



## EFFECT OF POLLUTION ON CHLOROPHYLL CONTENT IN PLANTS FROM URBAN LOCALITY.

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**ABSTRACT** The present study was conducted to analyse the effect of air pollution on the chlorophyll content on four different plant species namely *F. benghalensis*; *M. indica*; *A.indica*; *F.racemosa*. The study highlights the level of Chlorophyll A and Chlorophyll B along with total Chlorophyll a+b from all the four plants collected from polluted and non polluted site. It was observed in the present study, the level of Chlorophyll A and Chlorophyll B were less in the sample collected from polluted area as compared with the sample collected from non polluted area. Out of the entire plant sample under study, the level of Chlorophyll A and B was higher in *Ficus benghalensis*. The present study clearly indicates that due to automobiles the levels of pollutants in the air have increased and their adverse effect is seen on the chlorophyll content of the plant. There by affecting the percentage of energy production in photosynthesis.

**KEYWORDS :** effect of automobile pollution, Chlorophyll content, Photosynthetic pigment.

**INTRODUCTION**

In the developing countries like India, industrialization and urbanization has a direct effect on the environment. The population level is on the rise which is directly related to the number of vehicles on the road. The present study is conducted in Pune city from the state of Maharashtra (India). Pollution due to automobile is comparatively high than any other anthropogenic activity. Automobile pollution is virtually responsible for all of the carbon monoxide and lead in the air of cities and major portion of the NO<sub>x</sub>, VOCs (Volatile Organic Compounds), fine particles and toxic chemicals[1][2][3].

In the Pune city people commute from one place to another mostly by two wheelers and private vehicles. It also has large automotive industry which has 5 million populations [2]. 22000 vehicles are added in the Pune city every month [3]. Increasing number of vehicles is causing increase in pollution of city. Gaseous pollutants, Nitrogen oxide (NO<sub>x</sub>); Carbon

monoxides (Co); Carbon dioxide(CO<sub>2</sub>); Sulphur dioxide(SO<sub>2</sub>) these pollutants have adverse effect on the chlorophyll content of the plants and affect the overall physiological behaviour of plant [4][6][7] such as flower development, leaf surface wax characteristics biomass production, physiological and biochemical characteristics and plant growth [5][8][9][10][11][12].

Chlorophyll is a green pigments found in cyanobacteria and the chloroplasts of few algae and green plants. The main function of Chlorophylls is to absorb solar radiation mainly the blue portion of the electromagnetic spectrum as well as the red portion. This absorbed light helps in the process of photosynthesis. Two types of chlorophyll usually are present in the photo systems of green plants; they are designated as chlorophyll a and b. Chlorophyll a and chlorophyll b plays an key role in the process of energy fixation giving carbohydrate and oxygen as end product. [6][13]. In the thylakoid membrane chlorophyll molecules are present in the photo system of the plant.a

**MATERIALS AND METHODS**

Types of plant species used in experiment

**1. *Ficus benghalensis* :**

*Ficus benghalensis* is a tree native to Indian subcontinent. It belongs to family Moraceae. Its branches spread out and send trunk like roots to ground in order to support itself. It grows to the height of more than 21 meters and lives for many years. The leaves are 10-20cm long and have many aerial roots. Brood, oval and glossy in appearance. It has various medicinal uses as well as considered as culturally important tree.

**2. *Mangifera indica* :**

*Mangifera indica* is a large evergreen tree in the Anacardiaceae family that grows to a height of 10-45 meters. The leaves are spirally arranged on branches, linear -oblong, lancelet-elliptical pointed at both ends. The leaf blades are mostly about 25cm long and 8cm wide. Extracts of the bark, leaves, stem and unripe fruit have demonstrated antibiotic properties and are used in traditional medicine.

**3. *Azadirachta indica* :**

Neem is fast growing tree noted for its drought resistance, belonging to family Meliaceae. It can reach a height of 15-20 meters. The opposite, pinnate leaves are 20-40 cm long with medium to dark green in colour. It is known to have antiulcer, antimarial, antifungal, antibacterial, antiviral and antioxidant properties.

**4. *Ficus racemosa* :**

*Ficus racemosa* belongs to family Moraceae. It grows to 30 meters height, bark 8-10 mm thick. The leaves are dark green, 6-10 cm long, glabrous, receptacles small subglobose or piriform. It has pharmacological properties such as antidiuretic, antibacterial, antipyretic.

**AREA OF STUDY**

To study the effect of pollutants on chlorophyll content of leaves two work areas were selected, one which is polluted and other non polluted region. Leaf samples taken from Karve road which is highly polluted area and Tamhini ghat which is sparsely polluted region was studied for present study

**Polluted site :** Karve Road, Pune

Leaf samples of all the plant species mentioned above were collected from the trees along the rodeside of abasaheb garware college. Location co-ordinates of this area is 18°29'23.1324"N 73°49'13.0692"E.

**Non polluted site :** Tamhini ghat

Tamhini ghat is situated on the crest of western ghat mountain ranges near Mulashi, Maharashtra, India. Location co-ordinates for this area is 18°26'56"N 73°25'55"E. Tamhini ghat area is declared as eco-sensitive zone by Ministry of Environment & Forest (India). Since lichens are bio indicators of the non-polluted region, hence presence of Lichen confirmed the non polluted status of Tamhini ghats.

**SAMPLE COLLECTION AND CHLOROPHYLL ANALYSIS:**

Method proposed by Anderson & Boardman (1964) was used to determine amount of chlorophyll present in the leaves of all the four collected samples. One gram of fresh leaf sample from each plant were macerated in 10 ml of 80% acetone (v/v) with a pinch of MgCO<sub>3</sub> and centrifuged for 10 minute to clear suspension supernatant which contains soluble pigment and was used for determination of

chlorophyll. This supernatant was used for detection of chlorophyll content by spectrophotometer, absorbance of extract was recorded at 663nm and 645nm on spectrophotometer against 80% (v/v) acetone blank.

The chlorophyll content was calculated using formula given below and expressed in mg/g fresh weight.

**Formula:**

1. chlorophyll a =  $12.7 (OD \text{ at } 663\text{nm}) - 2.69(OD \text{ at } 645\text{nm}) * V/(100*W)$
2. chlorophyll b =  $22.9 (OD \text{ at } 663\text{nm}) - 4.68(OD \text{ at } 645\text{nm}) * V/(100*W)$
3. Total chlorophyll (a+b) =  $22.2(OD \text{ at } 645\text{nm}) + 8.02(OD \text{ at } 663\text{nm}) * V/(100*W)$

Where OD = Optical density; V=Final volume of supernatant in ml; W= weight of sample in gram.

**RESULTS AND DISCUSSION**

The studies which were undertaken on the following plants *F. benghalensis*; *M. indica*; *A.indica*; *F.racemosa* to study the chlorophyll content from the leaves. The area under studies for non polluted area was tamhini ghat (18.4759 °N, 73.4592 °E) and for polluted area karve road was selected (18.5110°N, 73.83 23°E).

In case of *F. Benghalensis* following results were obtained which are been tabulated below. All the results are in mg/gms .

**Table no. 1**

Chlorophyll	Polluted area	Non polluted area
“a”	0.3186801	0.3256626
“b”	0.559763	0.650302
“ a +b”	0.878134	0.975613

In case of *M. Indica* following results were obtained which are been tabulated below. All the results are in mg/gms

**Table no. 2**

Chlorophyll	Polluted area	Non polluted area
“a”	0.128566	0.269453
“b”	0.254305	0.511301
“ a +b”	0.382734	0.780476

In case of *A.indica* following results were obtained which are been tabulated below. All the results are in mg/gms

**Table no.3**

Chlorophyll	Polluted area	Non polluted area
“a”	0.324465	0.337144
“b”	0.486357	0.62533
“ a +b”	0.823223	0.949455

In case of *F.racemosa* following results were obtained which are been tabulated below. All the results are in mg/gms

**Table no. 4**

Chlorophyll	Polluted area	Non polluted area
“a”	0.292064	0.328580
“b”	0.487414	0.590293
“ a +b”	0.779207	0.918549

**Table no 5 - Percentage reduction in Chlorophyll pigment in Plants under study.**

Percentage reduction in Chlorophyll	<i>F. Benghalensis</i>	<i>M. Indica</i>	<i>A.indica</i>	<i>F.racemosa</i>
Chlorophyll “a”	2.1498	52.3014	3.7674	11.111
Chlorophyll “b”	13.9320	50.2640	22.2293	17.4178
Chlorophyll “ a +b”	11.1035	50.9610	13.2926	15.1660

Form all the above studies we observed that the chlorophyll content was more in the leaf sample collected from the non polluted area compared with the polluted area.

**Discussion:**

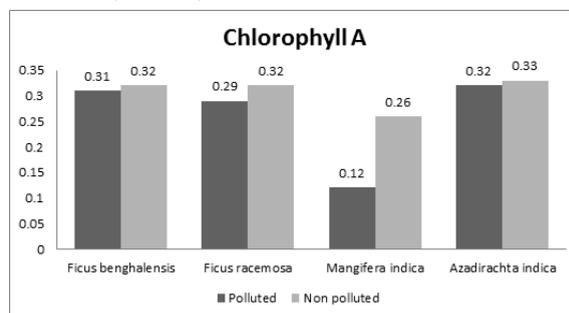
The diversity of flora of any region depends upon the environmental factor to which the floral population is exposed to. The role of

chlorophyll in any green plant plays a key role in the process of photosynthesis. It is an organic molecule. [7][14]. This organic molecule is responsible for trapping the solar energy and converting it into chemical energy which acts as a food for the plants. The present study revolves around the impact of environmental stress on the plant with reference to the chlorophyll pigment [8][15][16].

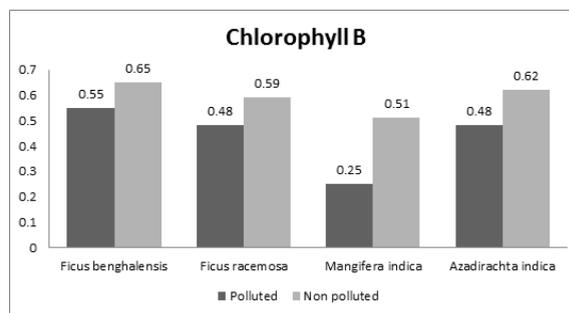
Pune city people commute from one place to another mostly by two wheelers and private vehicles. It also has large automotive industry which has 5 million population [9][2]. Due to industrialization the level of emission from factories has caused a tremendous stress on the flora and fauna of the city. Same results are observed by [10][17]. The exchange of gases and the process of energy production in plants depends upon the chlorophyll content and due to clogging of stomata by deposition of lead and soot particles. Same results were obtained in the present studies. Same results are in accordance with [11][18][19][20].

The present studies reveal the chlorophyll “a”, chlorophyll “b”, total chlorophyll in all the plants under studies shows a significant decrease in the chlorophyll pigment in polluted area compared with the non polluted area. Table (1-4) This is due to environmental stress and the present observation is in accordance with [12][21].

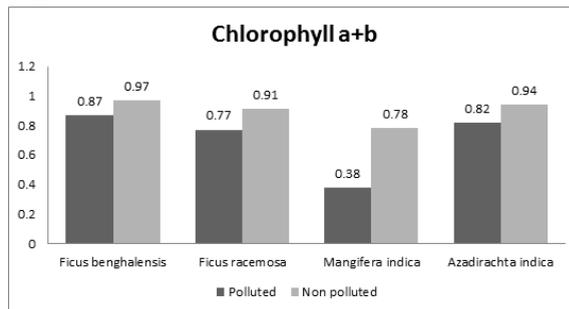
The present studies have clearly pointed out that the percentage chlorophyll reduction is more in *M. Indica* compared with other plants in the studies(table no.5).



**Graph no.1**



**Graph no.2**



**Graph no.3**

**CONCLUSION**

The effect of pollution on the chlorophyll content on the plants under studies (chlorophyll “a”, chlorophyll “b”, chlorophyll “a+b”) revealed that the chlorophyll content was less in the leaves content from polluted area compared with the leaves from non polluted area. The results clearly shows that the auto-vehicular exhaust emission has a

significant effect on the concentration of chlorophyll "a", chlorophyll "b" and total chlorophyll "a+b". This has a direct effect on the energy production by the plant by the process of photosynthesis. Further studies about the concentration of heavy metals in the leaf tissue should be undertaken to find out the damage caused by vehicular pollution on the plants. This study will help researchers from the pollution control board to create awareness amongst public about the adverse effect of high level of emission realised by the vehicle.

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