SCIENCE DU SOL n° 1986/1 - pp. 49-50 - PLAISIR-FRANCE

ADSORPTION OF NITROGEN-CONTAINING MOLECULES ON KAOLIN COATED WITH POLYMERIC METALLIC HYDROXIDES : a model of interaction between humic substances and mineral surfaces in soils

F. THOMAS [1], F. ANDREUX [1], J.-Y. BOTTERO [2]

(Science du Sol n° 1984/3)

The study of organic adsoprtion needed previous determination of the structural, morphological and superficial properties of the raw kaolin, containing 87 % weight kaolinite, supplied by Kaolins des Charentes (France). The structural parameters of the samples were determined by X-Ray diffraction, I.R. Spectroscopy and granulometry and compared with those of reference samples studied by LIETARD (1977 (Table I).

The surface properties of the kaolin, either untraeted or coated whith polymeric Fe and Al hydroxides, were studied by N2 adsorption, titration (ROUILLER et al., 1980) and electrophoresis (Tables II and III).

Table III : Comparison of some surface properties of the natural kaolin an the kaolin coated with polymeric Fe and Al hydroxides.

	Kaolin	Kaolin-Fe	Kaolin-Al
Granulométrie	50 % < 0,15µ	n.d.	n.d.
BET $m^2.g^{-1}$	26,8	44	25,1
CEC m.e./100g	9,2	4,2	4,0
Potentiel ζ pH 5,5 mV	- 45	- 17	+ 23
Acidité pH 8 m.e./100 g	1,2	5,04	7,8

Adsorption isotherms of a long chain ionic surfactant (dodecylmmonium) on the clay were interpreted by a thermodynamic model (CASES, 1979 ; RAKOTONARIVO et al., 1984) based on the comparison between the organization of the adsorbed layer and the lamellar phase of the surfactant. Since the lateral interactions between the molecules are equal in both cases, the shape of the adsorption isotherm depends only upon the distribution of the energies of normal adsorbent/adsorbate interactions, and features the superficial heterogeneity (or homogeneity) of the adsorbent. The surface heterogeneity was also quantified by low-temperature N2 and Ar adsorption calorimetry (TORRALVO et al., 1980), and water immersion calorimetry (CASES et FRANÇOIS, 1982). Two main groups of adsorption sites were separated and corresponded to the lateral and basal surfaces representing respectively 20 % and 80 % of the specific area (figure 1 and table II). These results agreed satisfactorily well with those reported by CASES et al. (1981).

1) Centre de Pédologie biologique, CNRS, B.P. 5, 54501 Vandœuvre Cédex.
2) Centre de Valorisation des Minerais, LA 235, rue du Doyen-Roubault, 54500 Vandœuvre-lès-Nancy.

A similar approach was used in the study of the adsorption of glycine, triglycine and a synthetic humic acid (ANDREUX et al., 1980) on the untreated or coated kaolin. Adsorption of glycine and triglycine on the untreated kaolin involved weak interactions and occured only at high equilibrium concentrations (figure 2), whereas adsorption on the coated kaolin was stronger, especially in the case of the aluminium coating which did not alter the morphology of the particles (figures 3-5).

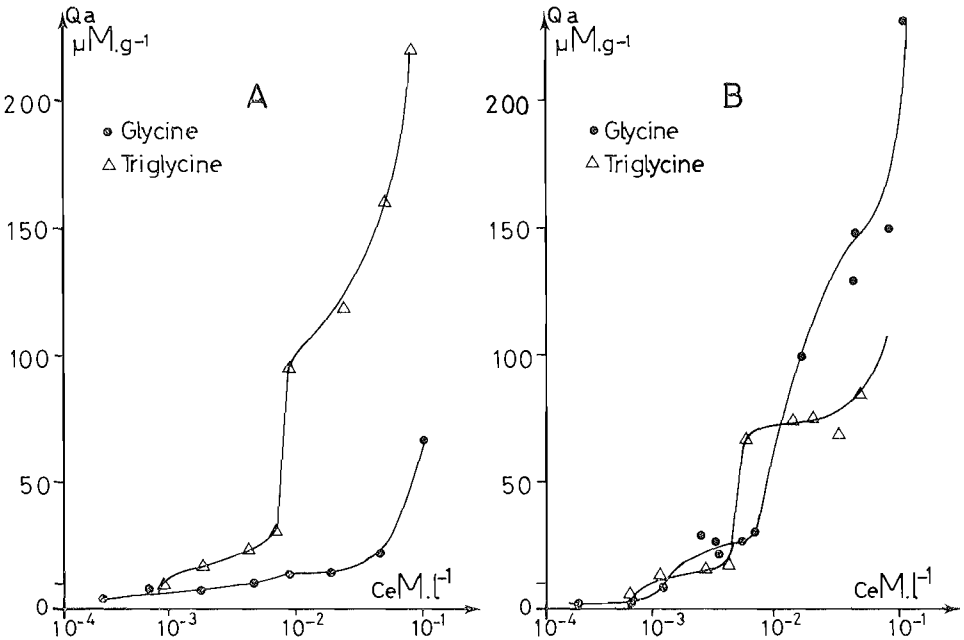

Figure 3 : Adsorption isotherms of glycine and triglycine on
a) Fe-kaolin
b) Al-kaolin

Significant amounts of the synthetic humic acid were removed from the solution only when the clay was coated whith iron or aluminum hydroxide (figure 6). An attempt was done to determine the contribution of actual adsorption and precipitation of the humic-like macromolecule in the presence of these hydroxides.