

X-Ray Studies of the Structure of Salts Adsorbed on Cellulose.

THE ability of cellulose to take up salts from aqueous solutions and retain them upon drying is well known, but little has been shown as to the condition in which they are retained. The following possibilities which might be distinguished by X-ray analysis are suggested: (1) a mechanical holding, in which both cellulose and the salt retain their original structure; (2) a reaction forming a new structural arrangement; (3) a molecular or ionic dispersion of the salt throughout the cellulose units, the cellulose being structurally unchanged. It has just come to our attention that Ruff, Ebert, and Luft (*Z. anorg. allgem. Chem.*, **170**, 49; 1928), in an X-ray study of salts adsorbed on activated carbon, found in the majority of cases no evidence of the presence of the salts in their crystalline state. This observation would correspond to the third possibility.

Our X-ray examination of salts adsorbed on cellulose has shown that up to a certain 'saturation concentration' of the salt, the third possibility is the correct one. Above this concentration the excess salt has its characteristic structure, and probably corresponds

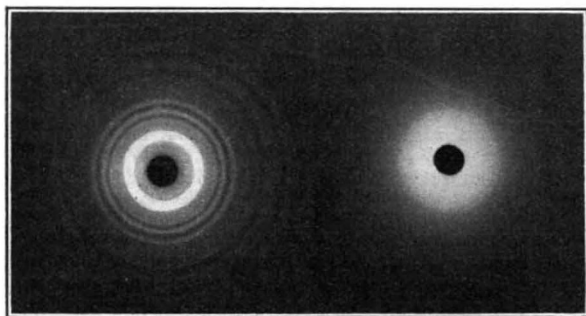


FIG. 1.—Tungstate-starch pattern, before wetting.

FIG. 2.—Tungstate-starch pattern, after wetting and drying.

to the first possibility. In no case did we observe any evidence of a new structural arrangement.

Investigations were made with cellulose both in the form of starch and as filter paper. The two salts studied were NaCl and $\text{Na}_2\text{WO}_4 \cdot 2\text{H}_2\text{O}$. Varying amounts of salts (from 0–10 per cent sodium chloride and 0–35 per cent tungstate) were soaked into weighed samples of filter paper, which were dried and reweighed. Ten thicknesses of the paper served as a specimen. The starch was mixed with the salt in the desired proportions, wetted with a few drops of water, and dried in a desiccator. The specimen containers for the starch were $\frac{1}{8}$ -inch metal strip, with $\frac{1}{2}$ -inch hole, covered on both sides with thin cellophane windows. The wetting process took place in these specimen containers. The powder diffraction method was employed, using unfiltered radiation from a Coolidge molybdenum target tube operated at 30 k.v. (eff.).

To have standards for comparison, diffraction pictures were taken of the filter paper alone; salts alone; filter paper with salt mechanically rubbed in until its salt content equalled that of the 'soaked in' specimen; and the starch-salt mixtures before wetting. The 'rubbed in' sodium tungstate specimen showed the superimposed patterns of the salt and of the paper, as would be expected. The tungstate-starch series before wetting (Fig. 1) also showed the two characteristic patterns, over all concentration ranges investigated.

After wetting and drying, however, the tungstate

pattern disappeared entirely at all concentrations below a point between 25 and 35 grams per 100 grams of starch, leaving only the unchanged starch pattern (Fig. 2). The filter paper series showed the same disappearance of the tungstate pattern at a corresponding concentration. Above this concentration in each case both the cellulose and the salt patterns appeared.

This phenomenon indicates that below a certain concentration the salt is molecularly or ionically dispersed. Above this concentration crystals of the salt exist as such. At no concentration was there evidence of any new structure.

The sodium chloride-starch study was similarly carried out, and with identical results, except that the 'saturation concentration' was much lower (in the vicinity of five grams per 100 grams of starch). Since the ratio of 'saturation concentrations' of the two salts is approximately six to one, and since their molecular weights are in a similar ratio, it seems quite probable that the phenomenon is a molecular one. Thus these 'saturation concentrations' would be more properly expressed as molecular concentrations than as weight concentrations.

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The Island of San Matteo.

LOOKING at an old map of Africa last year, I noticed an island named San Matteo about half-way between Ascension and the Gold Coast. My curiosity was aroused, and in the past eighteen months I have examined more than a dozen maps dating from the sixteenth to the eighteenth century, including the two oldest maps of Africa in the Vatican library. In every case San Matteo is indicated in approximately the same position. Lately, a French map of 1722 has come into my possession, which gives the following note: "Isle St. Mathieu découverte par les Portugais l'an 1526. Il y a une Source de Bonne Eau." The position of the island on this map is lat. 2° S., long. 16° E. of Ferro. Is it likely that a Portuguese navigator could have been so far out of reckoning, both in latitude and in longitude, as to have rediscovered Ascension without knowing it? Or did San Matteo really exist? S. J. SHAND.

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Aug. 2.

THE recurrence on a large number of maps, for at least two centuries, of the supposed Island of St. Matthew in the position named by Prof. Shand is a striking example of the vitality of error when once established. At the moment I am unable to trace a previous discussion of the question, but the following seems a possible solution of the problem.

There seems little doubt that the legend on the French map of 1722 was based directly or indirectly on a story told by the Portuguese historian Barros, Dec. I, Liv. 2, Cap. 2 (edit. of 1778, I, 1, p. 147), which had no doubt been current before he wrote in 1552. The story, given under the date 1525, comes at third hand from a Portuguese pilot, who told of having touched at an uninhabited island named S. Matheus, in which were two watering places, one good, the other not good; and of an inscription seen on two trees which recorded that Portuguese had been there 87 years before. The island of S. Thomé in the Gulf of Guinea is spoken of in the same passage, so the