



Effect of Vehicular Pollution on Chlorophyll Content of Roadside Plants

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Author's contribution

The sole author designed, analyzed, interpreted and prepared the manuscript.

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ABSTRACT

The influence of vehicular pollutants produced by automobiles on the chlorophyll leaves content has been investigated in the current study via comparative research. The leaves sample. *Caesalpinia pulcherrima*, *Cassia tora*, *Bougainvillea spectabilis*, *Lantana camera*, *Tacoma stans*, and *Cassia auriculata* were gathered from areas with potentially greater vehicular pollution. Chlorophyll a and Chlorophyll b photosynthetic pigments are estimated. A decrease in the plant leaves' photosynthetic pigments in areas with greater pollution levels as compared to areas without pollution.

Keywords: *Chlorophyll; vehicular pollution; Caesalpinia pulcherrima; Cassia tora; Bougainvillea spectabilis; Lantana camera; Ticoma stans; Cassia aurulata.*

1. INTRODUCTION

Pollution is the most alarming issue related to the environment. There is an increase in pollutants which are deteriorating the quality & quantity of

air [1,2]. The content of the leaves photosynthetic pigments, such as chlorophyll & carotenoids, decreases as a result of exposure to these pollutants, which has an impact on plant production. Chlorophyll plays a significant role in

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the process of fixation of energy-giving carbohydrates and oxygen as the end product [3-5].

Incomplete fuel combustion results in engine fumes, which are often the source of pollution from automobiles [6,7]. The damage that air pollution presents to human health and the environment is widely understood, and it is predicted that million tons of toxic pollutants are emitted into the atmosphere every year [8-10]. Chlorophyll catabolism not only has an impact on the essential elements of a plant's photosynthesis systems, but it also contributes to the green color of fruits and leaves, making it crucial for plant growth (Peng et al., 2013).

Plants may be employed as bio-indicators in many different types of studies in emerging cities [11-14]. It is a heavily populated area with significant vehicle traffic. Plant development is being affected by the dramatic rise in air pollution [15,16]. The environment has changed as a result of the rapid addition of harmful compounds into the environment. At present study was undertaken from Malegaon to Saundane (10km area) national highway (NH 3) this area has very high vehicular pollution. The current study is to determine the influence of vehicular pollution on the "chlorophyll content" of roadside-selected plant leaves.

2. MATERIALS AND METHODS

The current work compares plants growing in areas with substantial trafficable pollution to those growing in areas with minimal or no pollution. The site selected for sampling the plant material (plant leaves) from Malegaon to Saundane (National Highway no. 3) 10 Km area selected for collecting samples were heavy trafficable pollution. Malegaon City, located in Nashik district state Maharashtra the GPS coordinates of 20°33'38.8692" N and 74°31'30.2520"E. Nonpolluted or less polluted samples were collected from 5km away from the polluted sites.

2.1 Extraction of Chlorophyll (Arnon, 1949)

Fresh leaves that had been freshly cut were collected and ground in a mortar and pestle to the weight of one gram. With 20 ml of 80% acetone and made a volume of 100 ml with 80 percent acetone and the solution has been used for chlorophyll estimation. At 645 and 663 nm,

the solution's absorbance was measured in comparison to the acetone (solvent) blank.

The chlorophyll a, b, and total chlorophyll content were determined with the following formula (Arnon's 1949)

$$\text{Mg chlorophyll a/g tissue} = \frac{12.7(A663) - 2.69(A645) \times V}{1000 \times W}$$

$$\text{Mg chlorophyll b/g tissue} = \frac{22.9(A645) - 4.68(A663) \times V}{1000 \times W}$$

$$\text{Mg Total chlorophyll/g tissue} = \frac{20.2(A645) - 8.02(A663) \times V}{1000 \times W}$$

Here,

A indicates absorbance at a specific wavelength

V represents the chlorophyll extract's final volume in 80 percent acetone

W denotes the fresh weight of tissue extract"

3. RESULTS AND DISCUSSION

3.1 Cassia Tora

Chlorophyll 'a' level in Cassia tora leaves measured in polluted areas were 0.824 mg/g, compared to 0.954 mg/g at the control site. As a result, samples taken from polluted sites showed a 13.63 percent decrease in Chlorophyll 'a' compared to controls. The Chlorophyll 'b' content was 0.462 mg/g within leaf samples taken from polluted areas compared to 0.748 mg/g in those taken from control sites. Therefore, the sample from the polluted sites had 38.23% less chlorophyll b. The leaf samples taken from the polluted & control sites, respectively, had total chlorophyll contents of 1.286 and 1.502 mg/g. Thus, the overall chlorophyll concentration in the samples obtained from the polluted site decreased by 14.38 percent.

3.2 Cesalpinia Pulcherima

Chlorophyll 'a' level in Cesalpinia pulcherima leaves measured in polluted locations were 0.973 mg/g, compared to 1.215 mg/g at the control site. As a result, samples taken from polluted areas showed a 19.59% decrease in Chlorophyll 'a' compared to controls. The Chlorophyll 'b' content has been 0.568 mg/g in leaf samples taken from polluted locations compared to 0.670 mg/g in those taken from

clean sites. Thus, the sample from the polluted sites had 13.23% less chlorophyll b. The leaf samples taken from the polluted along with control sites, respectively, had total chlorophyll contents of 1.541 and 1.885 mg/g. Thus, the overall chlorophyll concentration in the samples obtained from the polluted site decreased by 18.24%.

3.3 Bougainvillea Spectabilis

In polluted areas, the Bougainvillea spectabilis leaves had 1.219 mg/g of chlorophyll a, compared to 1.815 mg/g at the control site. As a result, samples taken from polluted areas showed a 33.66 percent decrease in Chlorophyll 'a' compared to controls. Chlorophyll 'b' levels were 0.703 mg/g in leaf samples taken from polluted sites compared to 0.982 mg/g in those taken from clean sites. Thus, the sample from the polluted sites has 24.42 percent less chlorophyll b. The samples of leaves taken from the polluted & control sites, respectively, had total chlorophyll contents of 1.922 and 2.795 mg/g. Thus, the overall chlorophyll concentration within samples obtained from the polluted site decreased by 31.28 percent.

3.4 Lantena Camera

Chlorophyll 'a' level in the leaves of the Lantena camera were found to be 0.644 mg/g in polluted areas compared to 0.902 mg/g at the control site.

As a result, samples taken from polluted areas showed a 28.61 percent decrease in Chlorophyll 'a' compared to controls. Chlorophyll 'b' levels were 0.396 mg/g in leaf samples taken from polluted locations compared to 0.584 mg/g in those taken from clean sites. Thus, the sample from the polluted areas had 32.20 percent less chlorophyll b. The samples of leaves taken from the polluted and control sites, respectively, had total chlorophyll contents of 1.040 and 1.486 mg/g. As a result, the samples obtained from polluted sites had a drop in the total chlorophyll content of 31.28 percent.

3.5 Tecoma Stans

Chlorophyll 'a' levels in Tecoma stans leaves measured in polluted areas were 0.535 mg/g, compared to 0.702 mg/g at the control site. As a result, samples taken from polluted areas showed a fall in Chlorophyll 'a' of 23.79 percent when compared to controls. The content of Chlorophyll 'b' has been 0.445 mg/g in samples of leaves taken from polluted sites compared to 0.590 mg/g in those taken from clean sites. Thus, the sample from the polluted sites had 24.58 percent less chlorophyll b. The samples of leaves taken from the polluted as well as control sites, respectively, had total chlorophyll contents of 0.980 and 1.292 mg/g. Thus, the total chlorophyll concentration within samples obtained from the polluted site decreased by 24.14 percent.

Table 1. Various photosynthetic pigments (mg g⁻¹) concentration inside leaves of following plants gathered from polluted & non-polluted sites

Sr. No.	Name of the plant	Polluted	Nonpolluted/less pollution	% Reduction	
1	<i>Cassia tora</i>	Chlo. a	0.824	0.954	13.63
		Chlo. b	0.462	0.748	38.23
		Total chlo.	1.286	1.502	14.38
2	<i>Cesalpinia pulcherima</i>	Chlo. a	0.973	1.215	19.59
		Chlo.b	0.568	0.670	13.23
		Total chlo	1.541	1.885	18.24
3	<i>Bougainvillea spectabilis</i>	Chlo. a	1.219	1.815	33.66
		Chlo.b	0.703	0.982	28.42
		Total chlo	1.922	2.795	31.28
4	<i>Lantena camare</i>	Chlo. a	0.644	0.902	28.61
		Chlo.b	0.396	0.584	32.20
		Total chlo	1.040	1.486	31.28
5	<i>Tecoma stans</i>	Chlo. a	0.535	0.702	23.79
		Chlo. b	0.445	0.590	24.58
		Total chlo	0.980	1.292	24.14
6	<i>Cassia auriculate</i>	Chlo. a	0.873	1.015	14.00
		Chlo.b	0.620	0.862	29.08
		Total chlo	1.493	1.867	20.03

3.6 Cassia Auriculata

Chlorophyll 'a' level in *Cassia auriculata* leaves measured in polluted areas were 0.873 mg/g, compared to 1.015 mg/g at the control site. As a result, samples taken from polluted sites showed a 14.00% decrease in Chlorophyll 'a' compared to controls. The content of Chlorophyll 'b' was 0.620 mg/g in samples of leaves taken from polluted sites compared to 0.862 mg/g in those taken from clean sites. Thus, the sample from the polluted sites had 29.08 percent less chlorophyll b. The samples of leaves taken from the polluted & control sites, respectively, had total chlorophyll contents of 1.493 and 1.867 mg/g, respectively. Thus, the total chlorophyll concentration in the samples obtained from the polluted site decreased by 20.03 percent.

4. CONCLUSION

Different plant species growing at polluted road locations were compared to control sites to measure the impact of automobile pollution on the chlorophyll content (chlo. a & chlo. b) and total chlorophyll. All plant species showed a drop in chlorophyll concentration in comparison to samples taken from control or less polluted sites. The content of chlorophyll a, b, and total chlorophyll, have been observed to be strongly influenced by auto vehicular exhaust pollution.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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