



LIGHT ABSORPTION BY LEAVES OF MANGO TREE IN HARIDWAR CITY OF UTTARAKHAND STATE, INDIA

MANU

Research Scholar

Department of Physics,
Dev Sanskriti Vishwavidyalaya, Haridwar, Uttarakhand, India

Abstract: In the present study, comparative studies have been done, to find the effect of air pollutants generated from the vehicular exhaust on the Total Chlorophyll content of leaves. The leaves samples of *Mangifera indica* were collected from areas with potentially higher and lower levels of air pollution. A reduction was seen in the photosynthetic pigments of plant leaves growing in higher polluted site as compared to non or less polluted ones.

I. INTRODUCTION

With the rapid urbanization and industrialization, Urban air pollution has become a serious environmental problem to all types of vegetation (Chauhan and Joshi, 2008). Most of Indian cities are affecting with the presence of high concentrations of gaseous and particulate pollutants due to industrialization, badly maintained poor roads, poor maintenance of vehicles, uses of fuels with poor environmental performance and lack of awareness.

According to an estimation, dust pollutants comprise around 40% of total air pollution problem in India (Chauhan and Sanjeev, 2008). The particulates and gaseous pollutants, alone and in combination, can cause serious setback to the overall physiology of Plants (Mejstrik, 1980; Anda, 1986).

It has been reported that gaseous forms are absorbed by the leaves, while the particulate forms are absorbed through the outer surface of the plants. All of these pollutants certainly affect the light absorbing power of the leaves and affected plants shows some common effects such as chlorophyll necrosis, inhibition in photosynthesis and decreasing plant growth (Chauhan and Joshi, 2008).

Air pollutants like SO₂, NO_x, SPM and RSPM are responsible for reduction of biological and physiological responses of various plants and crops grown at polluted areas (Chauhan and Joshi, 2008).

Chlorophyll is one of the most important and abundant photosynthetic pigments. The amount of chlorophyll within a canopy is positively correlated with vegetation productivity and plant health (Dash and Curran, 2007).

The mountainous state Uttarakhand provides many rivers and other water resources along with pleasant climatic conditions. But in last few decades, the state has witnessed many developmental activities, change in land use pattern, urbanization and industrial setups. City of Haridwar, which is also world famous for the National River Ganga has many evidences of developmental activities in terms of newly built flyovers, highways, and industrial areas.

During the two or three decades, heavy vehicular influx has been continuously observed in Haridwar. Therefore, in the present study, an attempt was made to find the impact of pollutants on light absorbing capacity of leaves of selected tree species within the city.

II. MATERIALS AND METHOD

Haridwar City lies at an elevation of 965 ft from the sea level and between the latitude 20^o, 58' N and Longitude at 78^o, 13'E. Haridwar is an ancient city and important Hindu pilgrimage site in North India. Haridwar is the city where the River Ganges enters into the plains. The selected study sites for the present study were within the range of 15 Km in Haridwar. Following three sampling sites were selected to assess the impact of Environmental pollutants on light absorption in leaves of selected tree species.

1. Motichoor (Near Railway Crossing)
2. Ranipur More
3. BHEL Sec 3

Monitoring of particulate matter (PM₁₀) was undertaken as per the norms prescribed by the Central Pollution Control Board of Govt. of India. The sampling was done for a period of 24 hours on each sampling site, by Envirotech Respiratory Dust Samplers (APM 460) on the same dates and timings. The fresh matured leaf samples of *Mangifera indica* were collected during the study period of year 2021 on the basis of different seasons. The leaves were collected manually from the bottom of the tree crown, about 8-10 feet above from the soil. The matured leaf samples were collected from nearby branches of tree during the study period.

Chlorophyll content was determined by using the method of Singh et al. (1991). The absorbance of the filtered extract was measured with a UV-Visible spectrophotometer (Model UV-1800, Envirotech) at 645 nm and 663 nm.

III. MATERIALS AND METHOD

The results of present study were given in Table 1 to Table 5. Out of the three selected sites, Motichoor is found most polluted area while BHEL Sec 3 is reported least polluted. BHEL Sec 3 area has been considered as Control site in terms of anthropogenic activities round the year.

In year 2021, the total average chlorophyll content in *Mangifera indica* leaves was recorded 4.56 mg/g. The lowest total chlorophyll in case of *Mangifera indica* was recorded 3.78 mg/g at Motichoor study site during the winter season. While the highest value 5.35 mg/g for the same was noted at BHEL Sec 3 during rainy season.

Less amount of total Chlorophyll content was recorded in the samples from the polluted sites in comparison to control site i.e. BHEL Sec 3. In year 2021, there was a reduction of 29.35 % in the total chlorophyll content in the leaves samples of *Mangifera indica* from polluted site in comparison to control site.

Table 1: Comparative Study of PM₁₀ at the study sites during 2021

Comparative Study of PM ₁₀ at the study sites during 2021			
Months	Motichoor Range	Ranipur More	BHEL Sec 3
JANUARY	188.2	115.2	105.6
FEBRUARY	172.1	118.1	108.2
MARCH	160.5	121.5	111.4
APRIL	165.4	120.4	110.2
MAY	158.2	111.2	101.5
JUNE	118.3	76.3	70.4
JULY	125.6	96.6	86.8

AUGUST	130.8	98.8	90.6
SEPTEMBER	140.5	102.5	95.4
OCTOBER	146.2	106.2	98.1
NOVEMBER	153.4	110.4	102.2
DECEMBER	169.2	112.2	104.2

Table 2: Total Chlorophyll of *Mangifera indica* during the study period (Winter Season 2021)

S.No.	Study Sites	Total Chlorophyll (mg/g)
1	Motichoor	3.78
2	Ranipur More	4.02
3	BHEL Sec 3	4.80

Table 3: Total Chlorophyll of *Mangifera indica* during the study period (Summer Season 2021)

S.No.	Study Sites	Total Chlorophyll (mg/g)
1	Motichoor	4.10
2	Ranipur More	4.68
3	BHEL Sec 3	5.30

Table 4: Total Chlorophyll of *Mangifera indica* during the study period (Rainy Season 2021)

S.No.	Study Sites	Total Chlorophyll (mg/g)
1	Motichoor	4.20
2	Ranipur More	4.85
3	BHEL Sec 3	5.35

Table 5: Absorption of Light by the leaves of *Mangifera indica* during the study period

Wave length (nm)	Absorption of light %	
	<i>Mangifera indica</i> (Least Polluted Site)	<i>Mangifera indica</i> (Most Polluted Site)
600	25 %	17%
620	32%	22%
640	38%	25%
660	45%	37%
680	75%	60%
700	90%	75%

Air pollutants have a negative impact on plant growth, primarily through interfering with resource accumulation. Once leaves are in close contact with the atmosphere, many air pollutants, such as SO₂ and NO_x, affect the metabolic function of the leaves and interfere with net carbon fixation by the plant canopy.

Light is one of the most important environmental factors and plays a critical function in plant development and metabolism as it is a necessary component for the process of Photosynthesis. Low absorption of light causes slow growth, decrease of leaf weight and flower bud number. Furthermore, this stress reduces sugar and starch contents in plants species and changes the coloration and extends the maturity time in some floral species.

Floral community use the reaction of photosynthesis to convert light into chemical energy and produce organic molecules. Morphology of leaves, the structure of chloroplasts, content of pigments, diffusion of carbon dioxide, the efficiency of photosynthesis are most common among all of these. But due to the presence of air pollutants, the chlorophyll content got a rapid decrement which ultimately reduces the photosynthesis process through diminishing the absorption of light. The same pattern was observed in the present study. It was clearly came out from the results that air pollutants have disturbed the light absorption power of the leaves collected during the study period.

IV. REFERENCES

- [1] Chauhan, A. and Joshi, P. C. (2008). Effect of ambient air pollution on photosynthetic pigments on some selected trees in urban area. *Ecology, Environment and Conservations*, 14(4): 23-27.
- [2] Chauhan, A. and Kumar, S. (2008). Impact of dust pollution on photosynthetic pigments of some selected trees grown at nearby of stone-crushers. *Environment Conservation Journal*, 9 (3): 11-13.
- [3] Mejstrik, V. (1980). The influence of low SO₂ concentrations on growth reduction of *Nicotiana tabacum* L. cv. Samsun and *Cucumis sativus* L. cv. unikat. *Environ. Pollut.*, 21: 73-76.
- [4] Anda , A. (1986). Effect of cement kiln dust on the radiation balance and yields of plants. *Environmental Pollution*, 40: 249-256.
- [5] Chauhan, A. and Joshi, P.C. (2008). Effect Of Ambient Air Pollutants On Wheat and Mustard Crops Growing In The Vicinity Of Urban and Industrial Areas. *New York Science Journal*, 3(2): 52-60.
- [6] Dash, J. and Curran, P.J. (2007). Evaluation of the MERI Sterrestrial chlorophyll index (MTCD). *Advances in Space Research*, 39, 100-104.
- [7] Singh, S. K., Rao, D. N., Agrawal, M., Pande, J. and Narayan, D. (1991). Air pollution tolerance index of plants. *J. Environ. Manag.* 32: 45-55.