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A METHOD FOR DETERMINING STRYCHNINE IN THE PRESENCE OF ARSENIC TRIOXIDE, FERROUS CARBONATE, ALOIN AND CAPSICUM.

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During March the Children's Department of the Minneapolis General Hospital reported receiving an eighteen-month-old girl with severe symptoms of advanced strychnine poisoning. About four hours had elapsed from the time the child ate the tablets, which had been prescribed for her mother, until the initial spasm was evidenced. The remarkable work of the hospital physicians saved the child's life and the patient was dismissed at the end of five days. It was determined that the child had eaten seven of the tablets, each supposed to contain one-thirtieth of a grain or two and two-tenths milligrams of alkaloidal strychnine; a total dose of approximately one-quarter of a grain of strychnine with a four-hour period for absorption. The recovery was so unusual that the remainder of the tablets were sent to the writer in order that the presence as well as the amount of strychnine in the tablets might be verified.

A review of the literature did not disclose a method for the determination of strychnine in the presence of arsenic trioxide, ferrous carbonate, aloin and capsicum. First, the several methods that were used unsuccessfully will be cursorily reviewed and, secondly, the suggested method of analysis that was finally devised and which gave very satisfactory results will be given.

Method A.—Ten tablets were powdered and treated with ten per cent. hydrochloric acid and filtered. The filtrate was heated to boiling and hydrogen sulphide passed into it for ten minutes. The solution was cooled and again treated with hydrogen sulphide for two minutes. The mixture was then filtered and the precipitate carefully washed with ten per cent. hydrochloric acid. The filtrate was made alkaline with ammonia and filtered, the precipitate being well washed with hot water. The filtrate was then extracted with chloroform and the extract filtered through cotton into a tared dish. The precipitated iron was also well washed with chloroform. The chloroform was then evaporated and the residue weighed and subsequently dissolved in $N/10$ sulphuric acid V. S., using $N/50$ KOH V. S. with cochineal indicator to titrate the excess of sulphuric acid.

This method had several very objectionable features. (1) The hydrochloric acid dissolved a colored sticky material from the vegetable drugs and this, passing through all extractions, contaminated the residue making it unsatisfactory from a gravimetric standpoint. (2) The color of the residue, supposed to be a mixture of the color from the aloin and the cholesterin esters of oleic, stearic and palmitic acids from the capsicum, also made it exceedingly difficult to titrate the alkaloid,

using cochineal as the indicator. (3) The hydrochloric acid attacked the ferrous carbonate and converted it to ferrous and ferric chlorides, which, upon the addition of ammonia water, produced a precipitate consisting of ferroso-ferric hydroxide from which it was exceedingly difficult to extract the alkaloid. The results obtained by this process were high and did not check.

Method B.—Ten tablets were powdered and refluxed over chloroform for six hours. The chloroform was then filtered and extracted with ten per cent. hydrochloric acid. The acid solution of the alkaloid and arsenic was then heated to boiling and hydrogen sulphide passed in to complete precipitation. From this point on the method was the same as A.

By extracting with chloroform, in which the arsenic and strychnine are soluble, the objectionable iron was eliminated. However, the vegetable extractives and coloring materials from the aloin and capsicum came through the extraction and made an accurate determination impossible.

From the preceding results it was very evident that not only the iron but also the vegetable extractives and coloring materials must be removed before satisfactory results could be obtained. The following method is suggested for determining the amount of strychnine in tonic tablets that contain arsenic, ferrous carbonate, aloin, capsicum and other vegetable drugs.

Method C.—Powder ten tablets and reflux over 125 mils of alcohol (95%) for six hours. (Each one of the tablets examined was supposed to contain two and two-tenths milligrams of alkaloidal strychnine.) Filter the material and wash with hot alcohol. Evaporate the filtrate, adding a little water as it approaches dryness. At this point most of the capsicine, a volatile alkaloid of capsicum, is driven off. Add sixty mils of 10% acetic acid and heat on a water-bath. To this hot liquid add 50 mils of a 10% normal lead acetate solution and allow to cool. Filter off the lead precipitate and wash with hot water. Heat the filtrate nearly to boiling and pass in hydrogen sulphide until all of the lead is precipitated. Filter through barium chloride filter paper and wash the sulphides with hot water. The filtrate should be colorless. Boil off the excess of hydrogen sulphide, concentrate to about 150 mils and cool. Add stronger ammonia water until the solution is alkaline and shake out with three 25-mil portions of chloroform. Dissolve the residue in $N/10$ sulphuric acid V. S. and titrate the excess with $N/50$ potassium hydroxide V. S. using cochineal as the indicator. Each mil of $N/10$ sulphuric acid V. S. is equivalent to 33.42 milligrams of alkaloidal strychnine.

This method was most satisfactory. By extracting with alcohol the ferrous carbonate was eliminated and from the acetic acid solution any coloring materials and vegetable extractives could be precipitated with lead acetate. By the above method the following results were obtained:

Sample.	Grams of strychnine found per tablet.	Grams of strychnine supposedly present in each tablet.
A	0.00217	0.0022
B	0.00230	0.0022
C	0.00223	0.0022
D	0.00219	0.0022

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