

THE DETERMINATION OF MANDELIC ACID IN CALCIUM  
MANDELATE, MONOETHANOLAMINE MANDELATE AND  
ELIXIR OF MANDELIC ACID.\*

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Since Rosenheim (1) reported that mandelic acid had therapeutic properties there have been several (2), (3) methods proposed for its quantitative estimation. During the course of some experimental work we found a volumetric method for the determination of mandelic acid in calcium mandelate, monoethanolamine mandelate and elixir of mandelic acid which we believe to be both accurate and time-saving. In this method the mandelic acid is extracted with ether in acid solution and is subsequently titrated, directly, with tenth-normal barium hydroxide. The procedure is described as follows.

METHODS.

*For Calcium Mandelate and Monoethanolamine Mandelate.*—Place 0.25 Gm. of the sample, accurately weighed, in an automatic extraction apparatus, then add 50 cc. of distilled water and 1 cc. of hydrochloric acid. Assemble the apparatus on a steam-bath and completely extract with ether. Usually three hours is sufficient. At the end of this period dismantle the extraction equipment and remove the ether from the flask by evaporation on a steam-bath. Add to the residual liquid 25 cc. of neutral alcohol and 1 cc. of phenolphthalein T. S. Then titrate the solution with tenth-normal barium hydroxide. Each cc. of tenth-normal barium hydroxide corresponds to 0.0152 Gm. of mandelic acid.

*For Elixir Mandelic Acid.*—Place 10 cc. of the elixir in a 100 cc. volumetric flask and dilute to the mark with distilled water. Mix thoroughly and transfer 10 cc. of this solution to an automatic extraction apparatus. Then add 40 cc. of distilled water containing 1 cc. of hydrochloric acid. Test with litmus paper and if the solution is not acid, add sufficient hydrochloric acid to provide a distinctly acid reaction. Assemble the apparatus on a steam-bath and proceed as directed in the assay for calcium mandelate.

RESULTS.

TABLE I.—CALCIUM MANDELATE.

Sample No.	% Mandelic Acid Found.	Theoretical Amount Mandelic Acid %.	% Theoretical Amount Found.
1	88.51	88.30	100.20
2	87.87	88.30	99.51
3	88.51	88.30	100.20
4	87.87	88.30	99.51

TABLE II.—MONOETHANOLAMINE MANDELATE.

Sample No.	% Mandelic Acid Found.	Theoretical Amount Mandelic Acid %.	% Theoretical Amount Found.
1	71.51	71.36	100.2
2	71.20	71.36	99.7
3	71.50	71.36	100.2
4	71.20	71.36	99.7
5	71.84	71.36	100.6
6	72.07	71.36	100.9
7	72.07	71.36	100.9
8	72.71	71.36	101.8

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TABLE III.—ELIXIR MANDELIC ACID.

Elixir No.	Mandelic Acid Found Gm./100 Cc.	Theoretical Amount Mandelic Acid Gm./100 Cc.	% Theoretical Amount Found.
1	0.2878	0.27	106.5
2	0.2789	0.27	103.2
3	0.2730	0.27	101.1
*4	0.525 (0.25 Gm. mandelic acid added to 3)	0.52	100.9

\*0.25 Gram of pure mandelic acid was added to sample No. 4 in order to demonstrate that all of the mandelic acid had been accounted for in the assay.

## SUMMARY.

(1) A convenient method is presented for determining mandelic acid in calcium mandelate, monoethanolamine mandelate and elixir of mandelic acid, which involves an ether extraction in acid solution and a direct titration by means of tenth-normal barium hydroxide solution.

(2) The varied application of the method gives promise that it may be of considerable value in estimating the amount of mandelic acid present in other salts of mandelic acid.

## REFERENCES.

- (1) Rosenheim, M. L., *Lancet*, 1, 1032-1037 (May 1935).
- (2) *Chem. Abst.*, 32, 3089 (1938).
- (3) *New and Nonofficial Remedies*, 293 (1938).

POSSIBILITIES OF SYNONYMY IN GENUS DELPHINIUM.\*<sup>1</sup>BY JOAN COONS AND C. W. BALLARD.<sup>2</sup>

There are many instances of disagreement as to the validity of several species of *Delphinium* as separate entities and of sub-species and varieties. P. A. Rydberg (1), Britton (2) and Small (3) classed *Delphinium carolinianum* and *Delphinium azureum* as one; while Gray (4) placed a question mark after this classification. Phillips (5) stated that *Delphinium azureum* was once considered a variety of *carolinianum*; while Leonian (6) said that *carolinianum* was the *azureum* of one botanist and the *virescens* of another, and was probably an analog of *Delphinium azureum* from a different environment.

A similar diversity of opinion exists in regard to *Delphinium virescens*. Rydberg (7) classed *Penardi*, *virescens* and *albescens* as one; while Davis (8) classed *azureum* and *virescens* as synonyms of *carolinianum*; and Britton (9) stated that *albescens* is confused with *carolinianum*. Gray (4) also stated that *Penardi* has as synonyms both *Delphinium camporum* and *albescens*. Moreover, *Delphinium Nortonianum* is involved in this confusion.

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