top layer, the pepsin will be salted out of the water solution, rise to form the middle layer, and the solution of potassium citrate will subside; a graduated tube will give the parts of each ingredient near to the truth. The writer has found that 50 percent alcoholic liquids respond promptly to the test. Since pepsin preparations are much lower in alcohol than this it is good practice to add alcohol in known quantity to the test, to insure the best result, making proper correction of course for the added spirit. Again, this test may be made to disclose in whisky not alone the alcoholic content but a factitious spirit, and the amount of caramel that has been used in coloring it. Simply proceed as before; a measured quantity of the suspected liquid is saturated in a graduated tube, with the dried potassium citrate; the alcohol rises at once; the caramel, insoluble in strong alcohol, separates from both it and the saturated water solution and assumes the middle portion between them. If this tube be corked and set aside for some days the caramel may be removed in one piece and weighed.

Strong mixtures of alcohol and water separate most readily under this method, though a 10 percent alcohol (and 90 of water) responds. So far the writer has not succeeded in separating the alcohol from five percent beer by this method. Such determinations must be assisted by the addition of known amounts of alcohol.

The specific gravity of alcohol prepared by this process indicates 89.25 percent by volume. There is, no doubt, a small quantity of water retained by the alcohol; on the other hand there is doubtless a small portion of alcohol retained by the water so that these errors are acting to neutralize each other and the result is a very fair approximation of the fact.

A METHOD FOR ESTIMATING QUININE AND STRYCHNINE WHEN OCCURRING IN COMMON SOLUTION.

BY A. RICHARD BLISS, JR., M.D.

INTRODUCTORY.

One of the recommendations turned over to the writer as Associate Referee on Alkaloids to the Association of Official Agricultural Chemists was "*That further work be done on the methods for separating Quinine and Strychnine, and that a method be submitted to the collaborators which has a reasonable certainty of yielding concordant results.*" A communication sent to all the collaborators on alkaloids and to the chief chemists of the great majority of the leading chemical manufacturers in which the question was asked, "*Have you been using a method for the separation of Quinine and Strychnine that has proved satisfactory?*" was answered in every case (where the communication was answered at all) in the negative. A search of recent chemical and pharmaceutical literature available to the writer failed to disclose mention of any methods for the estimation of Quinine and Strychnine when occurring in the same solution other than the *Oxalate Method*,[1] the *Tartrate Method*,[1] and the *Ferrocyanide Method* as modified by Simmonds.[2] It seems that most investigators have concluded that these methods are not entirely satisfactory.

[1] Allen, "Commercial Analysis," Vol. VI, p. 461; Vol. IX, p. 518.

[2] *The Analyst*, 39, 81–85, 1914.

While considering the physical properties of the two alkaloids the method below presented itself, and in the hands of the writer has proved to be rather satisfactory. The very simplicity of the method seemingly indicates that surely other workers in this field must have tried this method or some modification of it, but, as already stated, available literature failed to reveal anything but mention of the three methods listed above. The writer is submitting the method for collaborative work and will be grateful for criticisms, suggestions and reports of results.

THEORY OF THE METHOD.

The preparations which are most likely to call for a method of this kind are, of course, the preparations of Iron, Quinine and Strychnine, such as the Glycerite, the Syrup and Elixir of the U. S. P. VIII. After the usual treatment of the sample with citric acid and ammonia water, the shakings out with ether-chloroform, and the recovery of the mixed alkaloidal residue from the latter by careful evaporation, advantage is taken of the following physical properties of the two alkaloids:

	Quinine.	Strychnine.
Solubility in Water[3]	1 Gm. in 1560 mils	1 Gm. in 6420 mils
Solubility in Ether[3]	1 Gm. in 1.9 mils	Very slightly
Solubility in Chloroform[3]	1 Gm. in 1.1 mils	1 Gm. in 5 mils

The separation is accomplished by (1) dissolving the mixed alkaloidal residue in sufficient diluted sulphuric acid, (2) adding an *excess of water*, keeping in mind the fact that 1 Gm. of strychnine requires 6420 mils of water for solution,[3] (3) precipitating the quinine by the addition of ammonia water (the strychnine remaining in solution since a sufficient excess of water is present to accomplish this), (4) dissolving and separating the quinine by shaking out with separate portions of ether (in which strychnine is practically insoluble), (5) shaking out the remaining ammoniacal liquid with separate portions of chloroform to dissolve out and separate the strychnine.

DETAILS OF THE METHOD.

Fifty (50) mils of the sample are treated in the usual way (as with the Oxalate or the Tartrate Methods[4]) with Citric Acid and Ammonia Water, the precipitated alkaloids removed by shaking with ether-chloroform, and the mixed alkaloids recovered by very careful evaporation in a tared dish. This weight of the mixed alkaloids is noted to be used later in checking the results of the method.

The mixed alkaloidal residue is dissolved in sufficient 5 percent sulphuric acid, transferred to a separatory funnel, and the dish washed with sufficient distilled water to make a volume of about 250 mils (1 Gm. of strychnine requires 6420 mils for solution). An excess of ammonia water is added and the mixture shaken out with seven (7) portions of ether using 35, 20, 10, 10, 10, 10, and 5, carefully washing the stem of the separatory funnel each time and running such ether used for washing into the combined ethereal fraction. The combined ethereal fraction is washed with 5 mils of distilled water and allowed to stand for 15 minutes to completely separate. A pledget of absorbent cotton is introduced into the stem

[3] U. S. P. IX, p. 349, 416.

[4] Allen, "Commercial Analysis," Vol. VI, p. 461.

of the separatory funnel, and the ethereal fraction very carefully run into a tared dish. Five (5) mils of ether are poured into the separatory funnel and run into the tared dish, and this is repeated with 5 more mils of ether. Finally the outside of the stem of the separatory funnel is carefully washed with ether and this also run into the tared dish. The ethereal solution is then *very carefully* evaporated on a bath, dried at 100° C. for an hour and weighed as quinine.

The ammoniacal liquid left after the foregoing treatments with ether, is next shaken with seven (7) portions of chloroform using 35, 20, 10, 10, 10, 10 and 5 mils, and carefully washing the stem of the separatory funnel with chloroform and running this chloroform also into the combined chloroformic fraction. The combined chloroformic fraction is washed with 10 mils of distilled water and allowed to stand 15 minutes. A pledget of absorbent cotton is introduced into the stem of the separatory funnel and the chloroformic solution carefully run into a tared dish. Ten (10) mils of chloroform are added to the contents of the separatory funnel, the mixture thoroughly agitated, and, when completely separated, the chloroformic layer run into a tared dish. The outer and inner surfaces of the separatory funnel are washed with a little chloroform and this also run into the tared dish. Lastly, the chloroformic solution is evaporated *very carefully* on a bath, removing the dish from the bath as the last portions evaporate. The residue is dried at 100° C. for an hour and weighed as Strychnine.

Both the weight of the strychnine and that of the quinine may be checked volumetrically by dissolving each residue separately in neutral alcohol, adding an excess of $\frac{N}{10}$ H_2SO_4, and titrating back with $\frac{N}{60}$ KOH, using methyl red as the indicator. One (1) mil of $\frac{N}{10}$ H_2SO_4 is equivalent to 0.0334 Gm. of strychnine and 0.0428 Gm. of strychnine sulphate. One (1) mil of $\frac{N}{10}$ H_2SO_4 is equivalent to 0.0324 Gm. of quinine and 0.0436 Gm. of quinine sulphate.

EXPERIMENTAL.

The following table gives the results of ten estimations carried out on a solution containing 0.4375 Gm. of quinine and 0.0138 Gm. of strychnine in 50 mils (Elixir I. Q. & S., U. S. P. VIII strength):

TABLE 1.

Experiment No.	No. Shakings with ether.	Quinine found. (Had 0.4375).	% Found.	No. Shakings with chloroform.	Strychnine found. (Had 0.0138).	% Found.
1	4	0.4284	98—	4	0.0131	95
2	4	0.4287	98	4	0.0130	95—
3	5	0.4333	99+	5	0.0133	97—
4	5	0.4330	99—	5	0.0132	96
5	6	0.4330	99—	6	0.0135	98
6	6	0.4333	99+	6	0.0135	98
7	7	0.4374	100—	7	0.0136	99
8	7	0.4378	100+	7	0.0133	97
9	7	0.4373	100—	7	0.0135	98
10	7	0.4377	100+	7	0.0137	99

A few preliminary experiments with solutions containing strychnine alone, and carried out by diluting the solutions first with distilled water as above, adding an excess of ammonia, and then shaking out with chloroform, gave the following:

TABLE 2.

Experiment No.	Strychnine in 50 mils.	Strychnine found.	%.	No. shakings.
1	0.0376 Gm.	0.0360 Gm.	95—	5[5]
2	0.0376 Gm.	0.0375 Gm.	99.9	7
3	0.0182 Gm.	0.0182 Gm.	100	7
4	0.0182 Gm.	0.0176 Gm.	97	5[5]

CONCLUSIONS.

The method, as shown by the results of the experiments tabulated above, is certainly reasonably accurate, in the hands of the writer at any rate. A comparison of this method with the other three methods is now being carried out by the writer, who hopes to present the results of his comparative study in the form of a paper at an early date.

LABORATORIES OF PHARMACOLOGY,
SCHOOL OF MEDICINE,
EMORY UNIVERSITY,
ATLANTA, GA.

COMMERCIAL DRUG GROWING IN THE UNITED STATES IN 1918.*

BY W. W. STOCKBERGER.[1]

When some historian of the future writes the history of drug plant growing in the United States, the eventful year 1918 will stand out in sharp relief as a period of readjustment of popular opinion with regard to this important subject. The cumulative effect of the unusual conditions occasioned by the great war cannot yet be fully determined, nevertheless there is much positive evidence that certain important changes have occurred in the drug growing industry. By no means the least of these is the partial emergence of drug growing from the romantic phase which has been so pronounced during recent years into one which is more prosaic but certainly far more sensible and businesslike. Another change, brought about for the most part by bitter experience, is the growing realization that drug growing as a business proposition does not differ essentially from other types of agricultural enterprises, particularly in respect to crop risks and marketing problems, or if any appreciable difference is to be noted it is in the direction of greater uncertainty as to the successful outcome.

Stimulated by the high price levels reached by many important crude drugs during the early period of the war, or hoping thereby to render a patriotic service to our nation in a time of need, the commercial production of crude drugs was undertaken by numerous individuals who had little or no experience in this particular enterprise. In a regrettably large number of cases the outcome was very disappointing although this contingency had been foreseen and publicly predicted in advance by those whose previous experience placed them in a position to judge the situation fairly.

The situation with respect to some of the most important drug crops grown in 1918 fully demonstrates the danger of overproduction regarding which much

[5] After last shake-out still gave a decided precipitation with Mayer's reagent.

* Read before Scientific Section, A. Ph. A., New York meeting, 1919.

[1] Physiologist in Charge, Office of Drug, Poisonous and Oil Plant Investigations, Bureau of Plant Industry.