DUSTFALL AT JODHPUR—PART II
A NEW DESIGN OF A DUSTFALL COLLECTOR

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This paper describes a new design of Dustfall Collector specially suited to arid zone conditions encountered in Rajasthan and takes into consideration high evaporation rate of water, whirlwind and strong gusts of wind, bird dropping, and security. It has been found more reliable/efficient than the British Deposit Gauge and more useful/dependable than the ASTM cylinder.

The measurement of dustfall, including any other matter that may be deposited from the atmosphere, is carried out by collecting the same either in a "Deposit Gauge," in accordance with a British Standard Specification[1] or in a "Collector" as per an ASTM Standard[2]. These differ considerably in shape and design. Chaudhuri and Prajapat[3] proved that under the arid conditions of Jodhpur, the Deposit Gauge collects less dust than even a simple Glass Trough of nearly the same diameter but containing distilled water. In an effort to evolve a better apparatus, the authors carried out protracted trials with the existing equipments and developed a new type of dustfall collector called "Dustfall Collector" which has proved to be very efficient and better suited to the arid zone conditions such as found in Rajasthan.

DESCRIPTION OF DUSTFALL COLLECTOR

The new dustfall collector consists of the following parts : (*i*) Iron stand; (*ii*) Wooden platform; (*iii*) Spiked net frame; (*iv*) Collecting bowl.

Iron Stand : This is a tripod iron stand, rigidly joined to one another at a height of 30 cm. by means of Y-shaped iron bar. The top ends of the tripod are joined to an iron ring.

Wooden platform : A 2·5 cm. thick rectangular wooden base (106 cm.×76 cm.) is fixed on the supporting ring of the tripod stand. It has an opening at the middle so that the collecting bowl can be placed in position.

Spiked net-frame : Expanded metal (iron) nets are fitted to wooden frame which can be fixed on the corresponding side of the wooden platform by means of hinges. The top of each frame is fitted with iron spikes, alternately with a long (15 cm. length) and short (10 cm. length) spikes placed 2·5 cm. apart.

The spiked net frames, when fixed to the wooden platform, can be kept rigidly in position by means of bolts and locking arrangements. The side nets can be opened/removed for easy transportation.

Collecting Bowl : The collecting bowl made of brass has a total depth of 60 cm. at the centre. The tube of the bowl is 30 cm. long and 6 cm. in dia. The collecting bowl has been so designed that the volume of the collecting bowl amounts to 5 litres at the height of 44 cm. The total volume of the collecting bowl is 17 litres.

Assembly : The dustfall collector is assembled at the site where the dustfall is to be collected. The wooden platform is normally kept fitted to the tripod stand. The three legs of the iron stand are fixed into the ground just below the Y-shaped bar. (As the soil may be sandy, boulders and gravels along with cement are used to keep the stand firmly in position. On saline beds lime is also used to check possible breakdown due to

corrosion). The spiked net-frames are fitted to the sides of the wooden platform. These frames are made collapsible to afford ease of manipulation. The collecting bowl is washed with distilled water and placed on the wooden platform. It is rigidly fixed to it by means of nuts and bolts and filled with 10 litres of distilled water. The hanging spiked frames are then raised to positions, bolted and locked. The height of the bowl rim is one metre from the ground.

LEVEL OF WATER IN THE COLLECTING BOWL

In arid zone, water evaporates quickly. The rate of evaporation varies from place to place depending mainly on the wind velocity. The evaporation rate is highest during May and June and is on the average 17 mm. per day during this period at Jodhpur. This value is an average of the data[4] collected for three years (1961-1963). It will be thus seen that the collecting bowl may take about 30 days to dry up completely.

The level of water should not, however, be allowed to normally fall below the 5 litre mark. The water can be replenished at any time between the 10 litre and 5 litre marks by the addition of distilled water and brought to the 10 litre mark. During summer, the collecting bowl may require to be refilled 3–4 times a month.

The long tube of the collecting bowl acts as reservoir of the dust. The possibility of the dust being lifted out during storm or small whirlwind is reduced as the tube is long and narrow and would contain water even if left unattended for a long period due to some unavoidable reason.

PERIOD AND COLLECTION OF DUSTFALL

The period of dustfall collection is normally (30 ± 1) days. In order to collect the dustfall that has been deposited during a month or over any period, one of the spiked net frame is opened and suspended as shown in Fig. 1. The collecting bowl is carried to a room and the entire quantity of water and dust are transferred to a suitable glass beaker. Long camel hair brush is used to bring out any dust that might be adhering. The collecting bowl is washed with distilled water and the washings are added to the beakers. The water insolubles are determined by the usual procedures.

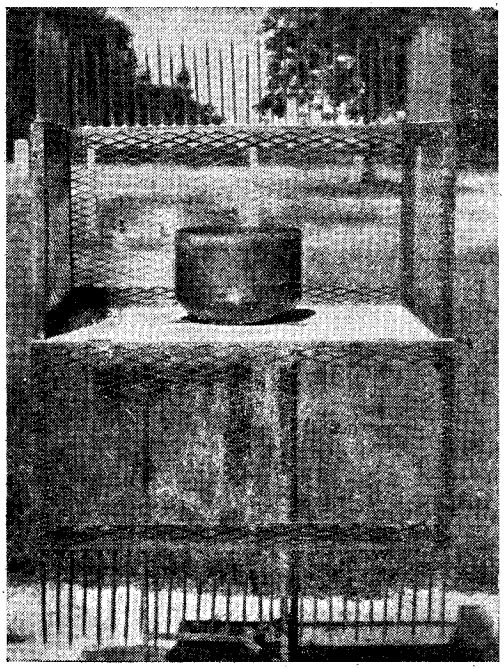

Fig. 1 The dustfall collector. When grouted, the three legs will sink in the ground up to the Y-shaped bar that secures the tripod legs.

SAFETY AND SECURITY

Birds do not come near the collecting bowl due to the spikes. However, this does not completely reduce the possibility of bird dropping.

Security is of great importance. The design of this apparatus takes this factor into account. However, the apparatus should not be left un-attended.

COMPARATIVE STUDY

The details of the four collectors including the Large Pan used for comparative study of their performance are given in Table 1.

TABLE 1

BRIEF DETAILS OF DIFFERENT TYPES OF COLLECTORS

Type of Collector	Dia. of open top (cm.)	Depth (cm.)	Area of open top (sq. cm.)	Material of construction of collecting bowl	Factor to convert area of open top to 1 sq. m.
Cylinder ASTM	15	45	176·8	Brass	56·56
Deposit gauge, B.S.	28	..	615·9	Glass	16·24
Dustfall collector	30	60	707·1	Brass	14·15
Large Pan	122	25·4	116·90	Aluminium	0.8553

TABLE 2

MONTHLY DUSTFALL COLLECTED BY THE DIFFERENT TYPES OF COLLECTORS AT JODHPUR

Year/Month	Cylinder, ASTM* (gm.)	Deposit Gauge British‡ (gm.)	Dustfall Collector† (gm.)	Large Pan (gm.)
1964 Nov.	0·0300	0·1720	0· 960	2·784 (D)
				5·205 (W)
Dec.	0·0340	0·0794	0·2096	2·458 (D)
				6·541 (W)
1965 Jan.	0·0548	0·1830	0·1800	3·125 (D)
				5·100 (W)
Feb.	0·0606	0·1600	0·3556	5·655 (D)
				14·632 (W)
Mar.	..	0·3088	..	46·316 (D)
				66·779 (W)
Apr.	0·4656	0·2004	2·1510	16·562 (D)
				49·487 (W)
May	0·9040	0·5812	4·7080	42·060 (D)
				120·320 (W)
June	0·8648	0·7984	4·5350	62·110 (D)
				135·850 (W)
July	3·8080	0·0168	9·4600	81·310 (D)
				258·080 (W)

The collectors were placed in the premises of the Defence Laboratory, Jodhpur at a height of 1 metre from the ground except the British Deposit Gauge which was placed at a height of 93 cm. The 'height' refers to the vertical distance of the open rim of the bowl/funnel from the ground.

The dustfall was collected every month from November 1964 onwards. For the purpose of this paper, data obtained for the period November 1964 to July 1965 is presented in Table 2. The dustfall here denotes the water isoluble portions only.

From Table 1, it will be seen that the collecting areas are different for different collectors. The amount of dustfall has therefore, been converted to per sq. m. area for each of the collectors by multiplying the monthly values by the factor given in the last column of Table 1. The values so obtained are shown graphically in Fig. 2.

(D) denotes that the large pan is dry and does not contain any distilled water except what may fall as rain.

(W) denotes that the other large pan is wet and contains distilled water to a depth of 6-8 cm.

* Cylinder ASTM contains distilled water to a depth of about 15 cm.

† Dustfall Collector contains it to a depth of 52 cm.

‡ Deposit Gauge is a dry one.

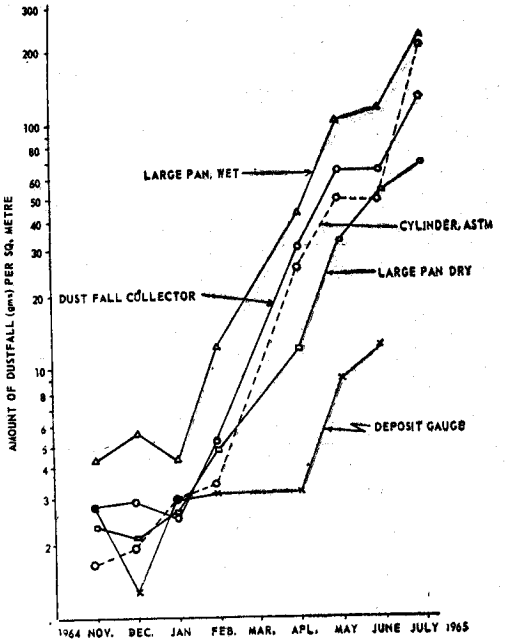

Fig. 2—Calculated dustfall per square meter per month by different collectors, at Jodhpur.

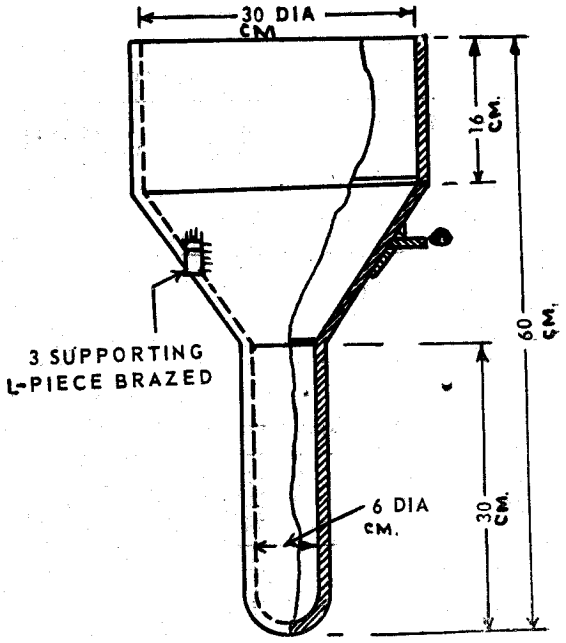

Fig. 3—Dustfall Ccollector

DISCUSSION

Fig. 2 shows that the Deposit Gauge collects the least amount of dustfall. This confirms the earlier findings of Chaudhuri and Prajapat.[3] Further it may be observed that the Dustfall Collector gathers slightly more dustfall than the ASTM cylinder while the Large Pan (Wet) collects the maximum amount.

The low collection of dustfall by the Deposit Gauge is due to its design and the fact that it uses a dry funnel as dust collector[3]. The dust collections increase with the increase in the area of the bowl/funnel; they do not appear to be proportional to the square of its radius.

The ratio of the area of the Dustfall Collector to the ASTM sylinder is 4 : 1. It will be observed that the Large Pan (Dry) collects more dust than the Deposit Gauge but less than the ASTM cylinder. This indicates that the deposited dust has partially borne out and therefore, the presence of water is essential.

CONCLUSION

The dustfall collector (Fig. 3) described in this paper has been found to be more reliable and efficient than British Deposit Gauge. The basic principle of the dustfall collector is the same as that of the ASTM Cylinder, *i.e.* a reservoir containing water and the water surface kept exposed to the open atmosphere. The design of the dustfall collector, however, taken into consideration the following factors : (*i*) high evaporation rate in Rajasthan (*ii*) action of whirlwinds and strong gust of wind (*iii*) bird droppings and (*iv*) security.

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