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Indian Standard

METHODS OF SAMPLING AND TEST (PHYSICAL AND CHEMICAL) FOR WATER AND WASTEWATER

PART 23 ALKALINITY

(First Revision)

(Incorporating Amendment No. 1)

1. Scope — Prescribes the potentiometric and indicator methods for determination of alkalinity. These methods are applicable to determine alkalinity in water and wastewater in the range of 0.5 to 500 mg/l alkalinity as $CaCO_3$. The upper range may be extended by dilution of the original sample.

2. Principle and Theory — Alkalinity of water is the capacity of that water to accept protons. It may be defined as the quantitative capacity of an aqueous medium to react with hydrogen ions to *p*H 8.3 (phenolphthalein alkalinity) and then to *p*H 4.5 (total alkalinity or methyl orange alkalinity). The equation in its simplest form is as follows:

$$CO_3^{--} + H^+ = HCO_3^- - (pH\ 8.3)$$

From *p*H 8.3 to 3.7, the following reaction may occur:

$$HCO_3^- + H^+ = H_2CO_3$$

3. Interferences — Free available residual chlorine markedly affects the indicator colour response. The addition of minimal volumes of sodium thiosulphate eliminates this interference. Substances such as salt of weak organic or inorganic acids present in large amount may interfere. Oils and greases may also interfere by coating the electrode. Coloured or turbid samples may interfere in end point. Analyse such samples by potentiometric titration.

4. Sampling and Storage — Sampling and storage shall be done as prescribed in IS : 3025 (Part 1)-1986 'Methods of sampling and test (physical and chemical) for water and wastewater: Part 1 Sampling (*first revision*)'.

5. Sample Preparation — The sample aliquot used for analysis should be either free from turbidity or should be allowed to settle prior to analysis.

6. Apparatus

6.1 p*H Meter*

6.2 *Burette* — 50-ml capacity.

6.3 *Magnetic Stirrer Assembly*

7. Reagents

7.1 *Distilled Water* — Distilled water used should have *p*H not less than 6.0. If the water has *p*H less than 6.0, it shall be freshly boiled for 15 minutes and cooled to room temperature. Deionized water may be used provided that it has a conductance of less than 2 μs/cm and a *p*H more than 6.0.

7.2 *Sulphuric Acid* — Dilute 5.6 ml of concentrated sulphuric acid (relative density 1.84) to one litre with distilled water.

7.3 *Standard Solution of Sulphuric Acid* — 0.02 N.

7.4 *Phenolphthalein Indicator* — Dissolve 0.5 g of phenolphthalein in 100 ml, 1 : 1 (v/v), alcohol water mixture.

7.5 *Mixed Indicator Solution* — Dissolve 0.02 g methyl red and 0.01 g bromocresol green in 100 ml, 95 percent, ethyl or *iso*propyl alcohol.

Adopted 31 July 1986 | | **Price Group 1**

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8. Procedure

8.1 *Indicator Method* — Pipette 20 ml or a suitable aliquot of sample into 100-ml beaker. If the *p*H of the sample is over 8.3, then add 2 to 3 drops of phenolphthalein indicator and titrate with standard sulphuric acid solution till the pink colour observed by indicator just disappears (equivalence of *p*H 8.3). Record the volume of standard sulphuric acid solution used. Add 2 to 3 drops of mixed indicator to the solution in which the phenolphthalein alkalinity has been determined. Titrate with the standard acid to light pink colour (equivalence of *p*H 3.7). Record the volume of standard acid used after phenolphthalein alkalinity.

8.2 *Potentiometer Method* — Pipette 20 ml or a suitable aliquot of sample into a 100-ml beaker and titrate with standard sulphuric acid to *p*H 8.3 and then to *p*H 3.7, using a potentiometer. No indicator is required.

9. Calculation — Calculate alkalinity in the sample as follows:

$$\text{Phenolphthalein alkalinity (as mg/l of } CaCO_3) = \frac{A \times N \times 50\,000}{V}$$

$$\text{Total alkalinity (as mg/l } CaCO_3) = \frac{(A + B) \times N \times 50\,000}{V}$$

where

A = ml of standard sulphuric acid used to titrate to *p*H 8.3,

B = ml of standard sulphuric acid used to titrate from *p*H 8.3 to *p*H 3.7,

N = normality of acid used, and

V = volume in ml of sample taken for test.

EXPLANATORY NOTE

Alkalinity of water or wastewater is its quantitative capacity to react with a strong acid to a designated *p*H. Alkalinity is significant in many uses and treatments of natural and wastewaters. Alkalinity measurements are used in the interpretation and control of water and wastewater treatment processes.

This method supersedes **13** and **14** of IS : 3025-1964 'Methods of sampling and test (physical and chemical) for water used in industry.

This edition 2.1 incorporates Amendment No. 1 (September 2000). Side bar indicates modification of the text as the result of incorporation of the amendment.