

## Air pollution influence on non-structural carbohydrates and protein constituents of native flora along the Lahore Canal

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### Abstract

Fresh air is fundamental assets for living being to survive healthy but with increasing index of anthropogenic activities, the percentage of gases in the air changes. The changes in ratio of gases in air cause the several effects on living being like plants. Plants are bio-indicators for climate justice and indigenous flora has maximum capacity to absorb the polluted air. To determine the vehicular pollution impacts on the roadside plant, an array of system and protocols generated. The objective of this study was to determine the air pollution impacts on biochemical parameters (Non-Structural Carbohydrates and Proteins) and morphological changes in plants. For this purpose, nine study sites were selected along Lahore Branch Canal and two indigenous floral species (*Accasia Fistula* and *Ficus Religiosa*) selected for sampling (leaves). The time of sampling and conducting air monitoring was same to determine the effects of polluted gases at plants at that time. Concerned subject in leaves were to study the percentage of Non-Structural Carbohydrates (NSC) and Proteins in w/w%. The study reveals polluted air break the carbon bonding and proper NSC and proteins manufacturing halts due to which morphology of plants change.

**Keywords:** fresh air, index, activities, carbohydrates, proteins, gases, carbon

### Introduction

Air atmosphere is vital for the welfare of the urban inhabitants. Air is the valuable asset that makes sure the presence of human being on earth. In healthy and clean air, the percentage of gases is 21 % Oxygen, 0.038 % Carbon Dioxide, 0.93 % Argon, 78% Nitrogen, and other traces of gases (Chauhan, 2010) [5]. Due to Anthropocene, plantation around the urban roadsides is enhancing rapidly and it is eco-sustainable tool for measuring and suggesting solution (Rai, 2016) [15]. Plantation around the roadside is tool to filter the air which becomes polluted by anthropogenic activities. Air pollution generates by urbanization, industrialization, economic development and population growth (Rai, 2012; Rai *et al.*, 2014; Rai and Chutia, 2014; Rai and Panda, 2014a; Panda and Rai, 2015) [12, 20, 19, 14, 16].

Air pollution is combination of gaseous pollutants and particulate matter (PM) which harm the health and also cause adverse health effects (Raabe, 1999; Rai, 2013; Rai and Panda, 2014a; Rai *et al.*, 2014; Rai and Panda, 2014b; Rai, 2015) [10, 14, 15]. Foliar surface of plants along the urban roadsides performs as a sink for gaseous pollutants and ultimately their installation shows definite morphological,

biochemical responses and physiological changes. Deposition of PM in the stomata of leaves cause the functional and structural variations (Panda and Rai, 2015) [14]. Plants are very sensitive and shows worst behavior by absorbing PM (Agbaire and Esiefarienne, 2009; Rai, 2013; Rai and Panda, 2014a; Rai *et al.*, 2014; Panda and Rai, 2015; Rai, 2016) [2, 13, 16, 17]. The plants along roadside shows clear changes in form of membrane disruption, senescence, stomatal behavior, enzymatic reactions, respiration, photosynthesis and ultimately death of plant (Thakar and Mishra, 2010; Shweta, 2012; Rai and Panda, 2014a; Rai and Panda, 2014b; Rai, 2016; Rai, 2015; Panda and Rai, 2015) [25, 23, 16, 18, 15, 14]. The adverse impacts of PM on physiological and morphological features have been observed along the roadside plants (Joshi and Haridwar, 2011; Shweta, 2012; Tsega and devi, 2014) [7, 23, 28]. The plants along roadside have been studied in context of determining pollution impacts in urban polluted region (Joshi and Haridwar, 2011; Shweta, 2012; Rai, 2013; Tsega and devi, 2014; Rai, 2015) [7, 23, 28]. Air pollution is a health hazard to humans as well as to plants (Bessonnova and Kryvoruchko, 2017) [3]. Air pollutants are recognized to

disturb several physical processes connected to carbon breakdown in green plants and the air pollution influence is the major issue on the local plants of a region. Actually physiochemical properties and the residence time of air pollution is the major problem which halts healthy photosynthetic activities and triggers increment of temperature (Wagh *et al.*, 2006)<sup>[29]</sup>.

An extensive variety of sugar alcohol, monosaccharides, disaccharides and oligosaccharides have been recognized as individual from the NSC pool in plant isolates (Raessler, 2011). NSC obsession changes with time, lesser wholes being accessible in the midst of the morning than in the midst of the night and the night. This is an immediate aftereffect of less availability of sunlight at a young hour in the day which increases with the movement of time and photosynthesis comes to at top in the twelve which ends up being moderate around evening time. Starches can be detached by using a HPLC system which displays the obvious depiction of sugars substance (Norikoshi *et al.*, 2008)<sup>[8]</sup>.

Amino acids are basic as they manufacture protein and absorption immediately, even they are basic for metabolic process (Dhillon *et al.*, 2014)<sup>[6]</sup>. Cape and Percy demonstrated the results that chamber condition impacts direct on the characteristics of leaves and may change their properties (Cape and Percy, 1993)<sup>[4]</sup>. It is also found that Nitrogen Oxide is the basic part in the vehicular sullyng which obstruct the pores of stomata a finally the mixture shapes bothers in the takes off. Various researchers have coordinated the investigation on the effect and relationship of poisons in air on plants as biochemical parameters, enzymatic and morphological changes (Agarwal, 1985; Tiwari *et al.*, 1993; Tiwari and Gautam, 2007; Sharma and Tripathi, 2009)<sup>[1, 26, 27]</sup>. The affectability with respect to biochemical changes in plants and response of plants to tainting contrast station to station (Tiwari and Gautam, 2007)<sup>[27]</sup>. The LBC boulevards are busiest out of all in Lahore and bear generous movement. This significant development has negatively influenced along the indigenous vegetation along LBC. The nearby species like *Accasia Fistula* and *Ficus Religiosa* need to fight against the characteristic tainting which has transformed into an overall hazard today. Show consider clears up vehicular sullyng impacts on the plants and how specific sections decided for consider stops their advancement and finally demonstrate hostile consequences for plant along LBC. For the recorded identity and social estimation of Lahore, LBC accept a central part. It was worked in the control of Mughals and further upgraded in the midst of the British time span. Its length is around 70 kilometers; it starts near the Khaira town, outside Lahore going through farmlands, and Lahore's obvious goals and moreover fresher rustic progressions, and terminations at the Kot Maiga area on Multan Road. The reason of picking this examination zone starting from Thokar Niaz Baig to Dharampura is to choose the staggering sullyng impacts on the plants along LBC. For the investigation consider, the air pollution impacts have been considered which change the measure of sugars and proteins in the plants which are evaluated from the leaves of plants particularly displayed to tainting. As a result of air pollution the morphology of plants transforms into the genuine setback since starches give the imperativeness to the germination of plants, at that point, disregarding the way that carbon is dashed for the amalgamation of proteins,

unequal carbon can cause major issues for the mix of proteins and finally plant bears unwanted impact Basically the objective behind the study is choose the authentic joining of Non Structural Carbohydrates and Proteins in the plants while bearing thick tainting along the roadside trench.

### Methodology

The studied area is located along the Lahore Canal road from Thokar Niaz Baig to Dharampura. The control site was an un polluted area, nearly 20 Km distant from the polluted zone with the same ecological belongings. Leaf models from top of the sprouts were collected on three duplicates from both places. These samples were instantly moved to an ice box and then were kept at -20°C. All of the experiments were repetitive three times for each biological element. Two plants *Accasia Fistula* and *Ficus Religiosa* were selected.

### Study Points

None (9) Study points were selected along the Lahore Branch Canal from Thokar Niaz Baig to Dharampura. Selected study points are mentioned in the table 1 and geographical map with coordinates from where samples were collection and conducted ambient air monitoring.

### Study Period

The samples (leaves) were collected in the month of July, meanwhile gases were also analyzed at said points for study. The month (July) for study was selected as there are maximum photochemical reactions occurs when temperature increases.

### Samples Collection

Two samples were gathered from each point in zip and bolt sacks and safeguard them in cooler before achieving the research facility to maintain a strategic distance from any harm. Checking of the gases (essentially NO<sub>x</sub>, Sox and PM). The surrounding air checking at the examination indicates were led decide the contamination rate amid accumulation of tests. The example of *Cassia fistula* along the LBC was straight while *Ficus religiosa* was in irregular position. Distinctive gear and glass mechanical assembly as recommended in the standard techniques were utilized for surrounding checking of various gases noticeable all around along LBC.

Meanwhile samples (leaves) were collected to extract carbohydrates and proteins were and resultant peaks by HPLC were analyzed to determine pollution level of different sites come in study area (Saddic *et al.*, 2008).

### Results and Discussions

Results are generated by following complete protocols of study. The results of ambient air checking were different at altered study locations. Figure 2 shows ambient air concentration of CO. maximum value of CO that was measured is 7.5ug/m<sup>3</sup> at Thoakar Niaz Baig. NEQs value for CO is 5ug/m<sup>3</sup>. The concentration of NO<sub>2</sub> on ambient air was monitored and results are presented in Figure 3. Maximum value of NO<sub>2</sub> that was measured is 118ug/m<sup>3</sup> at mall road. While in NEQs value set for NO<sub>2</sub> is 80ug/m<sup>3</sup>.

Figure 4 uncovers surrounding air convergence of SO<sub>2</sub>. Most extreme estimation of SO<sub>2</sub> that was estimated is 138ug/m<sup>3</sup> at Thoakar Niaz Baig and Canal see Society. NEQs esteem for SO<sub>2</sub> is 120ug/m<sup>3</sup>. Figure 5 indicates surrounding air centralization of PM<sub>10</sub>. Greatest estimation

of PM10 that was estimated is 255µg/m<sup>3</sup> at Shopping Center Street. NEQs esteem for PM10 is 150µg/m<sup>3</sup>. The resultant estimations of including air gases exhibits that estimations of couple of parameters are near the NEQS and couple of characteristics are higher than the benchmarks set by NEQS.

The eventual outcomes of starches and proteins in w/w % shows that the two plants have moderately same readings. The results came in undulating outline as Aspartic destructive was essentially not as much as the standard while Glutamic destructive was near the standard. Basically, glutamic destructive and Valine were moderately near the standard. The rates of starches of a strong plant contains sucrose as 31.3, fructose 26.2, glucose 42.5 while values for protein are 5.75 for Aspartic Acid, 3.50 for Serine, 6.30 for Glutamic Acid and 4.02 for Valine (Danish *et al.*, 2011). Thusly, plants are being maddens by the sullyng which may rise with the extension of people and defilement along the LBC.

Table 3 demonstrates that the Glucose in w/w % was relatively same of the two examples (plants). Same case was for sucrose and fructose appeared in these plants. The outcomes showed in undulating design as Aspartic

corrosive. Thus, glutamic corrosive and Valine are additionally appeared in the figure. In this way, plants are being irritated by the contamination which may ascend with the expansion of populace and contamination along the LBC.

The plants in more polluted area like Thokar and Dharampura have to bear heavy pollution due to which they have low ratio of NSC and amino acids as compared to the slightly less polluted areas like Canal View Society. Flora along the LBC represents the aesthetic beauty as well as impacts the physiology and psychology of people as they provide fresh air, reduce noise level and absorbs toxic gases. Indigenous flora (Peepal and Amaltas) along the LBC are best bio-indicator of pollution as they are native plants and survive best in this atmosphere. The plants are best source for cooling the environment as well as reducing the hydrocarbons emissions (Taha *et al.*, 1991) [24]. The old flora like Peepal having diameter more than 80 cm should be replaced by new flora because the stomata of old plants become filled with toxins having no more capacity to provide fresh air into the environment. The resulting peaks of samples took from LBC demonstrated that conditions are not favorable and would be worse in coming period.

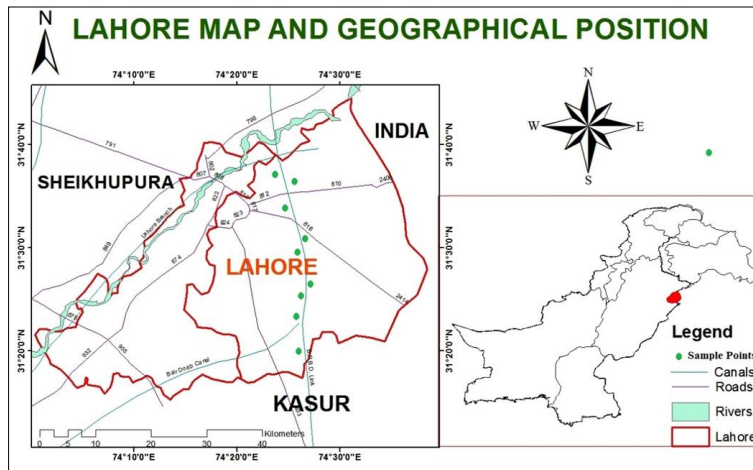


Fig 1: Geographical Map showing Study Points along LBC

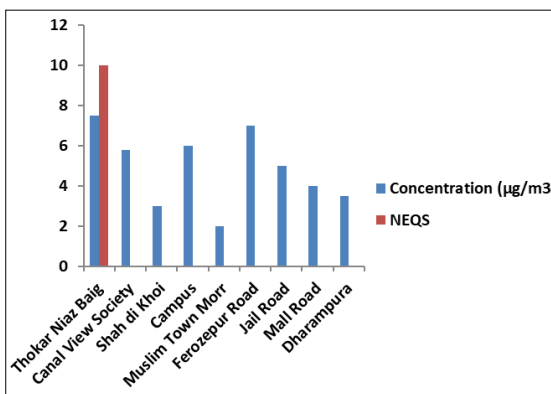


Fig 2: Concentration of CO at different site location

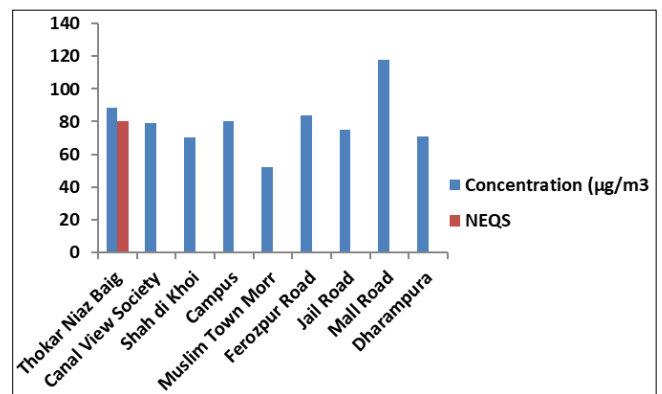


Fig 3: Concentration of NO<sub>2</sub> at different site location

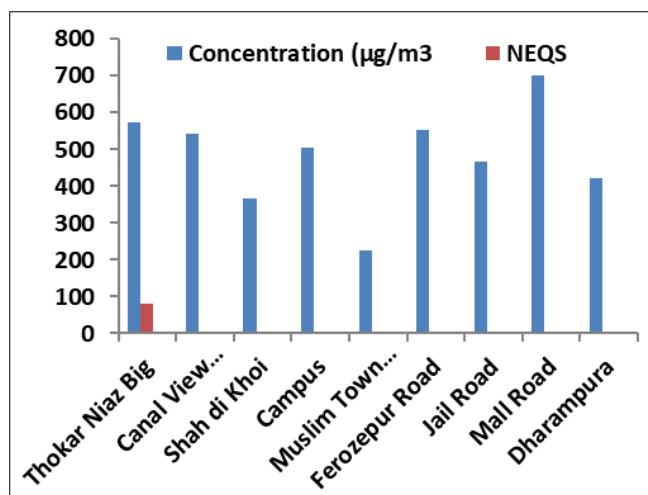
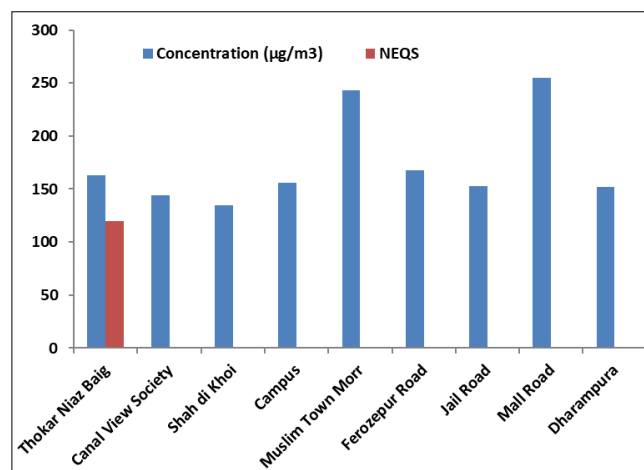
Fig 4: Concentration of SO<sub>2</sub> at different site locationFig 5: Concentration of PM<sub>10</sub> at different site location

Table 1: Study Points

Sr. #	Study Points	Coordinates at Study Points
1	Thokar Niaz Baig	31.471100 N, 74.241920 E
2	Canal View Society,	31.4760 <sup>0</sup> N, 74.2484 <sup>0</sup> E
3	Shah di Khoi	31 <sup>0</sup> 28'49" N, 74 <sup>0</sup> 17'34" E
4	Campus Point	31.4932 <sup>0</sup> N, 74.2972 <sup>0</sup> E
5	Muslim Town Morr	29.3949 <sup>0</sup> N, 71.7052 <sup>0</sup> E
6	Ferozepur road	31.489 N, 74.369 E
7	Mall road	31 <sup>0</sup> 32'20.4007" N, 74 <sup>0</sup> 20'8.8469" E
8	Jail road	33.905366 N, 73.392174 E
9	Dharampura	31.5525 <sup>0</sup> N, 74.3653 <sup>0</sup> E

Table 2: Ambient Air Monitoring Protocols

Serial No.	Parameter	Standard Method	Reference Method
1	CO	ISO Method No. ISO/FDIS-4224 [The method is covered under ISO/FDIS 1990a]	Non-Dispersive Infra-Red Method
2	NO <sub>2</sub>	ASTM Method No. D-1607 [The method is covered by ISO 6768 (ISO 1985a)]	Gries-Saltmann Method
3	SO <sub>2</sub>	[ASTM Method No. D-1355-55T** The method is covered by ISO 6768 (ISO 1990)]	Para rose-Aniline Method
4	PM	Urg, High Volume Sampler	ISO 9096

Table 3: Amino Acid &amp; Carbohydrates concentration (% w/w) of nine sites along LBC

Sr. No.	Site Name	Plant Specie	Aspartic Acid	Serine	Glutamic Acid	Glucose	Sucrose	Fructose	Valine
1	Thokar Niaz Baig	Amaltas	4.2	2.77	6.01	16.4	26.3	26.1	3.56
	Thokar Niaz Baig	Peeples	3.9	2.13	5.09	16.9	27.2	25.3	3.12
2	Canal View Society	Amaltas	4.2	2.37	5.89	17.6	28.5	27.1	3.12
	Canal View Society	Peeples	3.9	2.01	5.71	17.01	27.8	25.2	3.03
3	Shah di Khoi	Amaltas	4.2	2.37	5.89	18.6	27.5	28.1	3.12
	Shah di Khoi	Peeples	3.9	2.01	5.71	18.01	28.1	26.9	3.03
4	Campus	Amaltas	4.2	2.37	5.89	17.3	27.4	27.2	3.12
	Campus	Peeples	3.9	2.01	5.71	17.1	28.4	26.4	3.03
5	Muslim Town Morr	Amaltas	4.9	1.9	5.13	16.3	26.5	27.5	3.11
	Muslim Town Morr	Peeples	4.1	2.1	5.11	17.3	26.1	26.9	3.05
6	Ferozepur Road	Amaltas	4.9	1.9	5.13	16.3	26.5	27.5	3.11
	Ferozepur Road	Peeples	4.1	2.1	5.11	17.3	26.1	26.9	3.05
7	Jail Road	Amaltas	4.5	1.9	5.2	16.1	26.6	26.2	3.3
	Jail Road	Peeples	4.02	2.3	5.11	15.8	27.01	26.9	3.11
8	Mall Road	Amaltas	4.7	1.7	5.1	16.1	24.3	26.3	3.1
	Mall Road	Peeples	3.8	2.1	5.13	15.6	26.1	26.8	2.7
9	Dharampura	Amaltas	4.1	1.2	5.11	16.1	25.5	27.1	3.1
	Dharampura	Peeples	3.4	1.1	4.9	15.3	26.5	26.2	3.00

## Conclusion

Technology invasion always brings some changes in the environment but abatement technology always compete the pollution burden on environment. Vehicular pollution always brings the changes in the air gases while plants are bio-scrubbers and perform as abatement subject. Vehicular

pollution bring the serious changes in the bonding of Non Structural Carbohydrates and Proteins which halts the manufacturing process of nutrients in the plants and alarming condition come in front as minimum concentration of nutrients in plants and ultimately changes in phenotypes of plants.

**Disclosure of Potential conflict of Interest**

Not Applicable

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**Research involving Human and Animal Practices**

No such experiments were performed.

**Information Consent**

Not Applicable

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