RESEARCH NOTES:

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Estimation of Carbonates in Soils by a New Calcimeter (SVV Apparatus)

The carbonate present in the soil is generally determined and reported as calcium carbonate ($CaCO_3$) even though there may be dolomitic admixture and calcium replaced by magnesium. The calcium carbonate is usually estimated by reacting with dilute hydrochloric acid, either standard or non-standard depending on the method, collecting the carbon-di-oxide in strong potassium hydroxide and weighing, or by finding out the loss of carbon-di-oxide and computing for the calcium carbonate content.

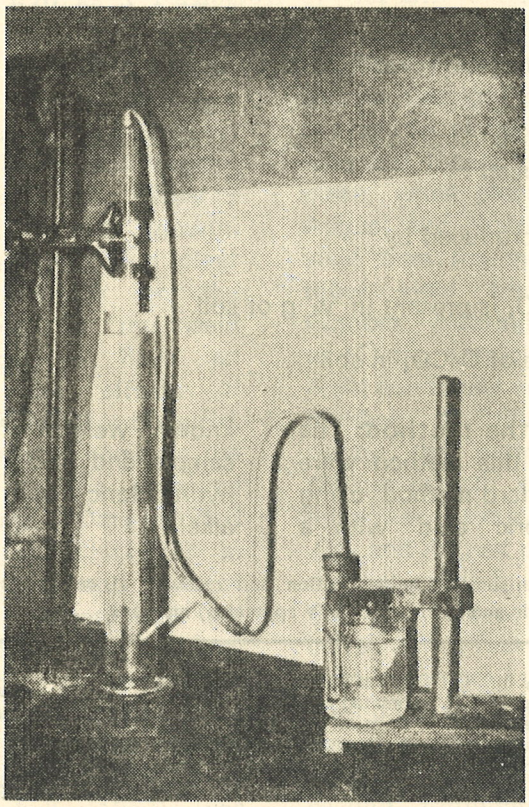
A number of methods have been described by various workers and these methods are mostly cumbursome and time consuming. In order to make the estimation easy, convenient, simple and quick a new calcimeter has been deviced by the authors and is named as S V V apparatus after the first letters of the name of authors. This apparatus can be assembled in any common laboratory. The apparatus gives accurate and reproducible results and is comparable with any standard method.

Requirements to assemble the calcimeter:

1. A 50 ml burette with I. R. connection
2. A suitable rubber tube to fit the burette, 1-2 meters (0.75 x 0.75mm)
3. A 'T' tube fitting to the rubber tube: (or a 'Y' tube)
4. Boiling tube (s) of 2.5 cm diameter and a suitable rubber stopper for the same.
5. A tall cylinder preferably 1000 ml capacity and tall enough to accommodate the 50 ml mark of the burette when kept inverted
6. A big beaker or a water trough
7. A glass vial or thimble of 5 ml capacity and a thread for tying the same.
8. A glass rod bit 2 to 2.5 cm long tightly fitting the rubber tube.

Setting up of the apparatus: A 1000 ml cylinder is taken and filled with water upto 1" below the brim. Then a 50 ml burette is introduced into the cylinder inverted. The open end of the burette is connected with a suitable I R tube of about 40 cm long. The other end of the rubber tube is connected to the horizontal arm of the 'T' tube. The other end of the 'T' tube is connected with another bit of I R tube of about 30 cm in length. The other end of the rubber tube is fitted to a suitable glass tube which is inserted tight into a hole in the centre of a rubber stopper suitable for the boiling tube (25 cm dia.) A thread of about 3" in length is fixed to the rubber stopper. The vertical end of the 'T' tube is fitted with a rubber tube of 4 cm long and plugged with a short glass rod air tight.

Procedure for estimating the calcium carbonate in the soil: 1-5 g of soil sample depending upon the calcium carbonate content in the soil, as not to exceed 0.1 g of $CaCO_3$ is



taken in a boiling tube. The vial or thimble attached to the rubber stopper by the thread is filled with 1:4 dilute hydrochloric acid and the outside of the tube is wiped dry. The tube is carefully inserted into the boiling tube and the stopper fitted well to the boiling tube. The boiling tube is kept in a water trough to attain a constant temperature. The glass rod is opened and the levels of the liquid both inside and outside of rhe burette are equalled; and the glass rod is once again inserted. Now the initial reading of the burette is noted as 'X'. The boiling tube is manipulated so that the hydrochloric acid in the thimble falls into the soil and mixes well with it. The boiling tube is once again placed in the water bath to attain constant temperature. The carbonate in the soil, reacts with acid and carbon-di-oxide is produced and the water level in the burette is pushed down. When equilibrium is attained, the burette is raised so that the level of liquid both inside ond outside are uniform. Now the reading is taken as Y. The difference between X and Y gives the volume of carbon-di-oxide produced as 'b' ml.

Standardisation : Exactly 0.1 g of analar calcium carbonate is taken in another clean, dry, boiling tube and the amount of carbon-di-oxide produced is calculated under identical conditions.

Calculation :

Let the volume of carbon-di-oxide produced by 0.1 gm $CaCO_3$ } = a ml

Volume of carbon-di-oxide produced by w. gms. of soil = b ml

a ml of CO_2 is produced by = 0.1 g $Ca CO_3$

b ml of CO_2 will be produced by $= \frac{0.1}{a} \times b$ g $CaCO_3$

This amount of $CaCO_3$ is present in 'w' g of soil.

Therefore percentage of $CaCO_3$ in soil $= \frac{0.1}{a} \times \frac{b}{w} \times 100.$

Evaluation of the method: The results obtained by this method were checked with a standard method using standard hydrochloric acid with a known weight of standardised soil sample and back titrating the excess hydrochloric acid against standard alkali.

TABLE A comparison of the estimation and recovery of calcium carbonate by the volumetric and calcimetric (SVV apparatus) methods

Wt. of sample used	$CaCO_3$ in the standard (per cent)	% $CaCO_3$ estimated by titration	% $CaCO_3$ estimated by SVV apparatus	% recovery titration	% recovery in SVV apparatus
2.0	2	1.98	1.95	98.9	97.5
1.0	3	2.91	2.82	97.1	94.0
2.0	3	2.99	2.99	99.8	99.6*
1.0	4	3.73	3.98	99.2	99.6*
2.0	4	3.85	3.98	96.2	99.6*
1.0	5	4.85	4.98	97.2	99.6*
2.0	5	4.96	4.98	99.2	99.6*

*Note the reproductivity of the results

Mean per cent recovery :

By titration method = 98.2 per cent

By SVV apparatus = 98.6

It is evident from the Table that the apparatus devised by the authors has given results comparable with or even better than those from standard methods. Efficiency was found to be greater when the $CaCO_3$ content was higher.

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T. L. SUBRAMANIAN
P. VASUDEVAN
C. R. VENKATARAMAN

Department of Soil Science and Agrl. Chemistry,
T. N. Agrl. University, Coimbatore - 641003.