

DUST POLLUTION MONITORING IN STONE QUARRY AREA -A CASE STUDY NARASAPURA KOLLAR DISTRICT, KARNATAKA

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ABSTRACT

The present study is carried out in the stone crushing area for monitoring the dust deposition level on leaf surfaces and its subsequent response for chlorophyll content and dust holding capacity. *Eucalyptus globules*, *Muntingia calabura*, *Mangifera indica* and *Butea monosperma* showed maximum dust holding capacity. The result also indicated that dust deposition on different plants varies according to leaf size and structure, epidermis and cuticular features.

INTRODUCTION

Dust pollution has been known to have an adverse effect on plants (Babich and Stotzky, 1974). Dust particulates generated during stone crushing activity for varying length of time and get deposited on various parts of the plants, especially on leaf surfaces and affect vegetation of the areas. The plant leaves are the main organs of impingement, which not only reduce dust concentrations through the physiological or biological activities but also reduces dust concentrations of air by absorption and filtration. The capacity of leaves as dust receptors depends upon epidermal and cuticular features of leaves, surface geometry, phyllotaxy, type of canopy, leaf pubescence etc. But certain species of plants is greatly affected with respect to photosynthetic activity. Due to the dust deposition, the photosynthetic activity is reduced affecting the physiological activity. Decrease in total chlorophyll content in unit fresh weight of polluted leaves might be due to chloroplast damage by incorporation of dust particulates in to leaf tissue. Similar observations have

also been made by Singh and Rao (1978). Pandey and Kumar (1996), are of opinion that alkaline condition caused by solubilization of dust in to cell sap might be the cause of chlorophyll degradation. Increased dust deposition and subsequent reduction in chlorophyll may be positively correlated with reduced photosynthetic efficiency. Keeping this in view, the present study has been focused to monitor dust pollution in the stone crushing area and their effect on various plant species. The study also focused in suggesting suitable plant species to monitor dust in stone quarry area.

MATERIALS AND METHODS

The study was conducted in selected stone crushing locations in the study area. Leaves from top, middle and basal canopy were collected from various plant species (Table1) growing in the vicinity within 500m radius away from the stone crusher area. Control studies were made 15km away from the study area. The collected leaves were separately washed with deionized water wash was filtered with initially weighed filter paper. The filter papers were dried at room temperature and were weighed again. The amount of dust deposition in mg/cm² was calculated as

$$\text{Dust content (mg/cm}^2\text{)} = \frac{\text{Final weight of filter paper} - \text{Initial weight of filter paper}}{\text{Total leaf area (cm}^2\text{)}}$$

The total chlorophyll contents of leaves of different sites were determined by following the Standard procedures. The pH of leaf suspension was determined by pH meter. The chlorophyll contents of leaves of different sites were determined as suggested by (Maclachlan and Zalik, 1963) and relative water content (RWC) was calculated by the method proposed by Weatherly, 1950.

RESULTS AND DISCUSSION

It was observed that dust deposition not only depend upon the size and area of leaf surfaces but also the nature of leaf surfaces, its geometry, epidermal and cuticular features and canopy of trees, thickness of leaf, phyllotaxy, orientation, size and area of leaf surfaces etc. which play important role in the concentration of dust deposition and chlorophyll content.

Monitoring of air pollution by higher groups of plants is a recent development in the field of environmental sciences Monitoring of dust pollution by forage crops, taking morphological characters in to considerations has earlier been worked out by many workers (Kumar *et al.* 1991; Mishra *et al.* 1995; Quadir, *et al.* 1997).

In the present investigation maximum dust deposition was noticed in *Eucalyptus globulus* and *Butea Monosperma* species which could be attributed to increased size and surface area of leaves, rough surface etc. Shrubby habit of tree might be the other cause for maximum dust deposition on leaves. Maximum dust deposition in leaves of *Acacia arabica* might be due to its minute

Table 1
Study of Dust deposition on leaves

Plant species	DHC (mg/cm ² Leaf Surface)		pH (Leaf wash)		Total chlorophyll (Mg/g fresh leaves)	
	C	P	C	P	C	P
<i>Acacia Arabica</i>	-	0.75	6.5	6.1	5.7	4.5
<i>Mangifera indica</i>	-	4.86	7.5	7.1	6.9	4.8
<i>Muntingia calabura</i>	-	20.14	6.7	6.5	7.2	5.3
<i>Tamarindus indica</i>	-	1.10	6.9	5.9	6.1	5.4
<i>Eucalyptus globulus</i>	-	22.14	6.8	7.0	6.8	4.9
<i>Butea monosperma</i>	-	22.36	6.6	7.2	5.4	4.2

DHC- Dust Holding Capacity (mg/cm², leaf surface) C- Control, P- Polluted site

pinnate and smooth surface of the leaves, which provide minimum surface for dust deposition. The leaves of *Muntingia calabura* also showed maximum dust deposition, which might be due to rough nature of leaves and presence of minute hairs on the surface of leaves.

The present investigation clearly indicates that dust deposition not only depends on the leaf size but also the nature of leaf surface, its geometry, epidermal and cuticular features which can be used as indicators for detecting pollution extent and monitoring the biological effect caused by dust particulates in the stone quarry area. The study also indicated that plants can be used as potential device of dust remover in a stone quarry area. For dust abatement purpose, the leaves should be evergreen, simple with higher surface area, hairy and fast growing.

Hence the plants like *Muntingia calabura*, *Eucalyptus globulus*, *Mangifera indica*, *Butea monosperma* etc, are suggested for afforestation programme in the study area which aims at reducing the physiological effect of dust on vegetation.

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