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Indian Standard

METHODS FOR MEASUREMENT OF AIR POLLUTION

PART I DUSTFALL

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
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METHODS FOR MEASUREMENT OF AIR POLLUTION

PART I DUSTFALL

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 11 June 1969, after the draft finalized by the Chemical Hazards Sectional Committee had been approved by the Chemical Division Council.

0.2 It is generally recognized that air pollution is emerging as one of the most significant and challenging environmental problems of our modern society. The undesirable effects of air pollution on man, his property and possessions have given rise to an increasing degree of interest and concern on the part of the government, industry and the common citizen. Public authorities in all industrialized countries are now endeavouring to limit this pollution of air by legislative action. If legislation in this field is to be effective, it has to be based on accurate knowledge of the amounts of the various pollutants in the air, their effects, and the scientific and technical possibilities of eliminating them. Any exhaustive data can not be precisely interpreted unless standard methods of sampling and test are available and have been used to obtain these data. This standard forms the first part of the series of standard methods of measurement of air pollution to be published and it covers that part of the commonest pollutant, dust, which is coarse enough to settle down fairly rapidly.

0.3 The precise measurement of the solid material deposited at any particular site is difficult and it should be noted that the amount collected and retained in a collector is influenced by factors, such as the height of the collector above ground, the nature of the site and the meteorological conditions, for example, wind force and rainfall. These factors have to be borne in mind when any comparison is made of the quantity of deposit measured at different sites, or even at the same site under varying weather conditions but such comparisons may be valid in relation to known circumstances, especially when results are averaged over several months.

0.4 When a collector is suitably sited, the observed amount of deposition can reasonably be regarded as being representative of a larger area than

that actually covered by the collector. The period of exposure is commonly called a calendar month, but this is a variable number of days and, for purposes of comparison, the results may be suitably expressed in terms of the average daily rate of deposition. A convenient unit is milligram of deposit per square metre per day (mg/m^2d).

0.5 In drafting this standard, considerable assistance has been derived from B.S. 1747 : Part 1 : 1961 ' Methods for the measurement of air pollution, Part 1 Specification for deposit gauges ', issued by the British Standards Institution.

1. SCOPE

1.1 This standard prescribes a method for the collection and measurement of dustfall and covers the construction and installation of the apparatus to be used for the purpose.

1.1.1 It also prescribes a schedule of analytical determinations to be made and the form to be used for reporting the results.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 4167-1966* shall apply.

3. APPARATUS

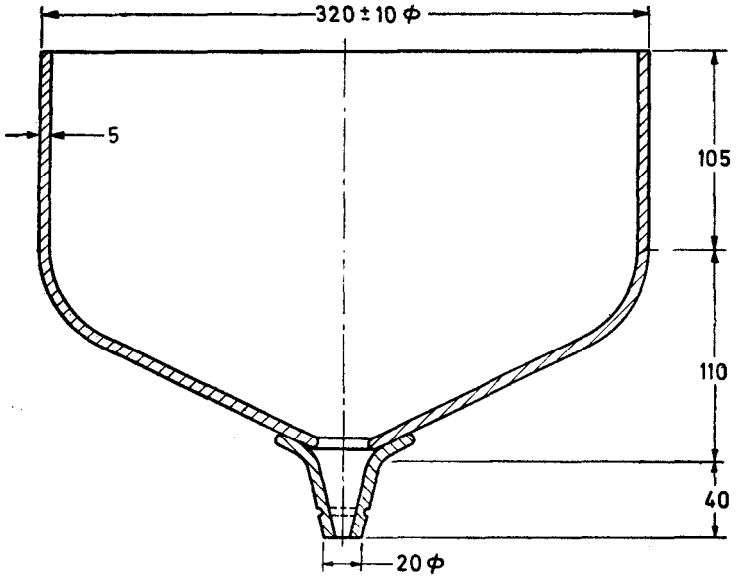
3.1 The apparatus shall consist of the following components.

3.1.1 *Stand* — The stand shall be made of mild steel and shall be galvanized after the components have been joined together. The bird-guard shall be of about 25 mm mesh, constructed of a corrosion-resistant material, such as plastics material. The collecting bottle shall be firmly positioned on the supports provided on the shelf.

3.1.2 *Collecting Bowl* — The collecting bowl (*see* Fig. 1) shall be made of chemically resistant glass or of a suitable plastics material, such as high density polyethylene or PVC, not prone to the accumulation of electrostatic charge. The dimensions of the bowl shall be as shown in Fig. 1. Each collecting bowl shall be indelibly marked with a serial number and a conversion factor shall be supplied for each bowl, such that the weight of the deposit collected, in milligrams, when multiplied by the factor, will represent milligrams per square metre (mg/m^2).

3.1.2.1 The conversion factor shall be obtained from the ' mean effective diameter ' of the collecting bowl, which shall be determined by

*Glossary of terms relating to air pollution.



All dimensions in millimetres.

FIG. 1 COLLECTING BOWL

measuring the internal and external diameters in millimetres of the bowl at 12 points round the circumference and taking the mean, D, of the 24 readings. The measurements shall be made to the nearest millimetre. The factor shall then be calculated from the formula:

$$\text{Factor} = \frac{127{\cdot}3 \times 10^4}{D^2}$$

3.1.3 *Collecting Bottles* — The bottles shall be made of a suitable plastics material, such as polyethylene, preferably with shoulders sloping at 45°, and shall be of the following dimensions:

Height	450 mm, *Max*
Diameter of neck:	
External	90 mm, *Max*
Internal	40 to 80 mm
Capacity	10 to 20 litres*

3.1.4 *Inverted Funnel* — The inverted funnel shall be made of stainless steel or polyethylene to the dimensions shown in Fig. 2. If made of

*The size of bottle chosen should be adequate for maximum local rainfall covering a period of one calendar month.

steel, the tube portion shall be of 18/8/3 CrNiMo stainless steel. The inverted funnel and skirt may be made from the same steel or, if preferred, from 18/8 CrNi steel. In both the cases the material shall not be susceptible to weld decay. The funnel and the tube shall be joined by welding, after which the assembly shall be properly cleaned of oxide by pickling in dilute nitric acid, the acid being removed by boiling the funnel in water and thoroughly rinsing. If made of polyethylene, the funnel and skirt shall be moulded as a complete unit.

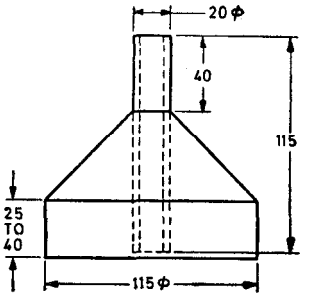
3.1.5 *Tubing* — The tubing connecting the collecting bowl and the inverted funnel shall preferably be of a suitable plastics material, or alternatively of best quality rubber, and of such bore that it will effectively grip the outlet nozzle of the bowl and the inverted funnel.

3.1.6 *Brush and Plug*; *Squeegee* — A test-tube or short burette brush with a rubber bung fixed on the handle is suitable. The squeegee may be made by fixing a strip of hard rubber in a suitable holder.

3.2 Assembly of Apparatus — The apparatus shall be assembled as shown in Fig. 3; the skirt of the inverted funnel shall be as close to the shoulder of the bottle as possible.

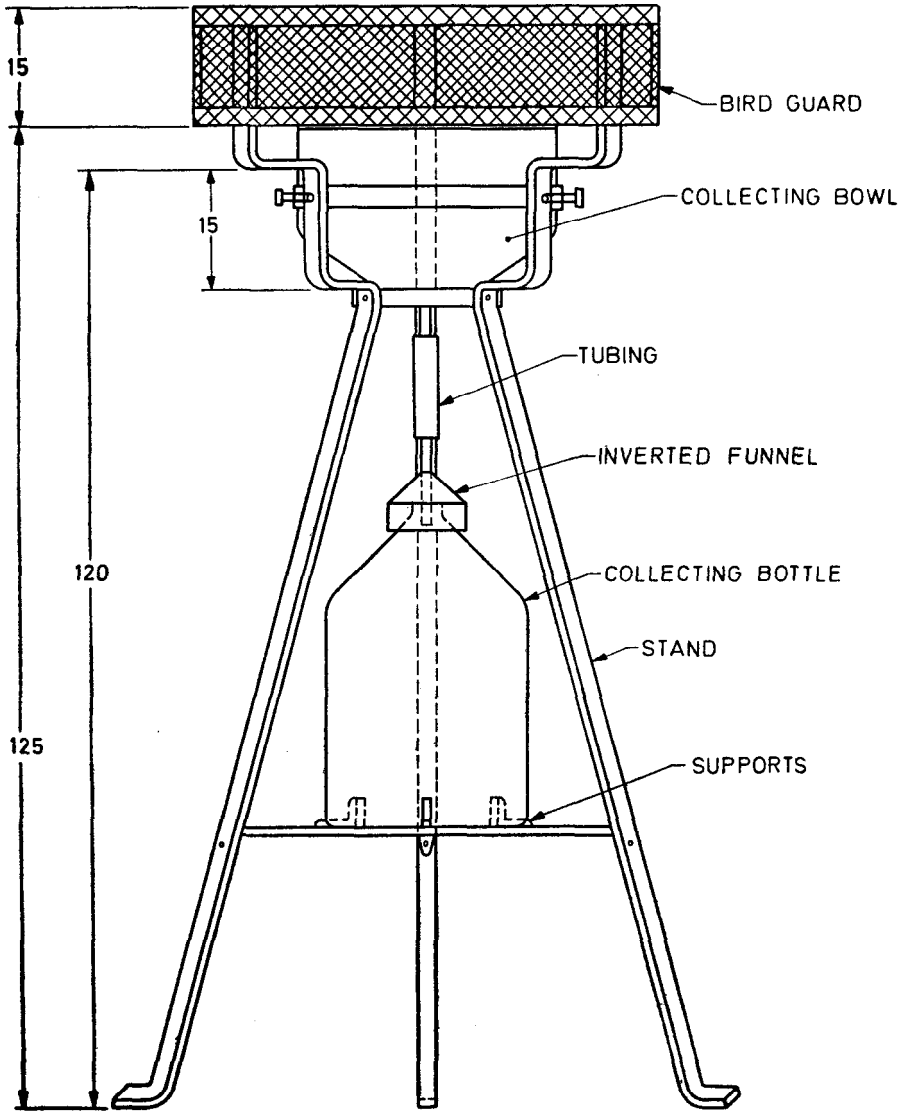
3.2.1 Two layers of adhesive tape shall be applied over the tubing after assembly to protect it from the sun and atmosphere and thus reduce the rate of deterioration.

3.3 Siting of Apparatus — Wherever practicable, the collector shall be sited on level ground in an open space. If this is not possible, the stand shall be supported so that the rim of the collecting bowl is horizontal. It is recommended that the holes in the feet be used to secure the stand by means of bolts or pegs.



All dimensions in millimetres.

FIG. 2 INVERTED FUNNEL



All dimensions in centimetres.

FIG. 3 COLLECTING ASSEMBLY

3.3.1 The distance of the collecting assembly from any object shall be more than twice the height of the object above the rim of the collecting bowl.

3.3.2 If necessary, the apparatus may be sited above ground level but the rim of the collecting bowl should be not more than 5 metres above the ground.

3.3.3 Precautions against stone-throwing or other interference may be necessary.

4. COLLECTION OF DUSTFALL

4.1 The collector shall be put into operation, on the chosen site as described in **3.3**, on the first day of a calendar month*.

4.1.1 A fungicide, consisting of 10 ml of either 0·02 N copper sulphate solution (2·50 g of $CuSO_4.5H_2O$ per litre) or 2·5 ppm solution of a quaternary ammonium compound, shall be placed in the clean collecting bottle. This is necessary to prevent the growth of algæ which would alter the chemical nature of the collected deposit.

4.2 On the first day of the following calendar month*, the assembly shall be inspected and identifiable foreign matter, such as leaves or insects, removed from the collecting bowl.

4.2.1 The brush shall then be inserted in the outlet of the collecting bowl and passed downwards through the inside of the tubing and inverted funnel until the outlet of the bowl is securely closed by the plug attached to the top of the brush.

4.2.2 About 500 ml of the liquid collected in the bottle shall be poured into the bowl and any deposited matter adhering to the bowl dislodged with the squeegee.

4.2.3 If the quantity of liquid collected in the bottle is insufficient for this cleansing process, a measured quantity of distilled water shall be used. This additional water shall not be added unless either it is impossible to wash out the bowl with the rainwater collected, or no water has collected.

4.2.4 The plug shall then be removed and the contents of the bowl run, without loss, into the bottle. During this operation, the inside of the tubing and the inside of the inverted funnel shall be cleaned by means of the brush.

4.2.5 The apparatus shall then be reassembled and the procedure described under **4.1** repeated, using another clean collecting bottle.

*If for any reason any operation is not carried out on first day of the month, the fact shall be stated in the report.

4.2.6 The bottle, which contains the material collected during the previous calendar month, shall be sealed and delivered for analysis with the following information:

a) Description of site;

b) Period of collection;

c) Conversion factor supplied with the collector;

d) Quantity of distilled water (if any) used for cleaning the bowl; and

e) A note of any unusual event, or events, which may have influenced the character or amount of the deposit.

5. ANALYSIS OF THE COLLECTED MATTER

5.0 Analysis shall be carried out by or under the supervision of a skilled analyst, using accepted analytical procedures.

5.1 Normal Analysis — In general, the following information shall be obtained by the analyst:

a) Quantity of liquid collected; this is the total volume in the bottle less any amounts added under **4.1.1** and **4.2.3**;

b) *p*H value of the liquid, except where distilled water has been added;

c) Weight of total dried undissolved matter obtained after filtration;

d) The weight of ash obtained by combustion of the undissolved matter; and

e) The weight of total dried soluble matter obtained from the residue from a measured portion of the filtrate after evaporation to dryness, making allowance for the copper sulphate or quaternary ammonium compound added in accordance with **4.1.1.**

5.2 Detailed Analysis — If more information than that provided by the normal analysis is required, any or all of the following determinations may be made:

a) Tarry matter or benzene soluble fraction on the residue from item (c) of **5.1.**

b) Calcium, iron, sulphate, chloride, flouride on the filtrate from item (c) of **5.1.**

6. METHOD OF REPORTING RESULTS

6.1 The results shall be reported on a suitable form, such as that illustrated below:

INVESTIGATION OF AIR POLLUTION: DUSTFALL

Analysis of matter collected in atmospheric collector during the period of.....days from.....(date) to.....

.....(date). Collector.....Authority

.....Collecting bowl No.....

Site.....

Factor (mg deposit to mg/m^2).....

	Quantity Measured	Calculated Deposition per Day
Retained Water.....litres		
*p*H Value.....		
	mg	mg/m^{2}d*
Total Undissolved Matter	.....	.....
Ash	.....	.....
Total Dissolved Matter	.....	.....
Total Solids	.....	.....
Other Determinations	.....	.....

Remarks:

Signed..... Date.....

*The figures for mg/m^{2}d should be given to the nearest whole number.