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BUREAU OF INDIAN STANDARDS

DRAFT FOR COMMENTS ONLY

भारतीय मानक मसौदा

जल एवं अपशिष्ट जल के नमूने लेने तथा परीक्षण (भौतिक एवं रसायन) की पद्धतियाँ

भाग 20 प्रसार अभिलक्षण (प्रवाह प्रतिमान)

(*दूसरा पुनरीक्षण*)

Draft Indian Standard

Methods of Sampling and Test (Physical and Chemical) for Water and Wastewater Part 20 Dispersion Characteristics (Flow Patterns)

{*Second Revision of IS 3025 (Part 20)*}

ICS 13.060.60

Water Quality Sectional Committee, CHD 36	**Last date for Comments: 22.07.2024**

FOREWORD

(*Formal clause to be added later*)

Dispersion is the state of getting dispersed or spread. The dye dispersion method is used for determination of dispersion characteristics of a water body.

The Technical Committee responsible for formulation of IS 3025: 1964 'Methods of sampling and test (physical and chemical) for water used in industry' decided to revise the standard and publish it in separate parts. This standard was one of the different parts published under IS 3025 series of standards. The first revision was published in 1984.

In this second revision the following changes have been incorporated:

a) Clause 4 principle, and Clause 5 apparatus have been modified;

b) References, ICS No. have been updated; and

c) Other editorial changes have been done to bring the standard in the latest style and format of Indian Standards.

In the preparation of this standard, considerable assistance has been derived from the following:

a) USEPA method for Measurement Of Time Of Travel In Streams By Dye Tracing published by Techniques of Water-Resources Investigations of the United States Geological Survey.

b) Investigation of Flow Patterns in Various Wastewater Treatment Facilities by Thomas Joseph Martin Jr Louisiana State University and Agricultural and Mechanical College.

In reporting the result 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 : 2022 'Rules for rounding off numerical values (*second revision*)'.

1 SCOPE

This standard (Part 20) prescribes the dye dispersion method for determination of dispersion characteristics of a water body.

2 REFERENCES

The standards given below contain provisions which, through reference in this text constitute provisions of this standard. At the time of publications, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of these standards indicated below:

IS No.	*IS Title*
IS 7022 (Part 1) : 20XX	Glossary of Term Relating to Water Part 1 Water Sewage and Industrial Effluents (*first revision*) (Doc No. CHD/36/25209)
IS 7022 (Part 2) : 20XX	Glossary of Terms Relating to Water Part 2 Water Supply and Sewerage (*first revision*) (Doc No. CHD/36/25279)

3 TERMINOLOGY

For the purpose of this standard, definitions given in IS 7022 (Part 1) and IS 7022 (Part 2) shall apply.

4 PRINCIPLE

It involves the measurement of time of travel using a dye injection at some location along the stream and the rneasurement of the resulting dye dilution, at the downstream locations. The dispersion characteristics of a water body are determined using the organic pigment rhodamine-B. The concentration of dye in the sample is directly proportional to its fluorescence.

5 APPARATUS

5.1 Fluorometer

It measures the luminescence of a fluorescent substance when the substance is subjected to a light source of a given wavelength. The higher the concentration of the fluorescent substance, the more emitted light the fluorometer will detect. The actual concentrations of the samples can be determined by use of a fluorometer that has been calibrated by using a set ofstandard solutions of known concentration. Due care must be exercised to ensure that the fluorometer is working properly and is accurately calibrated by using a sample from the same lot as the dye that was injected.

6 REAGENTS

6.1 Sodium Chloride — saturated solution.

6.2 Dye

Rhodamine-B dissolved in methanol in the proportion 1:5 resulting in a solution of density 0.8 g/ml approximately.

7 PROCEDURE

7.1 Increase the density of rhodamine-B solution, by adding saturated sodium chloride solution, to the value of the density of the water body. Inject this solution into the water body.

7.2 At regular intervals, draw a sample from the centre of the patch (r = 0) and determine the concentration of Rhodamine-B using a fluorometer, which measures the fluorescence of the dye present in the sample. Hence one must obtain the concentration of the dye.

7.3 Precautions

The following should be noted before the results are interpreted:

7.3.1 Fluorescence of rhodamine-B decreases by about 2 percent per °C increase in temperature.

7.3.2 Effect of the chlorinity of water is insignificant.

7.3.3 The dye is heavily adsorbed by organic suspended matter and this adsorption decreases with increasing chlorinity.

7.3.4 In bright sunlight the fluorescence decreases by about 2 percent per h and by about 0.5 percent per h in cloudy conditions.

7.3.5 It may be noted that the position of the centre of the patch of the dye is an indicator of the movement of the water body; and

7.3.6 The dispersion can also be measured directly by using an in-situ fluorometer, which is commercially available.

NOTE — When the dye is released into a stream, it disperses in the directions i.e.: vertically, laterally, and longitudinally. After an initial mixing period, dispersion is complete in the vertical and lateral directions and disperses only longitudinally and continues indefinitely.

8 CALCULATION

Calculate the diffusion parameter using the following equation:

$$C(r,t) = \frac{M \times e^{-r/t}}{2\pi(\rho t)^2}$$

where

M = mass of rhodamine-B injected into a layer of unit thickness, in g/cm;

r =distance from the centre of the patch (point of maximum concentration), in cm;

t = time, in s;

ρ = diffusion parameter, in cm/s; and

C = concentration of rhodamine-B dye, in g/cm.