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INFLUENCE OF CEMENT MANUFACTURING POLLUTION ON CHLOROPHYLL AMOUNT OF CROPS AT NIMBAHERA RAJASTHAN

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ABSTRACT

In the vicinity of the cement business in Nimbahera, Rajasthan, a study was conducted to evaluate the effects of pollution from the industry on a few chosen plant species. Studying the impact of cement dust on chlorophyll in sesame and ground nut for 25, 50, 75, 100 and 125 days the cement industry was sampled at various distances. Compared to the control location, the chlorophyll pigments were decreased in plant species exposed to dust. Chlorophyll content changes in a few plant species exposed to cement industry dust were looked at. The amount of chlorophyll in each of the chosen plant species was measured, and it was discovered that plants furthest from cement plants had more chlorophyll than those closer to the industry. In compared to plants that had been dusted, control plants were consiste ntly shown to have greater chlorophyll levels. In the examined plants, reductions of up to 79.28% were noted. Cement dust pollution has generally had a negative impact on the photosynthetic pigments.

Keywords: chlorophyll, groundnut, sesam, cement, pollution

INTRODUCTION

The cement industry contributed to environmental pollution issues, and its pollutants had a negative effect on the air, water, and land. The Central Pollution Board of India has named the cement sector as one of the top 17 most polluting industries. Due to the establishment of more cement plants to fulfil the need for cement materials for building construction, the discharge of dust by cement factories has dramatically escalated over the past few decades. Compared to gaseous air pollutants, which are frequently known to cause harm to a variety of plant types,

Nitrogen oxide (NOx), sulphur dioxide (SO_2), carbon oxides (CO & CO_2), and dust are the most common gaseous emissions from cement manufacturing facilities **(Gupta AK, Mishra RM, 2014; Bilen S, 2010)**.

The plant is a long distance away. These include natural vegetation, towns, and villages, as well as agricultural fields. Particulate matter and other pollution depositions harm and damage the development and quality of plants directly, which may eventually result in a reduction in plant production **(Ogunbileje JO, Akinosun OM, 2019)**.

A common air pollutant that affects plants in a number of ways is cement kiln dust, which contains oxides of calcium, potassium, and sodium. For example, cement dust & cement crust on leaves plug stomata and prevent diffusion of gases and light, which lowers starch formation, reduces fruit setting **(Schuhmacher M, Nadal M, Domingo JL, 2021)**, causes premature leaf fall **(Yahaya T, Okpuzor J, Oladele EO 2022)**, and stunts growth.

In addition to inhibiting plant development, cement dust alters the physico-chemical characteristics of soil, which are often hostile to plant growth **(Oluyemi EA, Asubiojo OI, Oluwole AF, *et al* 2014, Dragovic S, Mihailovic N, Gajic B, 2008)** .

Only a few studies have been done on the impact of particulate air pollutants on plants, compared to gaseous air pollutants, as revealed with regard to fluoride silt (McCune *et al*., 1965), soot (Miller and Rich, 1967), lead particulate, cement debris **(Sadhana Chaurasia, Iqbal Ahmad, Anand Dev Gupta, 2020, Idakwoji Precious Adejoh, 2018)**.

The purpose of the current study was to evaluate the effects of pollution from the cement industry on a few chosen plant species near the cement industry at Nimbahera Rajasthan. Our research looked at how cement dust affected the chlorophyll of Arachis

hypogaea and Sesamum indium plant species **(Ji YQ, Feng YC, Wu JH, *et al*., 2008. Oyedele DJ, Aina PO, Oluwole F, *et al*.1990 Odoh R, Archibong CS, Anidobu CO 2018)**. The cement industry at nimbarha rajasthan was sampled at various distances, including 0.5 km, 1.0 km, and 2.0 km and studied for duration of 25 ,50,75 ,100 and 125 days and then analysed for chlorophyll value.

MATERIALS AND METHODS

In the Indian state of Rajasthan, Nimbahera is a city and a municipality in the Chittorgarh district. It is around 32 kilometres from Chittorgarh City and 350 km from Jaipur, the state capital. Nimbahera is connected by both rail and road and is located along the route that runs from Ajmer to Ratlam. The coordinates of Nimbahera are 24.62°N and 74.68°E. Nimbahera is an ideal location for cement businesses and a good source of employment since it is known for Nimbahera stone, a type of limestone used as a construction material and a raw material in the manufacture of cement. JK Cement & Wonder Cement are some cement cement mills in Nimbahera. Wonder Cement built its first facility, which has an annual capacity of 3 million tonnes.

The green pigments known as chloroplasts are found in all tissues of photosynthetic plants and are needed for photosynthesis. Although they are only weakly attached to proteins, they may be easily removed using organic solvents like acetone and ether. Each chlorophyll molecule chemically consists of a porphyrin (tetrapyrol) nucleus with a chelated magnesium atom in the middle and a long chain hydrocarbon (phytyl) side chain bonded through a carboxylic acid group. The research area was restricted to the vicinity of the cement plant. Til and groundnut. Samples of the plants were taken at distances of 0.5, 1.0, and 2.0 km from the cement facility. A control site 15 kilometres from a cement production was chosen. On 25, 50, 75, 100, and 125 days, samples of plants from all three species were taken from the contaminated and control sites, respectively. In order to remove the debris, the photo synthetic pigment was removed from leaves using 80% acetone & centrifuged at 3000 RPM for 15 minutes. By adding 80% acetone, the clear extract's volume was increased to 100 ml, and its absorbance at 645 and 663 nm was evaluated using a spectrophotometer. The formulas provided by Arnon, 1949, were used to determine the concentration of chlorophylls x and y.

Table 1: chlorophyll content (mg g $^{-1}$ dry wt.) and percentage decline (Arachis hypogaea 2021-22)

Plant age in days		Control	Distance		
			0.5 Km	1.00 Km	2.0 Km
25	Chlorophyll x	2.42	0.85	0.91	0.98
	Chlorophyll y	0.82	0.29	0.31	0.36
	Overall chlorophyll	3.24	1.18	1.22	1.32
	Percent decline in chlorophyll value over control		62.58	67.99	59.89
50	Chlorophyll x	2.69	0.95	1.05	1.09
	Chlorophyll y	0.88	0.34	0.38	0.35
	Overall chlorophyll	3.56	1.26	1.38	1.44
	Percent decline in chlorophyll value over control		64.11	61.34	59.06
75	Chlorophyll x	2.97	1.01	1.03	1.16
	Chlorophyll y	0.98	0.33	0.36	0.33
	Overall chlorophyll	3.99	1.36	1.41	1.56
	Percent decline in chlorophyll value over control		65.91	61.88	60.22
100	Chlorophyll x	3.64	0.98	0.95	1.01
	Chlorophyll y	1.1	0.2	0.35	0.31
	Overall chlorophyll	4.82	1.22	1.31	1.41
	Percent decline in chlorophyll value over control		74.13	72.33	70.99
125	Chlorophyll x	4.06	1.88	1.98	2.99
	Chlorophyll y	1.97	0.67	0.63	0.79
	Overall chlorophyll	5.03	2.55	2.61	3.78
	Percent decline in chlorophyll value over control		45.9	44.73	39.09

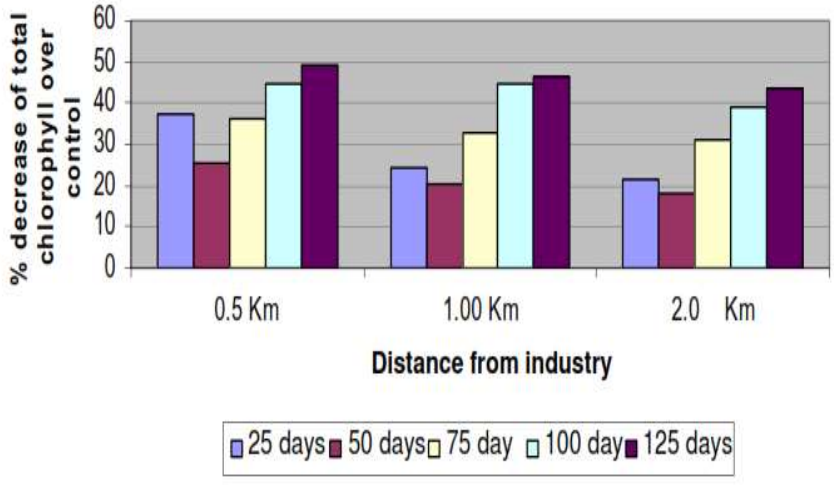

Figure 1: Percent decline in chlorophyll value (*Arachis hypogaea*)

Table 2: Chlorophyll content (mg g $^{-1}$ dry wt.) and percentage decline (Sesamum indicum 2021-22)

Plant age in days		Control	Distance		
			0.5 Km	1.00 Km	2.0 Km
25	Chlorophyll x	1.81	1.15	1.34	1.41
	Chlorophyll y	0.62	0.36	0.45	0.49
	Overall chlorophyll	2.43	1.51	1.79	1.8
	Percent decline in chlorophyll value over control		35.11	22.41	20.44
50	Chlorophyll x	2.41	1.83	1.92	1.96
	Chlorophyll y	0.82	0.62	0.65	0.67
	Overall chlorophyll	3.23	2.45	2.57	2.53
	Percent decline in chlorophyll value over control		25.08	20.77	18.09
75	Chlorophyll x	2.95	1.93	2.01	2.09
	Chlorophyll y	0.96	0.61	0.65	0.63
	Overall chlorophyll	3.94	2.54	2.67	2.74
	Percent decline in chlorophyll value over control		36.12	33.07	31.23
100	Chlorophyll x	3.1	1.84	1.81	2.03
	Chlorophyll y	1.2	0.62	0.63	0.68
	Overall chlorophyll	4.4	2.42	2.43	2.68
	Percent decline in chlorophyll value over control		45.67	44.09	39.12
125	Chlorophyll x	3.86	1.98	1.91	2.77
	Chlorophyll y	1.88	0.69	0.69	0.77
	Overall chlorophyll	5.74	2.67	2.6	3.54
	Percent decline in chlorophyll value over control		45.88	44.76	39.12

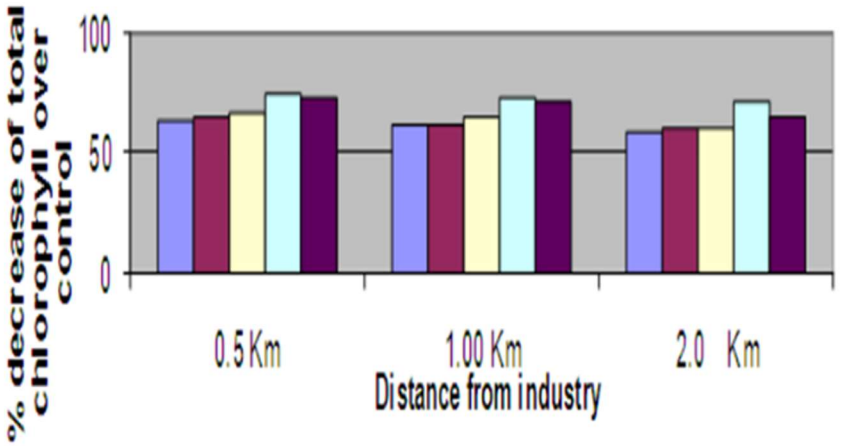

Figure 2: Percent decline in chlorophyll value (*Sesamum indicum*)

RESULTS & DISCUSSIONS

Chlorophyll concentrations per unit weight of control and Arachis hypogaea, and Sesamum indicum plants at various distances from industry were studied. The findings are shown in **Tables 1 and Table 2** and graphical variation of overall chlorophyll value with control for both plant species for 25, 50, 75, 100 and 125 day are shown in **Figure 1 and Figure 2**. **Czaja (1962)**, **Lerman (1972)**, **Singh & Rao** also found that the chloroplast damage produced by the incorporation of cement dust on leaves resulted in a decrease in chlorophyll content in the plants that are close to the factory (1978). Similar outcomes were shown in gramme leaves and maize crops **(Pandey *et al*., 1999)**; **(Pandey and Simba, 1989)**. These examples of evidence for the harmful impacts of gaseous pollutants include Mg^{+2} and the degradation of chlorophyll into the inactive phaeophytin by SO_2 at higher quantities.

As soon as monsoon season arrives in the region, groundnut is seeded. The soil is good for growing groundnuts since it is black cotton. Since it is a cash crop, it is produced everywhere. However, the monsoon weather has the most impact on the yield. The total estimated chlorophyll value of groundnut was discovered to be 4.82 mg g - 1 dry wt. in control plants in 100 days and 1.56 mg g - 1 dry wt. in dusted plants in 75 days at a distance of 2 km from the industry, while the minimum value was discovered to be 1.18 mg g - 1 dry wt. in 25 days at a distance of 0.5 km from the industry.

Till is the primary millets crop of the Kharif season, and at a distance of 0.5 km from the control, the largest reduction in total chlorophyll was seen. Due to the region's suitable soil, these crops are chosen. Being a cash crop is expanding everywhere in the region. The total estimated chlorophyll value of sesame was discovered to be 4.4 mg g -1 dry wt. control plants in 100 days & 2.74 mg g - 1 dry wt. dusted plants in 75 days at a distance of 2 km from the industry, while the minimum value was discovered to be 2.42 mg g -1 dry wt. in 100 days at a distance of 0.5 km from the industry.

CONCLUSION

According to this study, the overall chlorophyll in control plants always was higher and reached its peak at 100 days of age, but in plants that had been dusted, it peaked at 75 days. Without causing physical harm to the plant, exposure to particle deposition may influence plant development. Additionally, the buildup of dust particles on the examined plants' leaves may be a serious obstacle to the growth of such plants. It was suggested that a key factor in plants' ability to tolerate dust

pollution is the pigment concentration of the light harvesting complex. Because it is so sensitive to air contaminants, chlorophyll content has been employed as a measure of air pollution. Chlorophyll concentration is necessary for the photosynthetic process. The constant pollution from the cement industry clogs the stomata, preventing gaseous exchange. Plant species that were close to an industrial area had less chlorophyll, and as distance increases, so does the amount of total chlorophyll. Arachis hypogaea and Sesamum indicum were the most vulnerable plant species to dust pollution in the current study. It is abundantly obvious that pollution from the cement sector has a negative impact on the photosynthesis activity and chlorophyll concentration.

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