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Indian Standard

METHODS OF TEST FOR SOILS

PART XXIII DETERMINATION OF CALCIUM CARBONATE

(*First Revision*)

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Indian Standard

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(Continued on page 2)

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Indian Standard

METHODS OF TEST FOR SOILS

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(First Revision)

0. FOREWORD

0.1 This Indian Standard (Part XXIII) (First Revision) was adopted by the Indian Standards Institution on 16 February 1976, after the draft finalized by the Soil Engineering Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 With a view to establish uniform procedures for the determination of different characteristics of soils and also for facilitating comparative studies of the results, the Indian Standards Institution has published ' Indian Standard methods of test for soils ' (IS : 2720) in parts. So far 38 parts of this standard have been published. This part (Part XXIII) deals with the method of test for determination of calcium carbonate content in soils for civil engineering purposes. The calcium carbonate content of soil affects the engineering properties of the soils and is of interest to the engineer.

0.2.1 This standard (Part XXIII) was first published in 1966. In the present revision acetic acid has been replaced by hydrochloric acid which is comparatively less costly. The factor 0.074 used for the calculation in the original method has been omitted as its effect on the ultimate result is insignificant. Blank titration has also been omitted to save time. It is considered that the accuracy given by this method is sufficient for interpretation of engineering properties of soils.

0.3 In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

0.4 In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

*Rules for rounding off numerical values. (revised).

1. SCOPE

1.1 This standard (Part XXIII) lays down the method for rapid determination of the calcium carbonate content in soil.

2. APPARATUS

2.1 Burette — 50 ml, conforming to IS : 1997-1967*.

2.2 Conical Flask — 500 ml capacity.

2.3 Glass Funnel — 75 mm diameter.

2.4 Filter Paper — Whatman No. 40 or equivalent, of 12.5 cm diameter.

3. REAGENTS AND INDICATOR

3.1 Sodium Hydroxide Solution — 1 N. Dissolve slightly more than 40 g sodium hydroxide in 1 litre of distilled water and standardize against N hydrazine sulphate to get exact strength, using methyl red as indicator.

3.2 Hydrochloric Acid — 1 N. Dilute 175 ml of concentrated hydrochloric acid to 2 litres and standardize it against sodium hydroxide solution prepared as in 3.1 and determine the exact factor (strength) if the solution is not exactly 1 N.

3.3 Bromothymol Blue Indicator

4. PROCEDURE

4.1 Weigh 5 g (*see* Note 1) of soil accurately and transfer to a 150-ml beaker and add 100 ml of hydrochloric acid solution prepared as in 3.2 (*see* Notes 2 and 3). Cover with a watch-glass and stir vigorously several times for 1 hour. After settling, pipette off 20 ml of the supernatant liquid and take into a conical flask; add 6 to 8 drops of bromothymol blue indicator and titrate with sodium hydroxide solution (*see* Notes 2 and 3) prepared as in 3.1. With some soils, the colour of the indicator may fade as the end-point is approached. In such cases, add more indicator and complete the titration.

NOTE 1 — First take about 1 g of soil in a test tube and pour a few drops of concentrated hydrochloric acid. Note the intensity of reaction:

- a) For vigorous reaction, take only 2.5 g of soil and multiply the result by 2.
- b) In case of moderate reaction, follow the above procedure.
- c) If there is feeble reaction, take 10 g of soil and divide the result by 2.

NOTE 2 — Accurate weighing and standardization of hydrochloric acid and sodium hydroxide are important for correct results.

NOTE 3 — Intermittent checking of the strength of stock solution is necessary.

*Specification for burettes (*first revision*).

5. CALCULATION

5.1 One millilitre of 1N hydrochloric acid is equivalent to 0.05 g of calcium carbonate present in the soil sample.

$$\begin{aligned} \text{Carbonate present in soil,} &= \left(\frac{\text{Volume of 1N hydro-}}{\text{5 g of soil}} \times 0.05 \times \frac{100}{5} \right) \\ \text{percent by mass} &= \text{Volume of hydrochloric acid consumed} \\ &= \text{for 5 g of soil.} \end{aligned}$$

Details are shown in the example given below.

Example:

$$1 \text{ ml of N hydrochloric acid} = 0.05 \text{ g of calcium carbonate}$$

$$\text{Strength of NaOH} = 0.93 \text{ N}$$

$$\text{Strength of HCl} = 1.023 \text{ N}$$

$$\text{Quantity of NaOH used in titration} = 19.0 \text{ ml}$$

$$\begin{aligned} \text{Therefore, quantity of 1N} & \\ \text{HCl added in 5 g of soil} &= 100 \times 1.023 \text{ ml} \\ &= 102.3 \text{ ml} \end{aligned}$$

$$\begin{aligned} \text{Therefore, quantity of 1N} & \\ \text{NaOH required for titra-} & \\ \text{tion of 20 ml of the} & \\ \text{extractant} &= 19.0 \times 0.93 \\ &= 17.67 \end{aligned}$$

$$\begin{aligned} \text{Therefore, for 100 ml ex-} & \\ \text{tractant} &= 17.67 \times 5 \\ &= 88.35 \end{aligned}$$

$$\begin{aligned} \text{Therefore, 1N HCl consum-} & \\ \text{ed by 5 g of soil} &= (102.30 - 88.35) \\ &= 13.95 \end{aligned}$$

$$\begin{aligned} \text{Therefore, percentage of} & \\ \text{CaCO}_3 &= \frac{13.95 \times 0.05 \times 100}{5} \\ &= 13.95 \end{aligned}$$

$$\text{Thus, percentage of CaCO}_3 = \text{1N HCl consumed by 5 g of soil.}$$

(Continued from page 2)

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ON

METHODS OF TEST FOR SOILS

IS:

2720 Methods of test for soils:

- Part I-1972 Preparation of dry soil samples for various tests (*first revision*)
- Part II-1973 Determination of water content (*second revision*)
- Part III-1964 Determination of specific gravity
- Part IV-1975 Grain size analysis (*first revision*)
- Part V-1970 Determination of liquid and plastic limits (*first revision*)
- Part VI-1972 Determination of shrinkage factors (*first revision*)
- Part VII-1974 Determination of moisture content-dry density relation using light compaction (*first revision*)
- Part VIII-1974 Determination of moisture content-dry density relation using heavy compaction (*first revision*)
- Part IX-1971 Determination of dry density-moisture content relation by constant weight of soil method
- Part X-1973 Determination of unconfined compressive strength (*first revision*)
- Part XI-1971 Determination of shear strength parameters of a specimen tested in unconsolidated undrained triaxial compression without the measurement of pore water pressure
- Part XII-1975 Determination of shear strength parameters of soil from consolidated undrained triaxial test with measurement of pore water pressure
- Part XIII-1972 Direct shear test (*first revision*)
- Part XIV-1968 Determination of density index (relative density) of cohesionless soils
- Part XV-1965 Determination of consolidation properties
- Part XVI-1965 Laboratory determination of CBR
- Part XVII-1966 Laboratory determination permeability
- Part XVIII-1964 Determination of field moisture equivalent
- Part XIX-1964 Determination of centrifuge moisture equivalent
- Part XX-1966 Determination of linear shrinkage
- Part XXI-1965 Determination of total soluble solids
- Part XXII-1972 Determination of organic matter (*first revision*)
- Part XXIII-1976 Determination of calcium carbonate (*first revision*)
- Part XXIV-1976 Determination of cation exchange capacity (*first revision*)
- Part XXV-1967 Determination of silica sesquioxide ratio
- Part XXVI-1973 Determination of pH value (*first revision*)
- Part XXVII-1968 Determination of total soluble sulphates
- Part XXVIII-1974 Determination of dry density of soils, in-place, by the sand replacement method (*first revision*)
- Part XXIX-1975 Determination of dry density of soils in-place by the core cutter method (*first revision*)

IS:

2720 Methods of test for soils:

- Part XXX-1968 Laboratory vane shear test
- Part XXXI-1969 Field determination of California bearing ratio
- Part XXXII-1970 North dakota cone test
- Part XXXIII-1971 Determination of density in-place by the ring and water replacement method
- Part XXXIV-1972 Determination of density of soil in-place by the rubber-balloon method
- Part XXXV-1974 Measurement of negative pore water pressure
- Part XXXVI-1975 Laboratory determination of permeability of granular soil (constant head)
- Part XXXVII-1976 Determination of sand equivalent value of soils and fine aggregates
- Part XXXVIII-1976 Compaction control test (Hilf method)

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