CCXV. A NOTE ON THE USE OF TARTRAZINE IN THE DETERMINATION OF CHLORIDES IN BIOLOGICAL MATERIAL.

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THE list of adsorption indicators available for determining the end-point in the titration of halides by silver nitrate has been extended recently by Berry and Durrant [1930; Berry, 1932], who have introduced tartrazine (tartar yellow or tartrazole yellow) and phenosafranine for titrations carried out in acid solutions.

We have found the first of these particularly useful for the estimation of chloride in biological secretions and extracts. It is a convenient indicator for general class work and also provides a simple demonstration of the phenomenon of adsorption.

Direct method.

This is suitable for the estimation of chloride in normal urine and similar protein-free solutions, including sea water.

Method. Ten ml. of 0.1 *N* AgNO₃ in a large test-tube are acidified with 5 drops of pure HNO₃, and 2–5 drops of 0.5 % aqueous tartrazine solution are added.

The urine is run in from a burette in quantities of 0.1–0.5 ml. at a time, the mixture being well shaken after each addition. The precipitate of silver chloride which first forms is coloured buff by the adsorbed indicator, and separates out from an almost colourless solution. The end-point is shown by the sudden release of the adsorbed indicator, which passes from precipitate to solution, leaving the precipitate pure white and colouring the solution greenish yellow. This change is very sharp, and may be evoked by a single drop of urine or of a 0.1 % solution of NaCl.

Indirect method.

This is suitable where only small quantities of the chloride solution are available, as in the titration of cerebrospinal fluid, or where the solution contains proteins or other colloids that interfere with the aggregation of the silver chloride precipitate.

Method. One ml. of the chloride solution is added to the mixture of 10 ml. 0.1 *N* AgNO₃, acid and indicator, prepared as already described. After shaking well, the mixture is titrated with previously standardised 0.1 *N* HCl.

Notes on the method.

Where the chloride concentration is less than 0.1 % NaCl it is advisable to use not more than two drops of indicator, as the precipitated silver chloride may be insufficient in amount to adsorb the excess of tartrazine. Working with minimum quantities of indicator it is possible to evoke the end-point by addition

of as little as 0.05 mg. NaCl to the titration mixture. This method may also be adopted for determining the chloride contamination of the HNO_3 used. The tartrazine is liable to be contaminated by chloride, but the quantity present is usually insignificant. An important advantage of the method lies in the double colour change occurring at the end-point, namely (1) the change in the colour of the precipitate from buff to white, and (2) the change in the supernatant liquid from colourless to greenish yellow. By using the optimum of indicator both these changes are observed simultaneously, and the end-point is sharp and very sensitive. When proteins or other protective colloids are present the aggregation of the silver chloride may be prevented, and it becomes necessary to rely entirely on the colour change shown by the precipitate. Thus, in titrating by the direct method such liquids as albuminous urine, saliva, gastric juice, or even milk, moderately satisfactory results may be obtained by using an excess (8–10 drops) of indicator and matching the colour-change in the mixture with a control that has exceeded the end-point. The indirect method, however, is much more satisfactory for such liquids.

Proteins also interfere with the accuracy of the result by combining to a certain extent with the silver reagent and lowering its chloride value. This objection applies equally to the other argentimetric methods used for the titration of chlorides in biological material, and when possible the proteins should be removed by heat-coagulation or precipitation before the estimation. The commoner solutes in pathological urine, such as acetone, acetoacetic acid and glucose, do not interfere with the method. Bile pigment obscures the end-point but may be removed by bleaching the urine with a little persulphate or nitrite, after addition of a drop of nitric acid. Proteins cause difficulty. Sometimes the urine may be deproteinised satisfactorily by heat-coagulation after addition of sodium acetate and acetic acid, the coagulum being washed subsequently with hot water to remove chlorides, and the filtrates combined and made up to known volume. It is frequently found, however, that when the urine has become infected the protein undergoes partial bacterial decomposition and is no longer completely removed by heat-coagulation.

The standardisation of the silver nitrate and other reagents can be accomplished most readily by using the standard sea water of known chlorine content (usually 19.386 %) issued by the International Committee for Exploration of the Sea, Laboratoire Hydrographique, Polyteknisk Laereanstalt, Copenhagen.

REFERENCES.

- Berry (1932). *Analyst*, **57**, 511.
— and Durrant (1930). *Analyst*, **55**, 613.