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

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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:

- \[ \text{Chlorophyll a (mg/g f.wt)} = \frac{(12.7(A_{663}) - 2.69(A_{645})) \times V}{1000 \times W} \]
- \[ \text{Chlorophyll b (mg/g f.wt)} = \frac{(22.9(A_{645}) - 4.68(A_{663})) \times V}{1000 \times W} \]
- \[ \text{Total (mg/g f.wt)} = \frac{(22.9(A_{645}) - 4.68(A_{663})) \times V}{1000 \times W} \]

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>
<thead>
<tr>
<th>Cassia occidentalis</th>
<th>Different Study Sites</th>
<th>Control</th>
<th>Delhi Road</th>
<th>Garh Road</th>
<th>Railway Road</th>
<th>University Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorophyll a (mg/g f.wt)</td>
<td></td>
<td>15.5038 ± 1.1528</td>
<td>9.8677* 4.4675</td>
<td>10.9962 ± 5.6898</td>
<td>11.0695 ± 6.0363</td>
<td>14.272 ± 1.2905</td>
</tr>
<tr>
<td>Chlorophyll b (mg/g f.wt)</td>
<td></td>
<td>18.9860 ± 0.4510</td>
<td>11.7237 ± 2.8477</td>
<td>15.6332 ± 2.0244</td>
<td>16.6423 ± 1.9260</td>
<td>18.2223 ± 1.6250</td>
</tr>
<tr>
<td>Total Chlorophyll (mg/g f.wt)</td>
<td></td>
<td>35.4876 ± 0.4395</td>
<td>21.2897 ± 9.4650</td>
<td>27.1923 ± 5.0617</td>
<td>27.9430 ± 6.3667</td>
<td>33.9211 ± 2.25180</td>
</tr>
</tbody>
</table>

Values are mean ± Standard Error.
Values are statistically significant at * <CD5% and ** <CD1%
However, chlorophyll a was found to be more susceptible 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.

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REFERENCES