monomethyl ether (2), the residual material left after the removal of the chrysophanic acid-anthranol triacetate must contain a considerable quantity of emodine anthranol tetra-acetate. This material was oxidized in acetic acid solution with chromic acid and the oxidation product was saponified. To obtain the emodin, this material was extracted with sodium carbonate solution and the extract was acidified. The product so obtained was found to be quite pure. The yields were from 16 to 31 per cent of the weight of chrysarobin used.

EXPERIMENTAL.

Separation of Chrysophanic acid-9-Anthranol Triacetate.—The mixture obtained after reducing, demethylating and acetylating 25 Gm. of chrysarobin as described in the previous paper (1) was dissolved in 400 cc. of glacial acetic acid and the solution was cooled. The chrysophanic acid-9-anthranol triacetate crystallized and was filtered out. The mother liquor was diluted with water until no more precipitate formed. The precipitate was filtered out and air dried.

Preparation of Emodin.—The dried precipitate was dissolved in about 350 cc. of hot glacial acetic acid and treated with a solution of chromic acid in a small volume of 50 per cent acetic acid, using 0.34 Gm. of chromic acid for each Gm. of the precipitate. The mixture was heated to 100° C. for about fifteen minutes and then diluted with water until no more precipitate formed. The precipitate was filtered out and washed with water until the washings were no longer appreciably acid. After air drying, it was suspended in 250 cc. of alcohol and a solution of 12 Gm. of potassium hydroxide in a little water was added. The mixture was boiled under reflux for three hours, cooled and filtered. The filtrate was diluted to about a liter and acidified to Congo Red with hydrochloric acid. The precipitate which formed was filtered out and then stirred well with 800 cc. of 5 per cent sodium carbonate solution. The mixture was filtered and the emodin precipitated from the filtrate by acidifying with hydrochloric acid. Yield, 4.0 to 7.8 Gm., m. p. 254–256° C., with slight previous softening.

SUMMARY.

A satisfactory method for the preparation of emodin from chrysarobin has been developed.

REFERENCES.

(1) Gardner, JOUR. A. PH. A., 23, 1178 (1934).
(2) Hauser, Dissertation, *Zürich*, 1924.

THE TITRATION CURVE OF METHIONIC ACID.*

PHYLLIS M. BREWSTER[1] AND GLENN L. JENKINS.[1]

Before attempting to prepare stable complex and double salts of methionic acid, it was necessary to study the acid properties of the compound, $CH_2(SO_3H)_2$. If the acid were to behave as a fairly weak dibasic acid, showing two separate dissociations, then it is conceivable that a salt of the type $MM'CH_2(SO_3)_2$ might form easily, depending on its physical properties. Since a solution of such a salt would consist of a mixture of three ions M^+, M'^+ and $CH_2(SO_3)_2^-$ the salt that would crystallize would be determined roughly by the solubilities of the three possible products.

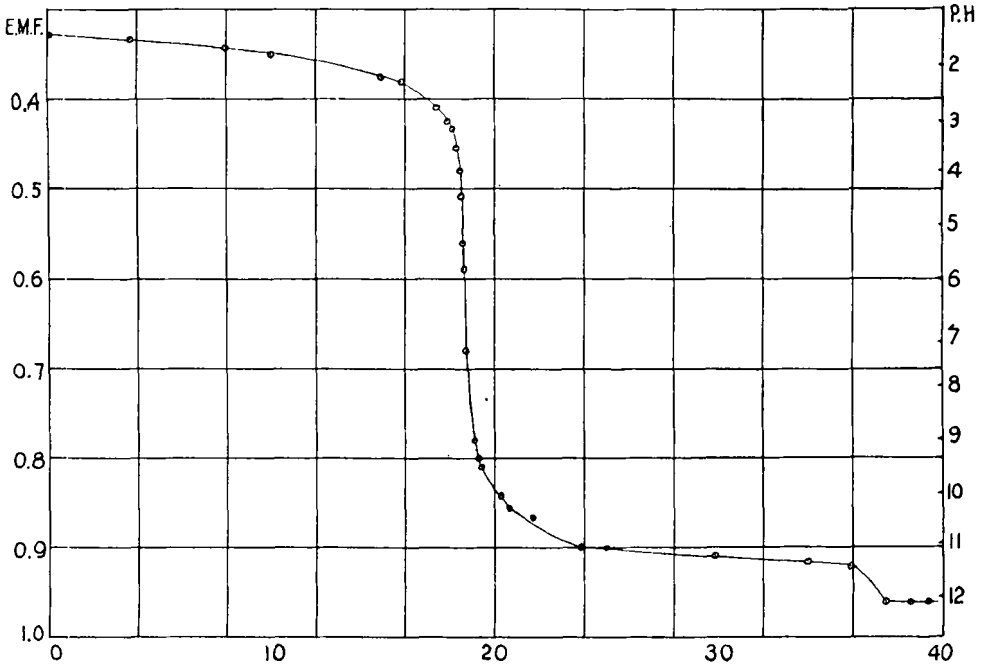
---

* Presented before the Scientific Section, A. PH. A., Minneapolis meeting, 1938.

[1] Contribution from the College of Pharmacy of the University of Minnesota, August, 1937.

The accompanying graph shows the titration of methionic acid with NaOH using the hydrogen electrode. It is seen that there are two breaks in the curve, the second occurring at approximately p_H 11.5, when twice the amount of alkali present at the first break has been added. A similar curve was obtained using the quinhydrone electrode. In other words, the methionic acid here appears to behave as a dibasic acid with a high primary dissociation, and an extremely small secondary dissociation—the dissociation constant being of the order 10^{-11}. In view of the fact that the SO_3H group usually confers strongly acidic properties on a compound, we would expect $CH_2(SO_3H)_2$ to behave in a manner similar to H_2SO_4 on titration, rather than to show such an extremely small secondary dissociation as indicated by the graph.

It was undertaken to prove either: (1) that at the end-point of the first break only one acid group was neutralized, or (2) that at this p_H both acid groups were neutralized and the second break in the titration curve of methionic acid was not significant. To decide between the two

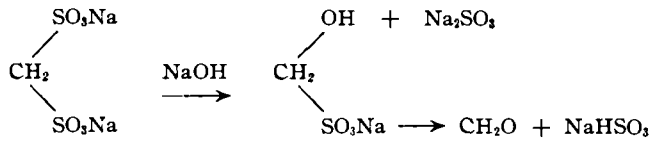


Titration of Methionic Acid with NaOH using the Hydrogen Electrode.

possibilities, the following experiment was carried out: Methionic acid was titrated with NaOH to approximately p_H 7 and a portion of this solution evaporated to dryness. The crystalline material so obtained was dried over P_2O_5 at 100° C. and analyzed.

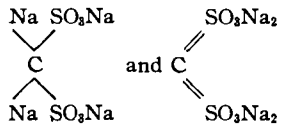
		C.	H.	S.	Na.
Theoretical	$Na_2CH_2(SO_4)_2$	5.450	0.9082	29.11	20.89
	$NaHCH_2(SO_3)_2$	6.054	1.514	32.38	11.60
Obtained		6.43	1.04	28.89	20.85

The results check for the disodium salt. We can say therefore, that in methionic acid both primary and secondary dissociations are very large and cannot be separately detected, and methionic acid behaves toward NaOH as a strong dibasic acid. The second break in the titration curve which invariably occurs at p_H 11 might be explained by the decomposition of some of the methionic acid in strongly alkaline solution. It is possible that a compound with two sulfonic groups attached to the same carbon might be partly hydrolyzed in strongly alkaline solution to give some sulfite,



However the alkaline solution of methionic acid gave no test for sulfite. The difficulty in obtaining the points on the curve at the second break due to the failure of the hydrogen electrode to come to equilibrium rapidly is evidence in favor of some decomposition.

It has also been suggested that substitution or enolization may occur in strongly alkaline solution to give compounds of the types:



Bauer and Jenkins (1) have shown evidence for the presence of two sodiums on the carbon atom at one time by their work with diphenyl methionate, which they showed could be converted into the disubstituted derivative, $RR'C(SO_3\emptyset)_2$ in one step.

CONCLUSION.

It has been proved that methionic acid behaves as a strong dibasic acid, in the manner of sulfuric acid. It has also been shown that the second break in the titration curve is due either to decomposition or to molecular rearrangement in strongly alkaline solution.

REFERENCE.

(1) Bauer, J. C., and Jenkins, G. L., JOUR. A. PH. A., 26, 490 (1937).

A METHOD FOR EXTRACTING ALKALOIDS IN TOXICOLOGICAL ANALYSIS.*

CHARLES O. WILSON[1] AND L. W. RISING.[2]

One of the first difficulties confronting a toxicologist in his work is the efficient separation of the suspected poison from the viscera containing it. Many methods have been proposed for performing this function, particularly where alkaloids are concerned. None are without fault. Some are too time-consuming, some are very expensive, some lose significant quantities of poison and others fail to eliminate comparatively large amounts of contaminating organic material.

The importance of such weaknesses, particularly in the extraction of pure alkaloids in forensic toxicology is not to be denied, and further, the value of any new procedure designed to eliminate the more conspicuous defects, is obvious. It was in the hope of developing such a strengthened procedure that the investigation described in this paper was instituted.

---

* Presented before the Scientific Section, A. PH. A., Minneapolis meeting, 1938.

[1] Assistant Professor of Pharmaceutical Chemistry, George Washington University, School of Pharmacy, Washington, D. C.

[2] Professor of Pharmacy, University of Washington, Seattle, Wash.