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A STUDY OF DUST POLLUTION AROUND OPEN CAST COAL MINES OF IB VALLEY AREA, BRAJARAJNAGAR

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ABSTRACT

To find out dust trapping tree species to open cast coal mines dust pollution, Ficus releginsa, *Ficus benghalensis*, *Psidium guyava*, *Ziziphus mauritiana* and *Calotropis procera* plants were selected in the IB valley area. Dust fall on the leaves were observed for a period of one year from June 2003 to May 2004. From the result, it is observed that *Psidium guyava* has the maximum dust trapping efficiency followed by *Ficus benghalensis*. At the same time *Ziziphus mauritina* has shown the minimum dust trapping efficiency.

INTRODUCTION

Dust is a generic term used to describe fine particles that are suspended in the atmosphere. The term is non-specific with respect to the size, shape and chemical make-up of the particles. Particles as small as a few nanometers and as large as 100 microns (μm) have been measured in the atmosphere. Dust is formed when fine particles become entrained in the atmosphere by the turbulent action of wind, by the mechanical distrubance of fine materials or through the release of particulate-rich gaseous emissions. Dust associated with mining activity usually occurs as a result of the disturbance of fine particles dervied from soil or rock. In the presence study IB valley area of Mahanadi Coal field is selected which is one of the important or prime cooking coal in the country. Five open cast mines and 10 underground mines are presently operating in that area.

Dust pollution in account of particulate matters is increasing tremendously

mainly due to rise of open cast projects, transporation, coal stockyard over burden dumps as well as mineral mine fires and other domestic activities. The particulate matters going to atmosphere are generally of size 0.1 to 100 μ , particle size from 0.1 to 10 μ remian suspended for long time depending on its weight, but particulate greater than 10 μ due to gravity settles on near vegetation surface, plant leaves, soils, water bodies etc act as pollution sink. The above mentioned open cast mines are located in the South west direction from Brajaranagar in IB valley area. A railway coal siding from Lajkura OCP is situated on the S.E. Railway towards Belpahar line. The present paper is an attempt to give an idea about the status of air pollution in open cast coal mines of IB Valley area and the dust fall on the leaves of five different plants which are found in this area.

MATERIAL AND METHOD

The leaves were chosen from the plants *Ficus releginsa*, *Ficus benghalensis, Psidium, Ziziphus mauritiana*, and *Calotropis procera*. These plants were selected for the present study because of their availability in and around the study area. The sampling was carried out during June 2003 to May 2004. At the height of 6 feet, 10 fully mature leaves were collected from all the plants in the seperate polythene bags at an interval of 30 days for all the months. The samples were transported to the laboratory and leaves were washed with 250 ml distilled water and polythene bags were also washed with 50 ml distilled water to wash out the dust remaining inside the polythene bags during dust collection. The dust was dried by keeping the beakers in electric oven at 70^0C, and dried dust was weighed. Individual leaf area in square centimeter was calculated by tracing out the leaves on graph paper and results were expresed in gm/m^2.

Impact of dust pollution on human beings and plants

Mine dust can result in a serious nuisance and loss of amenity for populations living in the vicinty of a mine. For certain industrial and mineral activities

Table - 1
The mean value of dust fall on the leaves of different plants, in gm/m^2

Month	Fiscus releginsa	Ficus benghalensis	Psidium guyava	Ziziphus mauritiana	Calotropis procera
June 2003	1.22	2.36	3.92	3.82	3.23
July 2003	0.65	0.90	0.80	0. 60	0.50
August 2003	0.45	0.60	0.50	0.52	0.25
Septermber 2003	1.38	1.40	1.98	1.45	1.25
October 2003	3.08	3.62	4.00	3.20	2.90
Novermber 2003	5.62	6.20	8.00	4.98	7.20
December 2003	8.30	10.72	12.55	9.53	10.26
January 2004	13.24	14.26	18.30	12.65	11.50
February 2004	15.38	18.95	22.60	15.22	18.35
March 2004	7.20	8.38	8.16	6.22	7.10
April 2004	4.00	4.62	6.38	3.65	4.28
May 2004	4.30	4.18	6.10	3.78	5.04

dust constitutes a nuisance and creates poor working condition. The control of pollution arising out of this industrial and other dust seems to be continuous ongoing and never ending process. Exposure to dust lead to several distinct types of diseases in the body. For example coal worker's pneumoconiosis due to coal dust. The majority cases of pneumoconiosis develops after proplonged exposure to such dust. Black Lung diseases is caused by accumulation of fine coal dust within the respiratory system. Inhalation of coal dust over a long time may cause blockage of the airways and Lungs. In some cases, the black Lung disease may further develop into progressive massive fibrosis. Patients suffering from progressive massive fibrosis may develop large scars in their lungs, therby causing significant damage to the pulmonary blood vessels. The effect of dust pollution on plant life is no less harmful. Qualitative and Quantitative changes in solar radiation on leaf surfaces and alternation in energy exchange process, decrease in chlorophyll and chloroplast.

RESULT AND DISCUSSION

The detailed results are given in **Table-1**. An analysis of the table reveals many interesting vital informations on the dust deposition rate and dust trapping efficiency of the plants in this coal mines complex. Irrespective of the type of plants around the study area, it is observed that dust deposistion on the leaves of the plants follows a very general trend. The trend can be generalized as follows: (i) There is a continuous and regular increase in the dust fall on the leaves of the plants during the winter months of November to February, (ii) Then during the hot and rainy months of March to August a continuous decrease in the dust deposition is observed on the leaves of the studied plants. However, during the hottest months of March to May dust deposition is more, than compared to the rainy months of June to August, (iii) Again during the months of September and October a steady rise in the dust deposition rate is observed on the leaves the plants. Since this pattern of dust deposition on the leaves are observed irrespective of the type of the plants, it clearly indicates that during the colder months (November, December, January and February) the dust deposition rate is highest. This may be attributed to the foggy and still weather during these months in this area. Survey of literature also reveals that fog and mist in air holds dust particles near the originating or emitting area and forms an envelop of dust mixed fog which is relased to the exposed flora as soon as ambient temperature is reached to an optimum level. Most likely this type of condition prevails during the colder months and thus dust deposition is maximum during these months. The minimum dust deposition on the leaves of the plants during the rainy months (June, July and August) is attributed to the heavy and minium rain fall during these three months. Thus the rainfall washed away the deposited dusts on the leaves indicating minimum dust deposition. During the other months of the year the weather and wind pattern of the area makes it possible to attract a very coherent pattern of dust deposition on the leaves of the plants. The dust trapping efficiency of the different plants, the list can be prepared in the ascending order of *Ziziphus mauritiana*, Ficus releginsa, *Calotropis procera*, *Ficus benghalensis*,

Psidium guyava. Clearly the dust trapping efficiency of these plants depend on the morphological structure and arrangement of leaves (Bhatanagar *et. al*. 1985). The leaves of plants *Psidium guyava* is observed to have very nice arrangement of horizontal leaf structure in combination with very rough to hold large amount of dust particles.

CONCLUSION

From the results of the present study it can firmly be concluded that we can think over to monitor our environment vegetatively at lowest cost and with a certain degree of accuracy and thus save our precious resource air. The need is only to select the right plant and observe them to determine the dust trapping states.

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