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SPURIOUS CREAM OF TARTAR.

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SOME few months ago a sample purchased as cream of tartar, and consequently labelled "Cream of Tartar," was submitted to me for analysis under the Sale of Food and Drugs Act.

The British Pharmacopœia, 1898, states that each gramme of dry cream of tartar should require for neutralization at least 5.2 c.c. of normal NaHO, which corresponds to 97.76 per cent.  $\text{KHC}_4\text{H}_4\text{O}_6$ . Two grammes of the sample I am describing required 9.6 c.c. normal NaHO = 4.8 for 1 gramme, corresponding, apparently, to 90.24 per cent. As shown in a paper read by A. H. Allen (ANALYST, xxi., 174), the alkalinity of the soluble ash of pure cream of tartar should be exactly equivalent to the acidity of the original substance. This sample, however, after being ignited and the ash boiled out with water, required only 1.1 c.c. normal  $\text{H}_2\text{SO}_4$  to neutralize the solution, a result which conclusively proved it to be a fictitious article.

The sample was not completely soluble in boiling water, the solution being turbid, and a small residue remaining; this was cleared up by a little HCl. Upon testing qualitatively, reactions were obtained for lime, sulphuric and phosphoric acids, and, most surprisingly, for starch. The starch was identified by the microscope as that of rice, and finally, after comparison with known standards, I arrived at the conclusion that there was approximately 5 per cent. present.

A complete analysis of the substance was made, when the following results were obtained :

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Moisture	...	...	...	...	4.10
Silica	...	...	...	...	0.30
Potassium oxide ( $K_2O$ )	...	...	...	...	15.50
Lime ( $CaO$ )	...	...	...	...	9.10
Tartaric acid ( $H_2C_4H_4O_6$ )	...	...	...	...	47.07
Phosphoric anhydride ( $P_2O_5$ )	...	...	...	...	6.97
Sulphuric anhydride ( $SO_3$ )	...	...	...	...	12.70
Rice starch	...	...	...	...	5.00
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					100.74

The tartaric acid was estimated by a modification of Goldenberg's method, which is abstracted in the ANALYST (xxi., 333). I made some slight alterations in details, and, as the method proved to be both quick and of sufficiently practical accuracy, I state it as adopted: Two grammes of the substance are dissolved in 20 c.c. of boiling water, together with 5 c.c. of dilute HCl. The solution is made up to 100 c.c., of which 50 c.c. are made faintly alkaline by the addition of powdered  $K_2CO_3$ . Boil for two minutes, cool and make up to 100 c.c. Of this liquid, after filtration if necessary, 50 c.c. (= 0.5 gramme original substance) are transferred to a 500 c.c. flask, 10 c.c. glacial acetic acid added, and then 250 c.c. of a mixture of equal parts of alcohol 90 per cent. and ether 0.730, and the flask closed with a well-fitting cork. The whole is then well shaken, hence the use of so large a flask, and allowed to stand for about three hours, in which time the potassium hydrogen tartrate formed is completely precipitated (I believe one hour would be sufficient for the purpose). Filter, wash the precipitate with the alcohol and ether mixture until neutral to litmus, remove it from the filter, dissolve in boiling water, washing off also the adhering traces from the filter-paper, and finally titrate with  $\frac{N}{10}$  NaHO. The following figures show the process to give fairly satisfactory results:

			Direct Titration.	Modified Goldenberg's Method.
Cream of tartar	...	...	98.9	99.4
Tartaric acid...	...	...	97.8	96.4

In order to ascertain whether this method would be affected by the presence of potassium hydrogen sulphate, a mixture of equal parts of cream of tartar (98 per cent.) and potassium hydrogen sulphate was examined. The result obtained was a little low, viz., 48 per cent. cream of tartar.

A consideration of the whole of the analytical results yielded by the sample points to the probability that the material was originally made by the adulteration of cream of tartar with bone-ash superphosphate and starch. The amount of  $K_2O$  present is equal to 62 per cent. of cream of tartar. Assuming this to be of 97 per cent. purity, the proportions in which the ingredients were mixed is probably as follows:

Cream of tartar	=	64
Superphosphate of lime	=	31
Rice starch	=	5
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		100

There is a considerable amount of ingenuity shown in the manufacture of such an article as this, as, although actually containing only 64 per cent. of cream of tartar, when tested by direct titration a result is obtained corresponding to over 90 per cent. This is of course due to the acidity of the added superphosphate.

It is much to be regretted that the compilers of the last edition of the Pharmacopœia, when adopting the method of direct titration of cream of tartar with  $\text{NaHO}$ , as a test of purity, did not also include at least the determination of the alkalinity of the soluble ash. The employment of these tests in conjunction was advocated by A. H. Allen in the paper already referred to, and it is obvious that a much more satisfactory assay of a tartar can be made when both tests are used than when either test is used singly.

Within the last few years I have had occasion to examine a number of samples of cream of tartar, and among them have found a few containing from 3 to 9 per cent. of tartrate of lime. I have also met with cream of tartar substitutes, which have proved to consist entirely of potassium hydrogen sulphate.

In view of the peculiar composition of this sample, and of the fact that at some time or other it must have been a marketable article, I have thought it desirable to lay the results before you.

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