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EFFECT OF AIR POLLUTION ON CHLOROPHYLL CONTENT OF URBAN AND GARDEN AREA PLANTS

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Abstract- Industrialization changing the gaseous composition of earth's atmosphere. Air pollution affects both plants and animals. Pollutants causes change in stomatal pores seems to be adverse effect with respect to survival of the plant during stress. In this study estimate chlorophyll of green leaves taken from urban area and garden area. It is well known that chlorophyll is essential for photosynthesis, allowing plants to absorb light energy and transformed into chemical energy. Respiration and other metabolic activities also get affected by air pollutants. Paper chromatography method used in this work. The qualitative comparisons of chlorophyll content between garden area and urban area leaves were observed. Four plant species were selected namely (*Pluoneria acutifolia*) Champa, (*Bougainville glabra*) Bougainvillea, (*Tecoma gaudichaudi*) Tecoma, (*Senna siamea*) Cassia for this analysis.

Keyword: chlorophyll, photosynthesis, paper chromatography, pigment

Introduction

Today's air pollution becomes a severe problem due to modern industrialized world. The atmospheric Co_2, gaseous pollutants like So_2 and No_2 concentration continuously increasing (Watson *et al*. 1990). It is known fact that 60% of air pollution in city is caused by automobiles only. Plants also include for investigating of effect of auto exhaust pollutant response of plants toward air is being tested by the chlorophyll content. Some plant species are very sensitive towards air pollutants which can cause positive and negative both effect on physiological and morphological character of plants depend on their concentration. Concentration of So_2 causes toxicity due to low chlorophyll formation. Air pollution can create general disruption on phenology, periodicity, fruiting, flower

development, leaf senescence and leaf surface wax characteristics, biomass production, seed germination, seedling growth, physiological and biochemical characteristics and plant growth (Iqbal and Siddiqui, 1996; Iqbal *et al.*, 1997; Aksoy and Sahln, 1999; Iqbal and Shafiq, 1999; Aksoy *et al.*, 2000; Wagh *et al.*, 2006; Prajapati *et al.*, 2008; Shafiq and Iqbal, 2007, 2012; Honour *et al.*, 2009; Narwaria and Kush, 2012; Leghari *et al.*, 2013; Parveen *et al.*, 2014).

Rai and Kulshrestha (2006) have suggested that due to air pollutants the inhibited cell elongation, leaf area and consequently the increase in cell frequency resulted in reduction in the size of stomata and epidermal cells. If the environmental condition is limited for the plant, then photosynthesis will be affected and chlorophyll content lead to premature leaf drop, senescence, reduction in rate of photosynthesis has been seen (Mirza *et al*., 2013; Srichaikul *et al*., 2011). Leaf chlorophyll concentration is an important parameter to measure plant metabolic activity Chl. a and chl. b are essential pigment of the plant photosystem. Chl. a is the primary photosynthetic pigment in plants which helps to produce energy in plants.

In present study records of chlorophyll content via paper chromatography. In this technique four primary pigments of green plants can easily separate, include two greenish pigment called chlorophyll and two yellowish pigment called carotenoids. Chlorophyll is a slightly soluble in a 3:1:1 mixture of petroleum ether, acetone and water. Carotenoids are very soluble in this solvent system. These solubility differences will allow the separation of chl.a from the carotenoids and chl.b on a paper chromatograms. Paper chromatography mainly used to detect contamination.

The technique of chromatography is vastly used for the separation, purification and identification of compounds. A physical method of separation in which the components to be separated are distributed between two phases, one of which is stationary while the other moves in a definite direction. The stationary phase is usually in the form of a packed column (column chromatography) but may take other forms such as flat sheet or a thin layer adhering to a suitable form of backing material such as glass (thin-layer chromatography). Different possible combinations of these phases give rise to principal techniques of chromatography.

In partition chromatography, stationary phase is thin film of liquid adsorbed on an essentially inert support. Mobile phase may be a liquid or a gas. Paper chromatography is an example of partition chromatography in which liquid present in the pores of paper is stationary phase and some other liquid is movable phase. Separation depends upon partition of substance between two phases and the adsorption effects of inert support on compounds undergoing chromatographic separation.

$$Rf = \frac{\text{Distance travelled by the substance from reference line}}{\text{Distance travelled by the solvent from reference line}}$$

Since solvent front moves faster than the compounds, the *Rf* value of a substance will always be less than one. Also note that *Rf* value has no unit. If the compound is coloured then its position on the chromatographic paper may be easily located.

Material and Method

Whatman's filter paper No.1 of size 4 cm × 17 cm, Gas jar of size 5 cm × 20 cm, Rubber cork fixed with hook in the centre, Test tubes: As per need, Extraction of leaves, Distilled water, Methanol/Acetone, Petroleum ether boiling range (60–80°C) and Chloroform /Acetone.

Grind leaves in a mortar and transfer the paste into a test tube. Add small amounts of methanol or acetone in the crushed material. Close the test tube with an appropriate cork and shake it well. Filter it and collect the filtrate in a test tube and cork the test tube. Procure a Whatman's filter paper No.1 of size 4 cm × 17 cm and mark a line at a distance of 3 cm from one of the ends of the paper with the help of a pencil. Using a finely drawn capillary, put one spot 'a' for the extract of leaves and one spot 'b' for the extract of flowers. Allow these spots to dry as shown in (Fig 1).

Hang the filter paper in a jar containing 20 ml mixture of petroleum ether (boiling range 60–80°C) and chloroform containing 19 ml petroleum ether and 1 ml chloroform or a mixture of petroleum ether (boiling range 60–80°C) and acetone in the ratio 9:1 (18 mL petroleum ether + 2 mL acetone) so that the solvent does not touch the reference line. Keep this jar as such till the mobile phase (solvent) rises up to 2/3 of the length of the paper. Remove the filter paper from the jar, mark the solvent front, outline the spots with the help of a pencil and allow the filter paper to get dry. Measure the distance travelled by the solvent front and the centre of different spots with respect to the reference line. Ascertain the number of pigments, which are present in the extract of leaves and flowers. Calculate the Rf value of different spots with the help of the expression mentioned earlier.

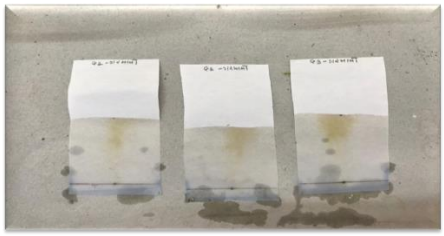
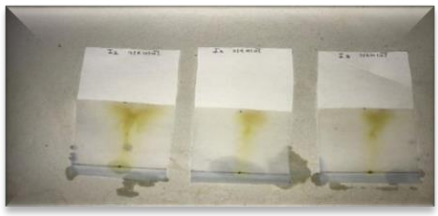
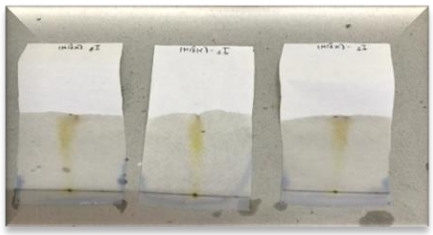
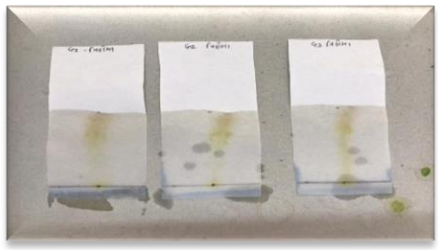
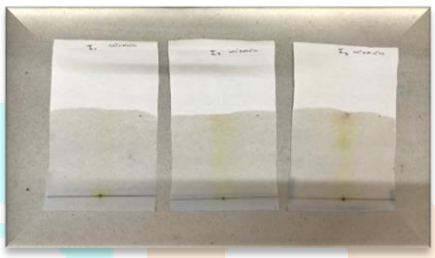
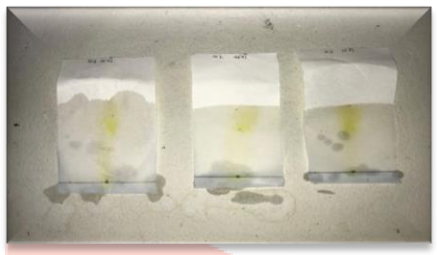
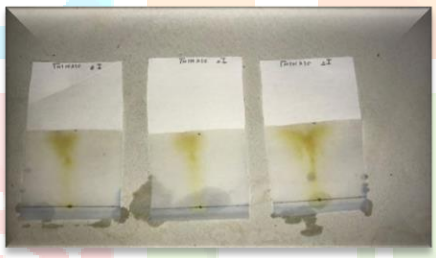
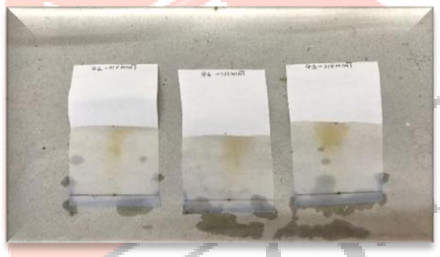
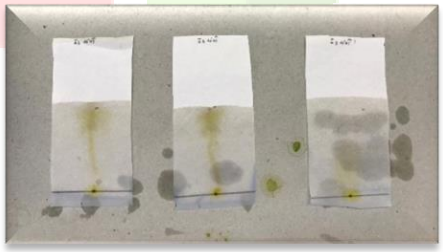
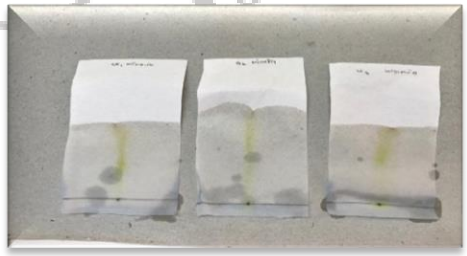
Result

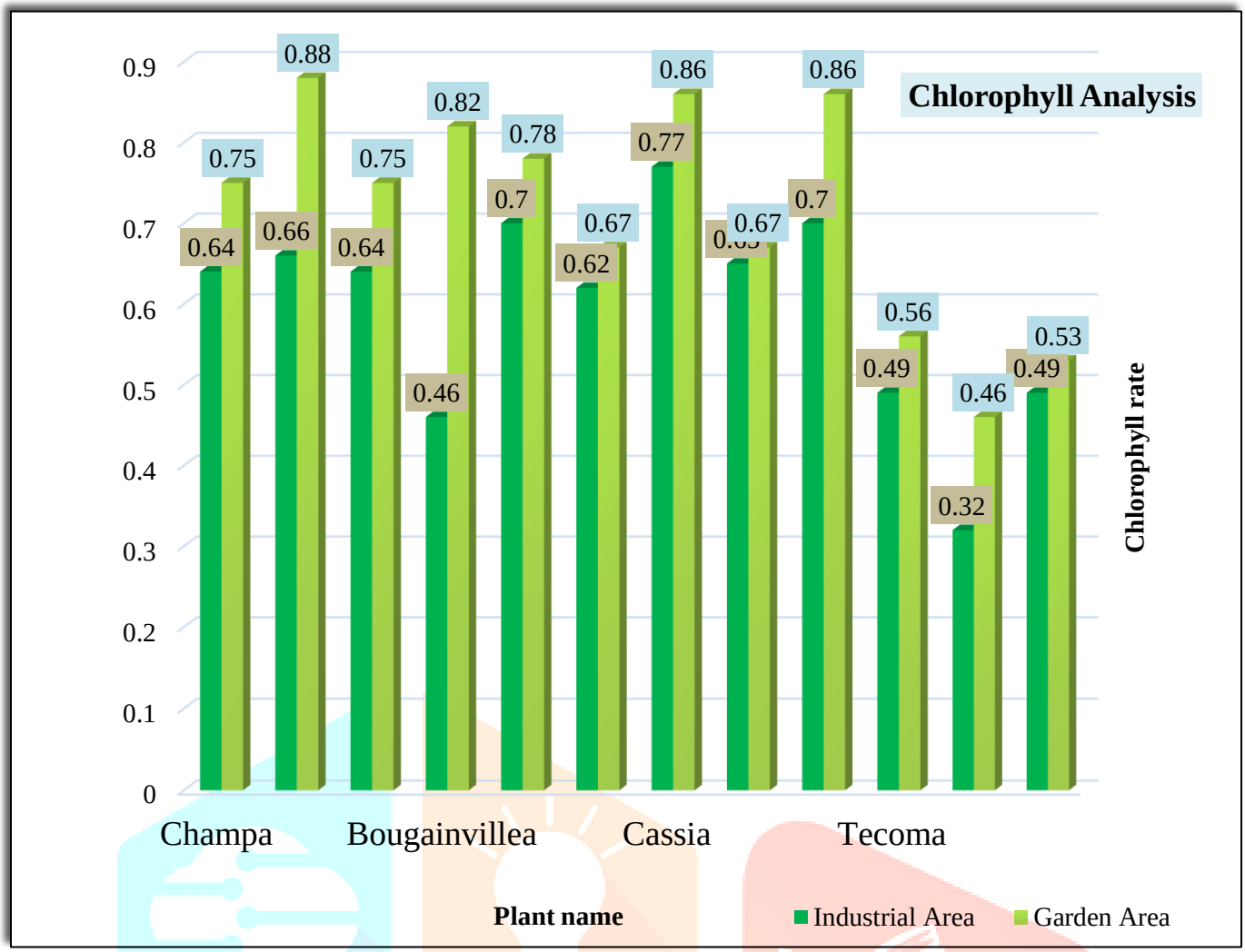
Chlorophyll content was analyzed from Garden area Champa (*Pluoneria acutifolia*) calculated as Rf value 0.75 cm and industrial area content value 0.65 cm, Garden area Bougainvillea (*Bougainville glabra*) content value 0.75 cm. while industrial area content value 0.78 cm., Garden area Tecoma (*Tecoma gaudichaudi*) content value 0.78 cm. and industrial area content value 0.76 cm., Garden area Cassia (*Senna siamea*) content value 0.85 cm and industrial area content value 0.76 cm.

Table1: Showing results of chlorophyll content in selected plants.

Plant Name	Industrial Area	Garden Area
Champa	0.64	0.75
	0.66	0.88
	0.64	0.75
Bougainvillea	0.46	0.82
	0.70	0.78
	0.62	0.67
Cassia	0.77	0.86
	0.65	0.67
	0.70	0.86
Tecoma	0.49	0.56
	0.32	0.46
	0.49	0.53

Figure 1. Showing Chlorophyll content in selected industrial area and garden area plants.

Plant name	I1, I2, I3 Industrial area	G1, G2, G3 Garden area
Casia (*Senna Siamea)*		
Champa (*Pluaneria acutifolia*)		
Bougainvilled (*Bougainville glabra*)		
Cassia (*Senna siamea*)		
Tecoma (*Tecoma gaudichaudi*)		



Graph1: Showing graphical presentation of chlorophyll content.

Discussion-

Findings of the present study we conclude that the most of the plant showed higher chlorophyll content in Garden Area leaves as compared to Industrial Area leaves. Some plants had shown very low difference between both areas. Chlorophyll content can be used as measurement of healthiness of plants canopy and the rate of photosynthesis as well, low difference showed plant resistance capacity to repel automobile pollutants and air pollution. These plants commonly planted near highways or highly traffic areas for elegant appearance.

This study will be helpful to do research in chlorophyll content analysis of various plants species and study the vegetation cover area also the effect of pollution on chlorophyll content is an important point of study. It needs to keep continuous monitoring on chlorophyll content to maintain and to check the healthiness of plants. The chlorophyll pigments are an indicator of O_2 production and carbon sequestration.

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