EFFECT OF DUST LOAD ON THE LEAF OF FIVE TREE SPECIES GROWING AROUND ACC CEMENT KAYMORE, KATNI DISTRICT (M.P.)

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Abstract: ***Dust is considered as one of the most widespread air pollutants. The objective of the study was to analyze the effect of dust load (DL) on the leaf of 5 tree species planted around areas of ACC Cement plant located at Kymore, Katni District, Madhya Pradesh. The ACC Cement industry is the major source of particulate matter, SOx, NOx and CO_2, emissions. Cement dust contains heavy metals like nickel, cobalt, lead and chromium, which are hazardous to the biotic environment, and impact vegetation, human and animal health and ecosystems. Present paper attempts to focus on impact of cement emission on plant vegetation around areas of ACC cement plant. Selected sites for study around industry are kymore, Amraiya, Gudgadauha, Bamhan Gawan, and Khalwara.***
Maximum dust load 1.69 mg/ cm^2 found kymore region on Eucalyptus globulus plant leaves, in amraiya region Max. dust load found 1.51 mg/cm^2 on Azadirechta indica, Gudgadauha region dust load found on Madhuca indica that is 0.96 mg/cm^2, bamhan gawan region maximum dust load on magnifera indica 0.26 mg/cm^2 found, Khalwara region maximum dust load found on magnifera indica 0.29 mg/cm^2. Maximum value of chlorosis and necrosis found maximum on Azadirechta indica plant leaves on in regions bamhan gawan 56%, kymore and gudgadauha found 40%, khalwara 35%, Amraiya value of chlorosis / necrosis found 26%and in kymore region maxium vaule of necrosis and chlorosis found on magnifera indica 50%.

Keywords: cement industry, environmental problem, dust pollution, Dust load.

I. Introduction

Cement industry is one of the most important industries involved in air pollution. The aerial discharge of cement Industries consist of Particulate matter, Sulphur dioxide and Nitrogen oxides producing continuous visible clouds which ultimately settle on the vegetation, soil and effects whole biotic life around, as a result the whole ecosystem around the cement factory is subjected to unusual stress. The cement industry is involved in the development of structures in this advanced and modern world because it is the basic ingredient of concrete used in constructing modern edifices and structures. In fact, life without cement in this 21stcentury is inconceivable. Cement, however, generates dust during its production. Cement dust contains heavy metals like nickel, chromium, cobalt, mercury and lead pollutants. The cement kiln dust, containing oxides of calcium, potassium and sodium is common air pollutants affecting plants in various ways that is cement dust and cement crust on leaves plug stomata and interrupt absorption of light and diffusion of gases, lowering starch formation, reducing fruit setting inducing premature leaf fall and leading to stunted growth. Due to increasing pressures to implement sustainable and environmentally friendly manufacturing techniques, there has been an increased exploration of alternative fuels to power the cement kiln. Testing of possible alternative fuels has been limited by the economic risks associated with real world experimentation with alternative fuels. Estimating leaf dust load of leaf samples from the selected tree species were collected as per the standard procedure. The leaf samples were then transported to the laboratory and washed with ordinary water and then with 0.1N HCL followed by washing with distilled water. The analysis of physiological and biochemical parameters of leaf samples was carried out.

II. Study Area

Kymore Cement Works is one of the most modern cement plants in ACC Group. This is located at Kymore, Katni District, Madhya Pradesh, INDIA. Geographical locations of ACC cement plant are Latitude 24^0 03' 29.12" (N) and Longitude $80^0$36' 52.56", Capacity of ACC, Kymore are 2.20 MTPA.
ACC Limited, Kymore Cement Works, as part of its AFR Policy has taken steps for utilizing the hazardous Waste/solid wastes generated from other industries of Madhya Pradesh. Thermal substitution of waste depends on type of waste material, quantity of waste & its supply mode and the continuity of its feeding for disposal.

Figure1: ACC cement plant Figure 2: Map of katni district

Five sampling sites selected around area of ACC cement industry of kymore, sampling sites are described below:

Kymore: Kymore is an industrial town and a Nagar Panchayat in Vijayraghavgarh tehsil in katni district in the India state of Madhya Pradesh. Kymore is 1 km away from ACC cement plant. Area of kymore 411 hectare and population of this town is 19343.

Amraiya: Amraiya is 2 Km is away from the ACC cement industry. Area of Amraiya 361.76 hectare and population of this town is 738.

Gudgadauha: Gudgadauhais 3 Km is away from the ACC cement industry. Area of Gudgadauha 348 hectare and population of this town is 3219.

Bamhan Gawan: Bamhan Gawanis 4 Km is away from the ACC cement industry. Area of Bamhan Gawan195.5 hectare and population of this town is 537.

Khalwara: Khalwara is 5 Km is away from the ACC cement industry. Area of Khalwara689 hectare and population of this town is 1335.

Table describes the details of sampling site as given below.

Table 1: Details of villages studied

No. of Site	Village around plant	Distance with respect to Industry (km)	Area (hectares)	Population
1	Kymore	1 Km	411	19343
2	Amraiya	2 Km	361.76	738
3	Gudgadauha	3 Km	348	3219
4	Bamhan Gawan	4 Km	195.5	537
5	Khalwara	5 Km	689	1335

III. Study of Five Leaf Species

Total five leafs are selected for dust load study named as Mangifera indica, Ficus religeosa, Eucalyptus globules, Azadirechta indica, Maduca indica. Figures described shape and design of the selected leaves.

Figure 3: Mangifera IndicaLeaves Figure 4: Ficus Religeosa Figure 5: Eucalyptus globules


Figure 6: Azadirechta Indica


Figure 7: Maduca Indica

IV. Material and method

3.1. Impact evaluation on plant vegetation

An attempt has been made to record the impact of emissions from cement industry on vegetation. Five plant species were selected i.e. Madhuca indica, Ficus religeosa, Azadirechta indica, Eucalyptus globulus and Mangifera indicain an area of five kilometers surroundings of cement plant and experiments were conducted as is described below.

3.2 *Dust load evaluation*

In order to estimate the dust load, 20 leaves from different branches of selected tree species have been collected and kept in separate polythene bags. In the laboratory, the leaves from each polythene bags were washed. The water containing dust had been filtered through pre-weighed filter paper. The filter papers were dried in the oven over night and weighed again. The difference in the weight of filter paper yielded the amount of dust on the sampled leaves. The leaves surface area was calculated. From this data, dust load per cm^2 of leaf was calculated.

3.3. *Chlorosis and necrosis*

Chlorosis is the phenomenon of leaves yellowing due to the loss of chlorophyll. Necrosis means the wilting of leaves due to the lack of chlorophyll. Chlorosis and necrosis occur due to exposure to pollutants like SOx, NOx etc. For measuring the extent of chlorotic effects, 100 leaves were collected at different heights and the percentages of leaves exhibiting chlorosis and necrosis were calculated.

V. Result and discussion

Table 2 and Fig. 8 reveal that the dust load was maximum on all types of plants sampled kymore, located at 1 km away, followed by Amraiya situated 2 km away on North-East side. The maximum deposition per cm^2 was on Azadirechta indica, followed by Eucalyptus globulus. The smallest amount of deposition was found on Ficus religeosa. The dust load study revealed that a small amount of dust was deposited in Khalwara located 5 km away from ACC cement plant respectively. Azadirechta indica and Eucalyptus globulus showed a high dust holding capacity followed by Madhuca indica, while Mangifera indica and Ficus religeosa showed a small dust holding capacity.

Table 3 shows the data on leaves suffered from necrosis/chlorosis of all five tested plants. It was found that the highest values resulted in Bamhan gawan, situated 4 km away and Kymore, in north direction. The smallest number of leaves suffering of necrosis/chlorosis was found in Khalwara and Amraiya (Fig. 9). Mangifera indica and Azadirechta indica were affected the most, while Madhuca indica and Eucalyptus globulus were affected least plant species from chlorosis and necrosis.

Table 2: Dust load on plant Species

Site Number	Plants in Village	Distance	Dust load of 20 leaves (mg)	Dust load per leaf (mg)	Dust load mg/cm2
1	**Kymore**	1 Km			
	Mangifera indica		520	26	0.43
	Ficus religeosa		144	7.2	0.68
	Eucalyptus globulus		640	32	1.69
	Azadirechta indica		1020	51	0.82
	Maduca indica		1484	74.2	0.86
2	**Amraiya**	2 Km			
	Mangifera indica		408	20.4	0.41
	Ficus religeosa		140	7	0.14
	Eucalyptus globulus		608	30.4	1.29
	Azadirechta indica		1000	50	1.51
	Maduca indica		520	26	0.29
3	**Gudgadauha**	3 Km			
	Mangifera indica		460	23	0.41
	Ficus religeosa		420	21	0.35

	Eucalyptus globulus		360	18	0.74
	Azadirechta indica		500	25	0.84
	Maduca indica		420	21	0.96
4	**Bamhan gawan**	4 Km			
	Mangifera indica		220	11	0.26
	Ficus religeosa		190	9.5	0.16
	Eucalyptus globulus		196	9.8	0.21
	Azadirechta indica		140	7	0.25
	Maduca indica		480	24	0.24
5	**Khalwara**	5 Km			
	Mangifera indica		258	12.9	0.29
	Ficus religeosa		180	9	0.15
	Eucalyptus globulus		174	8.7	0.17
	Azadirechta indica		84	4.2	0.15
	Maduca indica		400	20	0.19

Table 3. Necrosis/chlorosis on plant varieties

Site number	Village	Distance and direction	Percentage of leaves suffered Nercosis / Chorosis				
			magnifera Indica	Ficus Religeosa	Eucalyptus globulus	Azadirechta Indica	Madhuca Indica
1	Kymore	1 Km	50	35	5	40	5
2	Amraiya	2 Km	12	12	4	26	3
3	Gudgadauha	3 Km	40	36	6	40	6
4	Bamhan Gawan	4 Km	45	42	18	56	20
5	Khalwara	5 Km	14	5	4	35	9

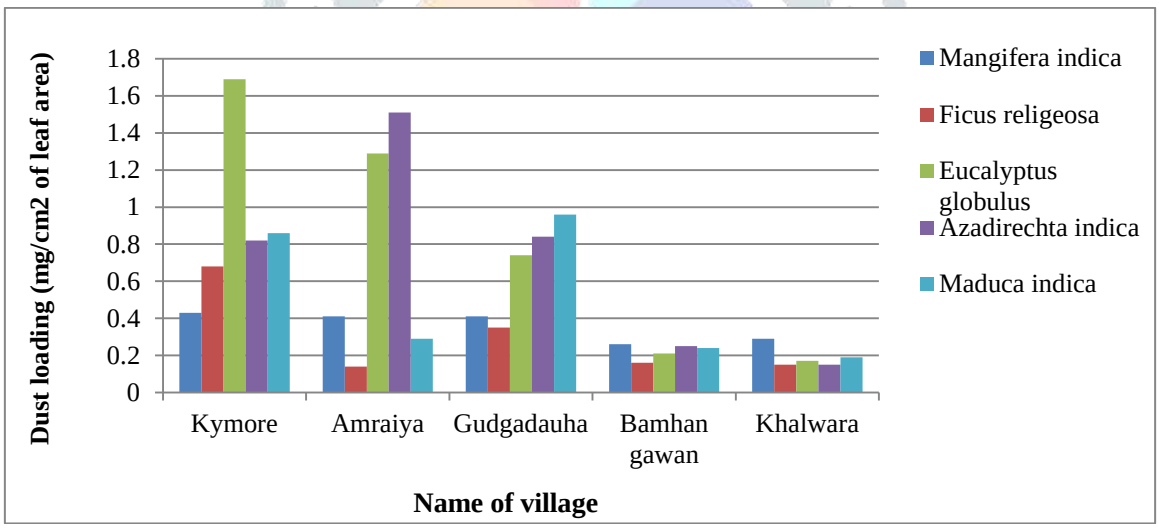

Figure 8: Variation in dust load in various plant species in different villages

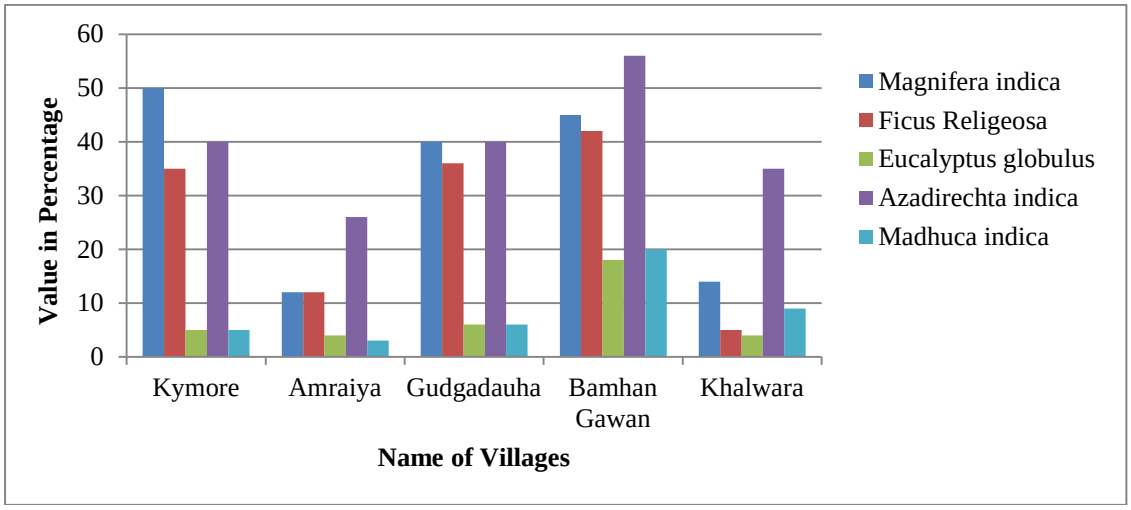

Figure9: Leaves suffering of necrosis/chlorosis in different villages

VI. Conclusion

The study concluded that the interception of dust varied with species as well as with the distance from the ACC cement plant in kymore katni. Among the selected plant species, the maximum deposition per $cm^2$was on Azadirechta indica, followed by Eucalyptus globulus and having the highest dust efficiency can be recommended for growing around area of cement plant and for green belt development in order to reduce the atmospheric concentrations of dust, thereby making the environment healthy for human beings. Cement industry faces a lot of problems due to mining activity. To overcome this problem, they should start back-filling of abandoned mine as soon as they complete the mining of a particular area. It was also found in above study that Azadirechta indica and Eucalyptus globulus were the species which showed high dust holding capacity followed by Madhuca indica. Also Madhuca indica and Eucalyptus globulus were least affected plant species from chlorosis and necrosis. So Eucalyptus globulus and Madhuca indica may be very significant for using as green belt surroundings of cement industry.

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