Physics. — *Titration of adsorbed acids.* By H. J. C. TENDELOO, A. E. MANS and Miss G. DE HOOGH. (Communicated by Prof. J. M. BIJVOET.)

(Communicated at the meeting of December 20, 1947.)

In the extensive literature on adsorption researches have been published which show that the adsorbent, the subphase, has some influence on the properties of the adsorbed substance.

DE BOER [1]) f.e. described changes of the absorption of light of adsorbed substances. This happens to be the case when iodine and caesium are adsorbed on the surface of calciumfluoride. The absorption of light is changed most markedly on those spots where the adsorption is strongest.

From the researches of LANGMUIR and many others on the spreading of molecules upon a surface of water it is known that the molecules are orientated, proofing that the adsorption forces influence one side of the molecules more than an other side.

Though much attention has been paid to the adsorption from solutions of acids, bases and salts by activated coal, and though titration curves of colloidal systems, including suspensions of clays and soils have been studied many times, only few researches are known which try to answer the question whether the physico-chemical properties of adsorbed molecules differ from those in solution.

The hydrolytic adsorption of a salt is for example a phenomenon like that. On adding to a solution of a neutral salt some activated coal the solution becomes alkaline.

VERWEY and KRUYT [2]) titrated well dialised sols of silveriodide. They wrote: „Die potentiometrische Titrationskurve hat aber keinesfalls die Form einer Titration starke Säure-starke Base, sondern zeigt eine starke Pufferung".

We determined titration curves of organic and inorganic acids without and with the addition of activated coal. The coal, Noritpowder, was purified according to MILLER [3]). The pH of a suspension of 1 gram of the purified product in 100 ml distilled water was 7.2—7.3.

A glass-electrode and a Cambridge valve-potentiometer have been used for the measurements of the pH. A microburet was used for the base, the concentration of which being high compared with the concentration of the acid; therefore changes of the volume could be neglected. Every titration was repeated at least twice.

From many results we give for the moment only those obtained with picric-acid and maleic-acid. Fig. 1 gives the titration curves of picric-acid

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1) J. H. DE BOER, Electron emission and adsorption phenomena. Cambridge (1935).
2) E. J. W. VERWEY and H. R. KRUYT, Z. physik. Chem. **167**, 149 (1933).
3) E. J. MILLER, J. Amer. Chem. Soc. **30**, 1031 (1926).

without and with the addition of different amounts of activated coal, as indicated. In fig. 2 the buffercapacities of the systems without and with

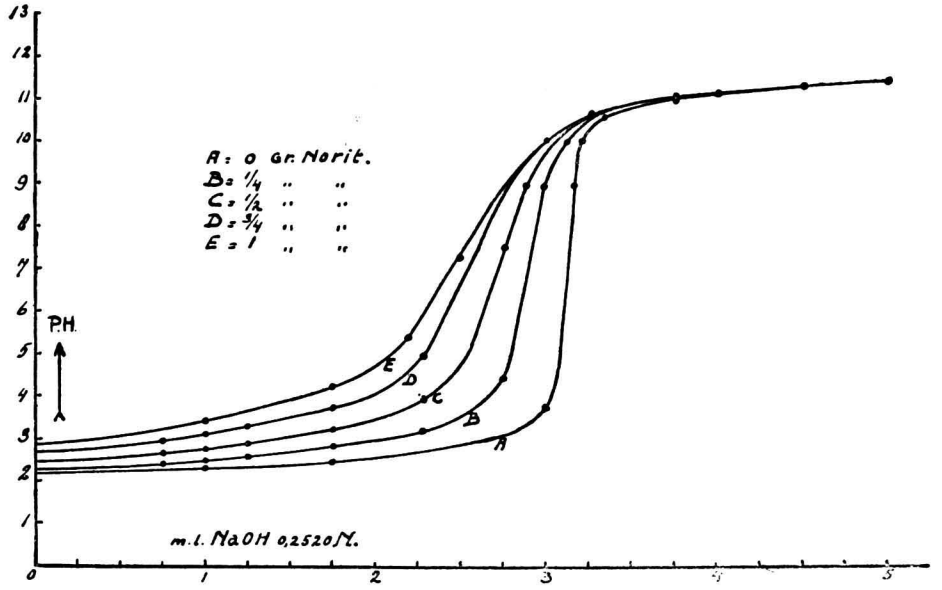

Fig. 1. Titration of 100 ml picric-acid 0,00788 N.

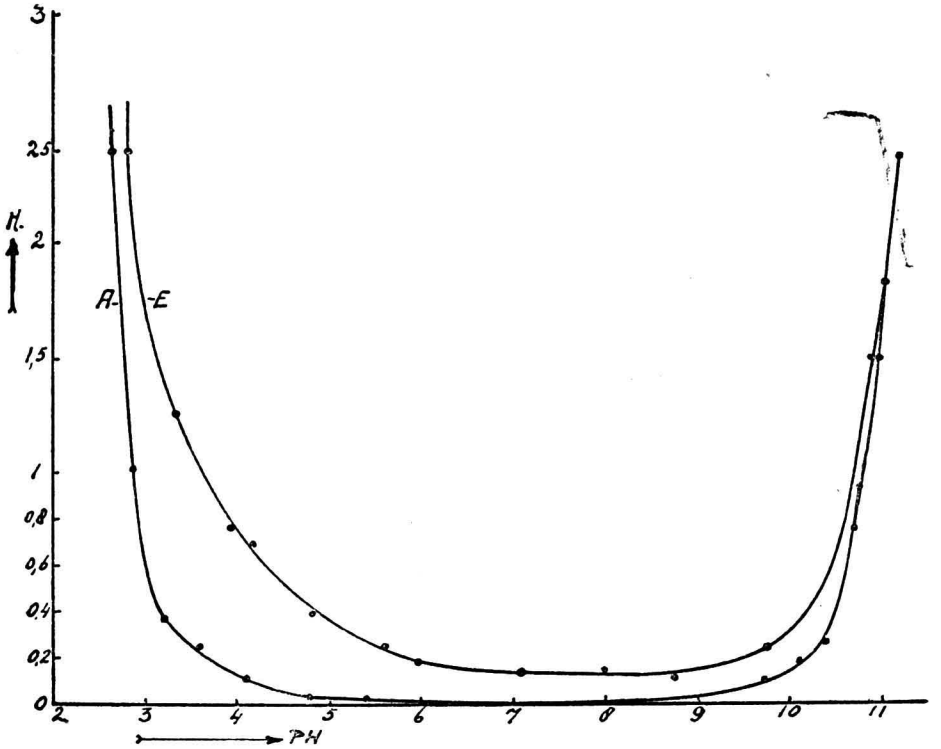

Fig. 2. Buffercapacities of curves *A* and *E* of fig. 1.

the addition of 1 gram activated coal in 100 ml of the solution are represented.

Fig. 3 and 4 give the results with maleic acid. In this case 2 gram of activated coal have been added to 100 ml of the solution. In general comparable results are obtained with other acids. By adding the adsorbent

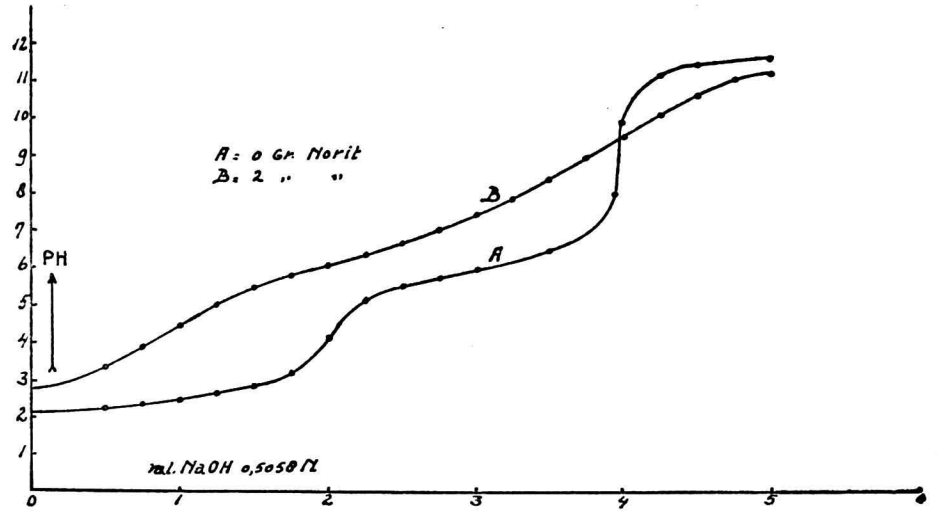

Fig. 3. Titration of 100 ml maleic-acid 0,0201 N.

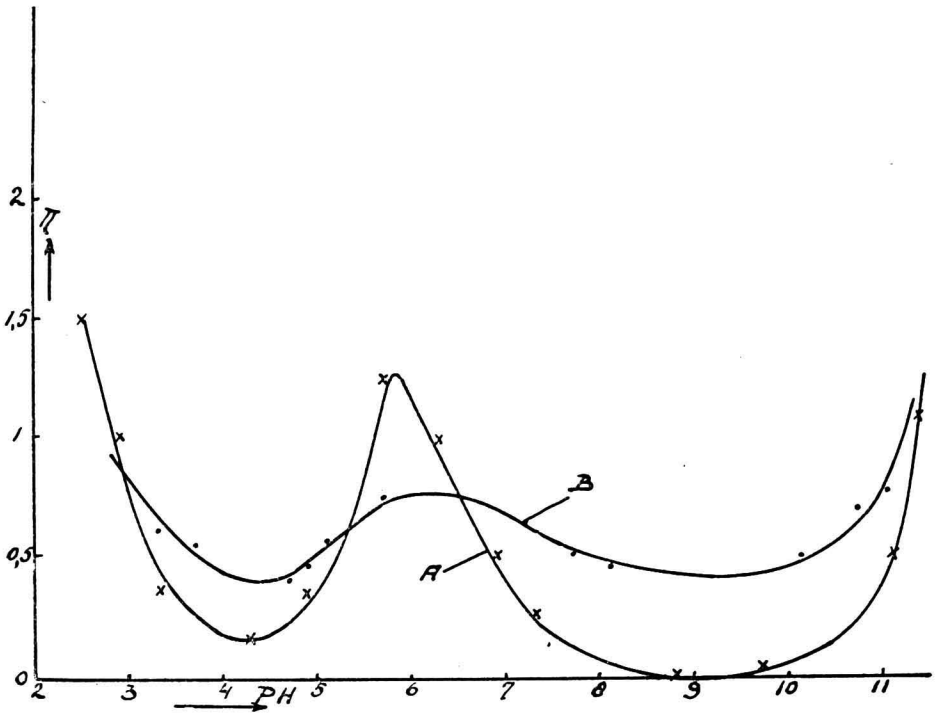

Fig. 4. Buffercapacities of curves *A* and *B* of fig. 3.

changes take place in the titration curves of strong acids, resulting in curves which are comparable with titration curves of weak acids.

Summary.

From the titration curves of strong acids with a strong base, activated coal being added, it follows that by the addition of the adsorbent the titration curves become comparable with those of weak acids. In the system containing coal there is a marked buffercapacity, a result which may be of value for biological problems.