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Indian Standard

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

PART 10 TURBIDITY

(First Revision)

Water Sectional Committee, CDC 26; Panel for Methods of Test for Water and Effluents, CDC 26 : P1 [Ref : Doc : CDC 26 (8856)]

1. Scope — Prescribes nephelometric method for the measurement of turbidity of water. This method is applicable to all types of water.

2. Principle — It is based on comparision of the intensity of light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension under the same conditions.

The higher the intensity of scattered light, the higher the turbidity. Formazin polymer is generally used as turbidity standard because it is more reproducible than other types of standards used previously. The turbidity of a particular concentration of Formazin suspension is defined as 40 Jackson turbidity units. The same suspension of Formazin has a turbidity of approximately 40 units when measured on Jackson candle turbidimeter. Thus turbidity units based on the Formazin preparation closely approximate those derived from Jackson candle turbidimeter but may not always be indentical to them.

3. Interferences — Coloured solutes cause low turbidity values.

4. Apparatus

4.1 *Sample Tubes* — The sample tubes should be of clear and colourless glass.

4.2 *Turbidimeter* — The turbidimeter shall consist of a nephelometer with a light source for illuminating the sample and one or more photo electric detectors with a readout device to indicate the intensity of light scattered at right angles to the path of the incident light. The turbidimeter should be so designed that little stray light reaches the detector in the absence of turbidity and should be free from significant drift after a short warm-up period.

5. Reagents

5.1 *Turbidity-Free Water* — Pass distilled water through membrane filter having a pore size not greater than 0·45 μm, if such filtered water shows a lower turbidity than the distilled water. Discard the first 200 ml collected. Otherwise use distilled water.

5.2 *Hexamethylene Tetramine Solution* — Dissolve 10·0 g hexamethylene tetramine in demineralised water and dilute to 100 ml.

5.3 *Hydrazine Sulphate Solution* — Dissolve 1·000 g hydrazine sulphate $(NH_2)_2H_2SO_4$ in demineralised water and dilute to 100 ml.

5.4 *Turbidity Standard Suspension I (Formazin)* — In a 100-ml volumetric flask mix 5·0 ml hydrazine sulphate solution with 5·0 ml haxamethylene tetramine solution. After 24-hour standing at 25 ± 3°C, dilute to 100 ml with demineralised water and mix well. Prepare fresh monthly.

5.5 *Turbidity Standard Suspension II* — Dilute 10 ml turbidity standard suspension I to 100 ml with demineralised water. The turbidity of this suspension is defined as 40 Jackson Turbidity units (JTU). Prepare fresh weekly. This suspension may be diluted as required to prepare more dilute turbidity standards.

6. Sample Handling and Preservation — Preservation of sample is not practical. Analysis should begin as soon as possible. Refregeration or chilling to 4°C is recommended to minimize microbiological reaction.

7. Procedure

7.1 *Turbidimeter Calibration* — Follow the manufacturer's operating instructions. Measure the standards on turbidimeter covering the range of interest. If the instrument is already calibrated in standard turbidity units, this procedure will check the accuracy of calibration.

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7.2 *Turbidity Less Than 40 Units* — Shake the sample to disperse the solids. Wait until air bubbles disappear. Pour sample into turbidimeter tube and read turbidity directly from the instrument scale or from calibration curve.

7.3 *Turbidity Greater Than 40 Units* — In case turbidity values are greater than 40 units, dilute the sample with turbidity-free water to bring the values within range. Take readings of diluted sample. Compute the turbidity of the original sample from the turbidity of the diluted sample and the dilution factor.

8. **Calculation** — Calculate the turbidity of diluted samples, using the following equation:

$$\text{Turbidity units} = \frac{A \times (B + C)}{C}$$

where

A = turbidity units found in diluted sample,

B = volume in ml of dilution water used, and

C = volume of sample in ml taken for dilution.

9. **Report** — Report turbidity as follows:

Turbidity Range in unit	*Record to the Nearest*
0 - 1	0·05
1 - 10	0·1
10 - 40	1
40 - 100	5
100 - 400	10
400 - 1 000	50
Greater than 1 000	100

EXPLANATORY NOTE

The turbidity of sample is the reduction of transparency due to the presence of particulate matter such as clay or silt, finely divided organic matter, plankton or other microscopic organisms. These cause light to be scattered and absorbed rather than transmitted in straight lines through the sample. The method is applicable to drinking, surface and saline waters in the range of turbidity 0-40 NTU. Higher values may be obtained by dilution of the sample. The values are expressed in nephelometric turbidity units (NTU). The NTU considered comparable to the previously reported Jackson Turbidity units (JTU) and Formazin Turbidity units (FTU). The standard method for the determination of turbidity is based on Jackson candle turbidimeter and the lowest turbidity values that can be measured on this instrument is 25 units. As turbidity of treated water is usually in the range of 0-5 units indirect secondary methods have been used which, however, do not duplicate the results obtained on Jackson Candle Turbidimeter for all the samples. Due to fundamental differences in optical systems, results obtained with different types of secondary instruments do not check closely with one another even though instruments are precalibrated against candle turbidimeter. Use of suspensions, of different types of particulate matter, for preparation of calibration curves may also cause discrepancies. Most commercial turbidimeters for measuring low turbidities give comparatively good indications of the intensity of light scattered in one particular direction predominantly at right angle to the incident light.

This method supercedes clause 6 of IS : 3025-1964 'Methods of sampling and test (physical and chemical) for water used in industry'.

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