OPEN ACCESS

Int. Res. J. of Science & Engineering, 2014; Vol. 2 (4): 158-160 ISSN: 2322-0015

RESEARCH ARTICLE

Changes in biochemical contents in *Cassia occidentalis* l. In response to automobile pollution in Meerut city, India

Kumari Shiv * and Prakash Ila

Department of Botany, D.N. College Meerut, (U.P.) India

** Corresponding Author drshivasharma85@gmail.com*

Manuscript Details

Received : 22 July, 2014
Revised : 12 August, 2014
Revised received: 17 August, 2014
Accepted: 23 August, 2014
Published: 30 August, 2014

ISSN: 2322-0015

Editor: Dr. Arvind Chavhan

Cite this article as: Kumari Shiv and Prakash Ila, Changes in biochemical contents in *Cassia occidentalis* l. In response to automobile pollution in Meerut city, India, *Int. Res. J. of Sci. & Engg*., 2014; 2 (4):158-160.

ABSTRACT

Urban Air Quality Management in developing countries due to vehicular pollution causes significant impacts. Increased traffic especially in cities and the exhaust from the vehicles cause adverse effect on the health of the people. It also affects the vegetation growing near the traffic intersections. Among the various categories, air pollution by automobiles is the most insidious one, which exerts highly detrimental effects on living organisms. Ambient air pollution in several large cities of India is amongst some of the highest in the world. Present study deals with the observation made on *Cassia occidentalis* on different roadsides having heavy pollution load in comparison to control. The studies were made on *Cassia occidentalis* taken from Garh Road, Delhi Road, Railway Road, and University Road. Reduction in chlorophyll contents were found to be depends on pollution concentration. An increase significant reduction was observed at highly polluted sites due to high concentration of automobile pollution, chlorophyll a, chlorophyll b and total chlorophyll content were reduced.

Key Words: Vehicular pollution, chlorophyll content, concentration, reduction.

INTRODUCTION

The earth is the only planet known in the entire universe capable of supporting life. This is due to its unique environment. Any undesirable change in the environment, which may be due to addition of unwanted substances results in atmospheric pollution and disturbs the normal functioning of the ecosystem. All natural ecosystems maintain balance between their diverse components. The race for rapid development has resulted in unscrupulous exploitation of natural resources. This has disturbed the delicate ecological balance between living and nonliving components of the biosphere. Hermens *et al*. (2009) has reported the effect of pollution on vegetation. Losses incurred in chlorophyll a were relatively higher than chlorophyll b in SO_2 exposed leaves of *Euphorbia hirta* (Gupta and Ghouse, 1987). Increased SO_2 concentration for longer duration results in considerable decrease in total chlorophyll content (Rath *et al.* 1994, Prakash *et al.*, 1997). Rajput and Agarwal (2004) and Manju *et al.* (2013) also observed total chlorophyll content at polluted sites.

Chapla and Kamalkar (2004) reported that ozone inhibit the production of necessary enzymes required for chlorophyll synthesis. Wath *et al.* (2006) observed that the plants along roadside with heavy traffic and markets are affected by vehicular emissions which cause a significant decrease in total Chlorophyll. Similar findings were observed in *Oryza sativa* (Prakash *et al.,* 2008).

MATERIALS AND METHODS

Fresh leaves of *Cassia occidentalis* were collected from different sites of Meerut city. Chlorophyll content was obtained by using Arnon's method (1949). For this purpose 100 mg of fresh leaf tissue was homogenized in 80% acetone with a pinch of sodium bicarbonate. After centrifugation at 5000 rpm for 5 min., the supernatant was collected and the final volume was made up to 10 ml with acetone. The absorbance was measured at 663 nm and 645 nm on a systronic spectrophotometer using 80% acetone as blank. Chlorophyll a, b and total chlorophyll were calculated by using the following formulae:

$$\text{Cla a (mg/g f.wt)}=[12.7(A_{633})-2.69(A_{645})]X\ \frac{V}{1000\ X\ W}$$

$$\text{Cla b (mg/g f.wt)}=[22.9(A_{645})-4.68(A_{663})]X\ \frac{V}{1000\ X\ W}$$

$$\text{Total (mg/g f.wt)}=[22.9(A_{645})-4.68(A_{663})]X\ \frac{V}{1000\ X\ W}$$

Where,

A = Absorbance at specific wavelength

V = Final volume (ml) of chlorophyll extract with 80% acetone

W = Weight (g) of leaf tissue.

All the data were subjected to statistical analysis to find out Critical Difference at (CD) 5% and 1% level (Fisher 1951), is superscripted with single star (*) and double star (**) respectively.

RESULTS AND DISCUSSION

A reduction was observed in total chlorophyll content in *Cassia occidentalis* at all polluted sites and it was maximum at Delhi road. The decrease in the value of chlorophyll a was found to be higher than chlorophyll b. In *Cassia occidentalis* reduction percentage in Chlorophyll a/ Chlorophyll b content were recorded 7.9%/ 4.0% in mg/gm fresh weight of leaves at University road and 36.3%/ 38.2% in mg/ gm fresh weight of leaves at Delhi road (Tables 1, fig. 1).

Total chlorophyll was also recorded a gradual decrease with the increase in automobile pollution. In *Cassia occidentalis* the total chlorophyll reduction percentage was 39.9% at Delhi road and maximum 4.3% at University road (Table 1, fig. 1).

Maximum reduction in pigment concentrations was observed at Delhi road, moderate at Garh road and Railway road and less at University road. Air pollutants are known to cause significant reduction in chlorophyll pigments (Katz and Shore; 1955, Agrawal *et al*., 1991). A significant reduction in total chlorophyll and protein was observed with reduced leaf area (Wath et al., 2006).The chlorophyll contents in leaves of the plants on polluted sites showed a significant reduction. The inhibition of vital physiological processes like photosynthesis, chlorophyll metabolism and enzymatic activites ultimately led to the reduced plant growth.

Table 1: Chlorophyll a , chlorophyll b and total chlorophyll (mg/g/f/wt) in *Cassia occidentalis* L. at different study site in Meerut city.

Cassia occidentalis	**Different Study Sites**						
	Control	Delhi Road	Garh Road	Railway Road	University Road	CD5%	CD1%
Chlorophyll a (mg/g.f.wt)	15.5038 ± 1.1528	9.8677* ± 4.4675	10.9962* ± 5.6898	11.0695* ± 6.0363	14.272 ± 1.2905	3.366	8.023
Chlorophyll b (mg/g.f.wt)	18.9860 ± 0.4510	11.7237* ± 2.8477	15.6332** ± 2.0244	16.6423* ±1.9260	18.2223 ± 1.6125	1.316	3.318
Total Chlorophyll (mg/g.f.wt)	35.4676 ± 0.4395	21.2897** ± 9.4560	27.1923** ± 5.0617	27.9430** ± 6.3667	33.9211 ± 2.25180	1.283	3.058

Values are mean ± Standard Error.

*Values are statistically significant at * <CD5% and ** <CD1%*

However, chlorophyll a was found to be more suspectible than chlorophyll b. Sensitivity of chlorophyll a hampers the plant growth as it plays significant role in the process of photosynthesis. Reduced activity of chlorophyll molecule is associated with deficiency of nitrogen and Mg^{+2} ions in plants. As both these ions are involved in structure and synthesis of chlorophyll, their deficiency leads to the reduction in chlorophyll. This results in a decline of photosynthetic activity. These results are in accordance with Farooq *et al*. (1985), Prakash *et al*. (1989) and Manju Sharma *et al.* (2013).

Increasing order of polluted study sites:

University road< Railway road< Garh road< Delhi road.

ACKNOWLEDGEMENT

The author is thankful to centre for the study of D.N.College laboratory, Meerut, U.P. India to providing me all the facilities for experimental work. author is also thankful to Dr. (Smt) Ila Prakash for her guidance and supervision for this work. The author is grateful to Dr. D.C. Pandey (A.S.O. Board of Central Pollution control). C.B.P.C. provides me data on pollution. Last but not least author is also thankful to Prof. V. Singh, for his guidance and timely help rendered to me from time to time.

REFERENCES

1. Agarwal M, Singh SK, Singh J, Rao DN. Biomonitoring of air pollution around urban and industrial sites. *J. Environ. Biol*. 1991; 209-220.
2. Arnon DI. Copper enzyme in isolated chloroplasts, polyphenoloxidasa in *Beta vulgaris*. *PI. Physiol.* 1949; 24: 1-15.
3. Chapla J and Kamalkar JA. Metabolic responses of tropical trees to ozone pollution *J. Environ. Biol.*2004; 25(3): 287-290.
4. Farooq M, Masood A, Beg MU. Effect of acute exposure of sulphur dioxide on the metabolism of *Holoptelea integrifolia* plants. *Environ. Pollut*. 1985; 39: 197-205.
5. Fischer RA. The Design of Experiments. Six Eds. Oliver and Boyd, London. 1951.
6. Goswami R. Toxicity of air pollution to plants. A ph.D Thesis. C.C.S.Univ., Meerut India. 2002.
7. Gupta MC and Ghouse AKM. Effects of coal and smoke pollutants from different sources on growth, chlorophyll content, stem anatomy and cuticular traits of *Euphorbia hirta* L. *Geobios* 1987; 14: 221-229.
8. Harmens H, Mills G, Hayes F, Jones L, Norries D, Cooper D and the participants of the ICP vegetation Programme Coordination Centre. (2009). Air Pollution and vegetation: ICP vegetation Annual Report 2008/ 2009. Bangore, *NERC/ Centre for Ecology and Hydrology*, PP: 40.
9. Katz M and Shore VC. Air pollution damage to vegetation. *J. Air Pollu. Cont. Asso*. 1955; 5: 144-150.11.Manju Sharma,Panwar N,Arora P,Luhach J and Chaudhry S. Analysis of biochemical factors for identification of air pollution tolerance index of selected plants in Yamuna nagar, India. *Journal of Exp. Biology*. 2013; 34: 509-514.
10. Prakash, Joshi C and Chauhan A. Performance of locally grown rice plants (*Oryza sativa*) exposed to air pollutants in a rapidly growing industrial area of Haridwar. *Life Science Journal*. 2008; 5(3): 57-61.
11. Prakash G, Agarwal S, Kumar N and Verma SK. Changes in growth and yield associated with photosynthetic pigments, carbohydrate and phosphorus content in *Lycopersicon esculentum* exposed to sulphur dioxide. *Acta Bot. Indica,* 1989; 17: 43-48.
12. Prakash G, Tomar YS, Sharma TK and Gupta V. Evaluation of *Spinacia oleracea* L. var. Pusa All Green on exposure to sulphur dioxide. *Ad. Pl. Sci. Res.* 1997; 5-6: 159- 169.
13. Rajput M and Agarwal M. Physiological and yield responses of pea plants to ambient air pollution. *Indian J. Plant Physiol.* 2004; 9 (1): 9-14.
14. Rath S, Padhi SK, Kar M and Ghouse PK. response of *Zinnia* to sulphur dioxide exposure. *J. OrnAmer. Horti.1994;* 2 (1-2): 42-49.
15. Wath ND, Shukla P, Tambe V, and Scarika B, Ingle ST (*Sch Environ Earth Sci, North Maharashtra Univ, Jalgaon),(2006). Biological Monitorining of roadside plants exposed to vehicular pollution in Jalgaon city. *J. Environ. Bio.* 27(2 Supplement): 419-421.