the dye to the mineral is 2.17×10^5 .

Sorption of BB^+ on Na-Kaolinite:

The sorption isotherm of BB^+ on Na-Kaolinite [Fig. 64(a)] is also of the Langmuir type indicating flat orientation of the adsorbed dyes on to the mineral. Accordingly the plot of C/x vs C is linear [Fig. 64(b)]. From the slope of the line, the value of V_m is found to be 8.1 meq/100g as against the maximum adsorption of the dye 7.8 meq/100g obtained from the isotherm. Both the values are higher than the cation exchange capacity value of Na-kaolinite. This is probably due to sorption of aggregated ions from the solution or dimerisation or stacking of the dye ions over the

ones already present in the adsorbed state. The computed Langmuir constant for the BB^+ on to Na-kaolinite is equal to $1.7 \times 10^5 M^{-1}$.

Sorption of BB^+ on Na-Laponite at pH 8.5

The adsorption isotherm of BB^+ on Na-Laponite is shown in Fig. 65(a). The plot of C/x vs C , where C is the equilibrium concentration of BB^+ and x is the amount adsorbed per 100 gm of adsorbent, produces a good straight line [Fig. 65(b)]. This indicates that the sorption data conform to the Langmuir equation suggesting a monolayer adsorption. Both the value of V_m (120 meq/100g) and the amount of dye exchanged at 7×10^5 (M) equilibrium concentration (117 meq/100 gm) are far in excess of the cation exchange capacity 88 meq/100g of the mineral. The top portion of the isotherm attained a plateau upto the concentration used in this study. This type of characteristics is however not found with the dye in montmorillonite. Since Laponite can swell to an unlimited extent, the dye molecules get sufficient space for an easy entry into the interlamellar region and stack themselves to form a bilayer or multilayer. Also the higher aggregation tendency of the BB^+ in aqueous medium favours the process. The calculated Langmuir bonding constant of the dye to the mineral is $1.51 \times 10^5 M^{-1}$.

It has been found the maximum adsorption study of BB^+ in respect to all the above three minerals is higher than each

of their respective cation exchange capacities of the mineral and also it is higher than that of RG and RB in respect of above mentioned study (pages 59, 91, 112). This type of behaviour of BB compared to that RG or RB is possibly due to the influence of its lesser size and stronger tendency to form aggregates in solution as well as in the adsorbed state. As a consequence when adsorption takes place from their solutions BB is adsorbed with large fraction of the aggregates than RB and RG at any particular concentration thus accounting higher adsorption of BB^+ with respect of those different minerals as studied. Monomer-dimer dissociation constant values of respective dyes are also in conformity with the above values.

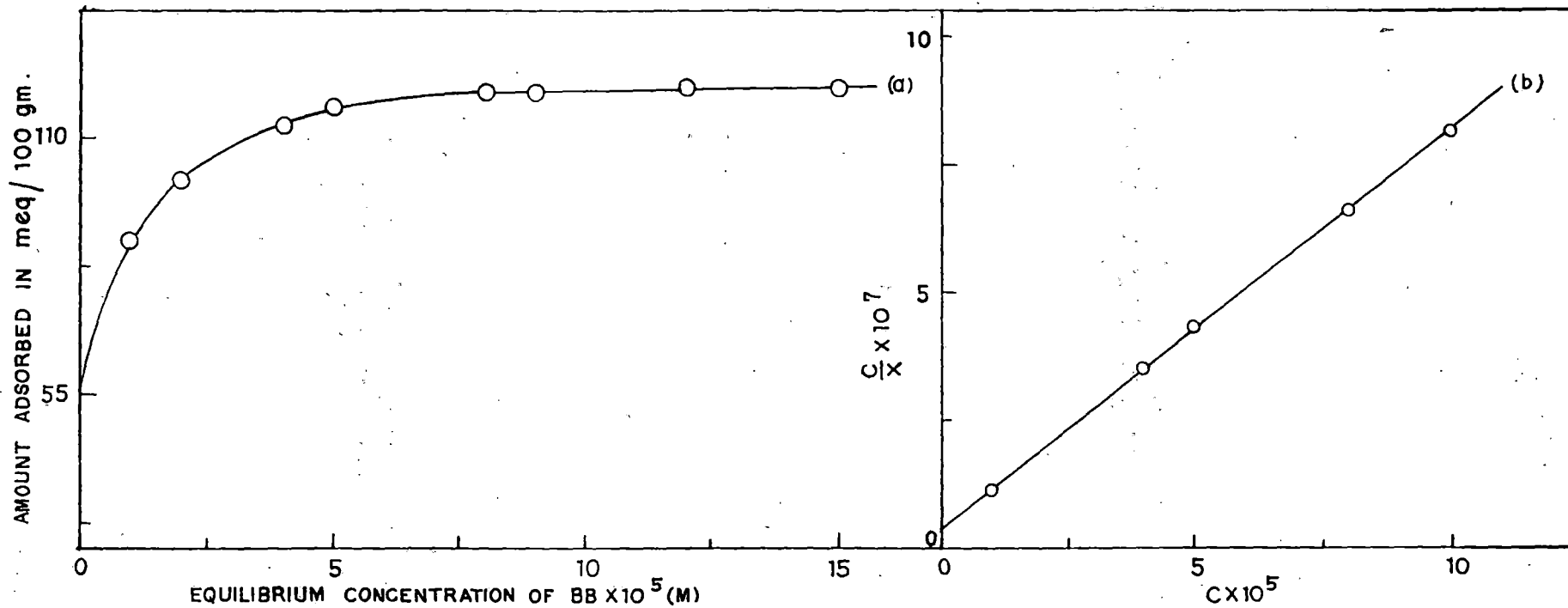


FIG. 63. ADSORPTION ISOTHERM AT 28°C (a) AND LANGMUIR PLOT (b) OF BB ON Na-MONTMORILLONITE.

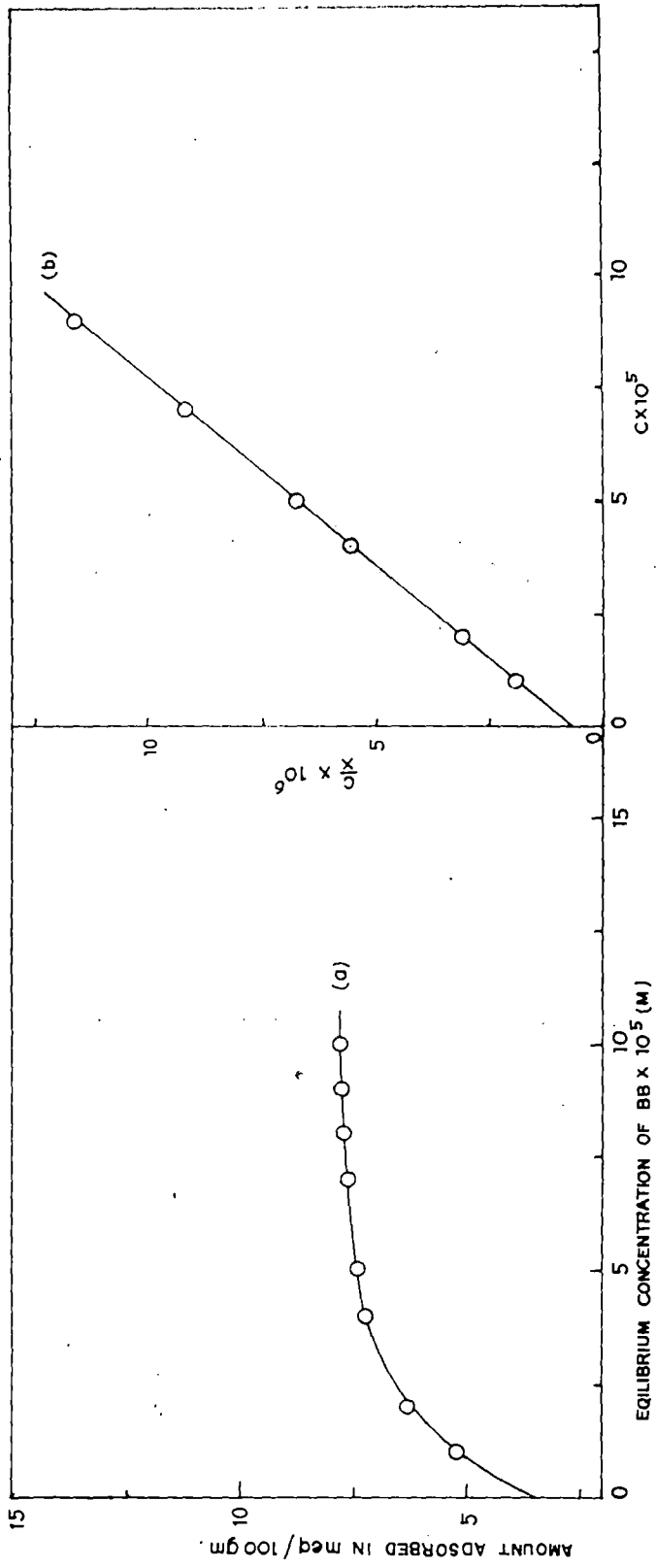


FIG. 64. ADSORPTION ISOTHERM AT 28°C (a) AND LANGMUIR PLOT (b) OF BB ON NQ-KAOLINITE.

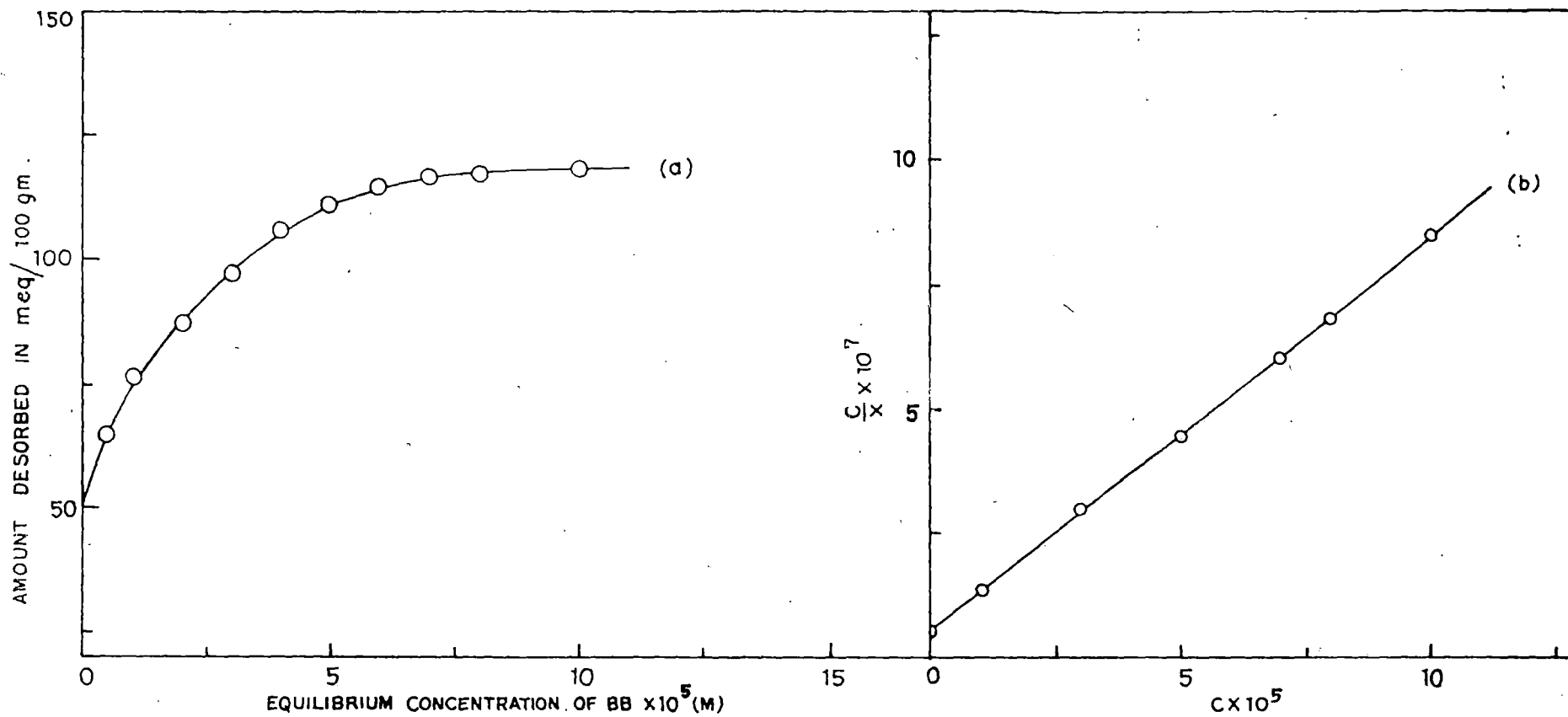


FIG. 65. ADSORPTION ISOTHERM AT 28°C (a) AND LANGMUIR PLOT (b) OF BB ON Na-LAPONITE .