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Air Pollution Effects on Plant Growth in three Sites of Hyderabad, Telangana

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ABSTRACT

Present paper deals with the air pollution effects on plant growth Hyderabad, Telangana. Three sites were selected in Hyderabad (from November 2009-October 2011) they are Site-1 IDA (Industrial Development Area) Bollaram, Site – 2 Koti is one of the best-known commercial suburbs of Hyderabad Site – 3 Shivam is situated in Hyderabad, India. It is one of the best residential sites in Hyderabad. The gradual decrease in the concentration of carbohydrates, protein, sugars of site-1 plants indicatalasees physiological activity of a plant and it determines the sensitivity of plants to air Pollution. AQI for SO_2 indicated Good category at site-1, site-2 and site-3 Air Pollution poses little or no risk indicating the green color. AQI for NO_x Indicated hazardous and very unhealthy category of air pollution at Site-1, Site-2 and Site-3. AQI for RSPM indicated moderate category. Members of sensitive groups experience more serious health effects. AQI for TSPM indicated hazardous category at site-1, very unhealthy category at site-2 and unhealthy category at site-3.

Keywords : Air pollution, plant growth, Bollaram, Koti and Shivam

I. INTRODUCTION

Air and water pollution are growing concerns, because the threats of environmental pollution are real and the effects are already felt world-wide with the start of 21st century (Das and Prasad, 2010 and Baumgardner et al, 2012). Though water and land pollution is very dangerous, air pollution has become a global problem faced by both the developed nations as well as the developing ones (Escobedo et al, 2008 and Al-Dabbous and Kumar, 2014). As air pollution has its own peculiarities, due to the tendency of its trans-boundary dispersion of pollutants over the entire world (Uma Devi and Anji Reddy, 2013). Air pollution can be defined as the human introduction into the atmosphere of chemicals, particulate matter or biological materials that cause harm or discomfort to humans, or other living organism or damage the environment (Singh et al, 2005 and Swami and Chauhan, 2015). The urban environment contains a complex mixture of air pollutants, the exact composition of which varies both over time and between individual towns and cities due to changes in patterns and sources of emissions. Typically, however, urban air quality is dominated by emissions from road traffic (Prajapati, 2015). Currently, in India, air pollution is wide spread in urban areas where automobiles are the major contributors and a few other areas with a high concentration of industries and thermal power plants. In the present study to assess the Air Quality Index (AQI) through gaseous pollutants and to protect the Quality of Air.

II. MATERIAL AND METHODS

Hyderabad, a capital city of Telangana, is continuously losing its grace and beauty under the growing pressure of densification of activities. A major center for the technology industry, its home to many upscale restaurants and shops. Its historic sites include Golconda Fort, a former diamond-trading center that was once the QutbShahi dynastic capital. The air is being continuously polluted in urban areas through heavy traffic, industry, domestic fuel combustion, coal based thermal power plants and various agricultural activities from the adjoining areas. Three sites were selected in Hyderabad they are Site-1 IDA (Industrial Development Area) Bollaram, also known as Bollaram Industrial Area, is located in the village of Bollaram, in Jinnaram Mandal, in Medak district, of Telangana and a suburb of Hyderabad.

Site – 2 Koti is one of the best-known commercial suburbs of Hyderabad, the capital city of Telangana, India. There are two areas in the vicinity called King Koti and Ram Koti. Koti is famous for the book business. Site – 3 Shivam is situated in Hyderabad, India. It is one of the best Residential sites in Hyderabad. It includes various colonies like Shivam, Bank colony, Central excise colony, BaghAmberpet.

At the height of two to three meters, fully expanded mature leaves were collected from each plant in the polythene bags and transported to the laboratory. The leaf samples were collected every month of 5th dated from all the 3 sites and this frequency was strictly maintained throughout the year.

The following investigations were carried out in all the twelve plants for photosynthetic study the chlorophyll pigments (Chlorophyll a, chlorophyll b, and total chlorophyll) were studied and biochemical changes in leaves (Starch,phenols, and sugars- total, reducing and non-reducing) were studied (Gostin and Ivanescu, 2007 and Mahecha et al, 2013). Air pollution tolerance index, PH, Relative Moisture Content, Ascorbic Acid Content, Determination of the antioxidant enzymes like Catalase, Peroxidase, Poly phenol oxidase and air quality parameters like NO_x: Jaccob & amp; Hochheiser Method (1958), SO_2: West & amp; Gaeke Method (1956) PM 10, TSPM: Trivedi.et.al. (1987) were studied. Meteorological data of AT, RH, BP, SR, VWS, WS, WD were studied.

Factor analysis uses variances to produce communalities between variables. The variance is equal to the square of the factor loadings. The communality is denoted by h 2 and is the summation of the squared correlations of the variable with the factors (Tripathi and Gautam, 2007).

III. RESULTS AND DISCUSSION

In the present investigation the results were carried out running exploratory factor analysis on SPSS input and obtaining the output for KMO and Bartlett's test, Total variance for extracted factors, Communalities and Factor matrix before and after Varimax rotation (Giri et al, 2013).

The Air Quality Index (AQI) for TSPM calculated value was varying from a minimum of 141 to a maximum of 438 during November 2009-October 2011 at Site-1. It shows Category of Hazardous. Maroon colour is represented for Hazardous Category according to Environmental Protection Agency (EPA) (Anil and Chand Bala, 2011). It triggers healthy warnings of Emergency conditions. Purple colour is represented for very unhealthy category according to Environmental Protection Agency. Orange colour is represented for unhealthy for sensitive groups.

The Air Quality Index (AQI) for TSPM calculated value was varying from a minimum of 196.0 to a maximum of 312 during November 2009-October 2011 at Site-2. It shows Category of unhealthy Red colour is represented for it. Very unhealthy Category

is represented by purple colour according to Environmental Protection Agency (EPA). Hazardous category is represented by Maroon colour. It triggers healthy warnings of Emergency conditions.

The Air Quality Index (AQI) for TSPM calculated value was varying from a minimum of 156 to a maximum of 264 during November 2009-October2011 at Site-3. It shows Category of very unhealthy represented by purple colour. Red colour is represented for Unhealthy Category according to Environmental Protection Agency (EPA).

Quality of Air

The air quality is important to protect the health of the citizens residing in a particular city. The air quality of Hyderabad City was found to be as follows.

SO_2 concentration was within the permissible limit at Site-1 IDA Bollarum 13.93µg/m³, Site-2 Koti 4.97µg/m³ and at site-3 Shivam 4.86 µg/m³given by WHO (2005) 20 µg/m³,USA (2010) 365 µg/m³, and Indian National Standards (2009) 80 µg/m³.

The concentrations of NOx at Site-1, IDA Bollaram 27.47µg/m³, Site-2 Koti 27.99µg/m³ and site-3 23.83µg/m 3 shivam was well within the permissible limits given by WHO (2005) 40 µg/m³, USA [2010] 100 µg/m³, but beyond the limits given by Indian National Standards (2009) 20 µg/m³. Hence precautions must be taken to reduce NOx in the air like use of CNG (Table: 1).

The Concentration of RSPM at Site-1 IDA Bollarum 83.83 µg/m³, at Site-2 Koti 71.54µg/m³ was above the permissible limits of 20 µg/m³ given by WHO (2005) and 50 µg/m³ USA (2010) but at Site-3 Shivam the concentration of RSPM was 57.6 µg/m³ within the permissible limits of Indian National Standards of 60 µg/m 3 which indicates the less particulatate matter in the Residential site than the other two sites.

The gradual decrease in the concentration of carbohydrates, protein, sugars of site-1 plants indicatalasees physiological activity of a plant and it determines the sensitivity of plants to air Pollution.

IV. SUMMARY AND CONCLUSION

High concentrations of SO_2 at site-1 IDA BOLLARUM Industrial site may be due to large number of industries emitting the Sulphur gases. In the air the amount of NO_x concentration was high in site-2 in both the years this may be due to the increase in usage of 2-wheeler and 4-wheeled vehicles which may lead to the increase of photochemical smog unless precautions are taken. Increase of the Particulate matter (RSPM & amp; TSPM) at site-1 due to the releasing of dust particulates into the air through the chimneys of the exhales. Based on Total Average of APTI 2 plants are Sensitive: Polyalthia longifolia.Sonn. Ficus religiosa.L.

4 plants are Intermediate: *Cassia tora* .L*. Peltaforum ferrigoenum*. Benth. *Bougainvillea spectabilis*.Comm. *Acacia nilotica*.L. 6 plants are Tolerant: *Calotropis procera*. T. Aiton. *Bauhinia variegata* .L. *Delonix regia*. Hook. *Terminalia catapa*.L. *Pongamia pinnata*.L. *Azadirachta indica*. L.

Tolerant plants can absorb air pollutants, Particulate matter and other emissions thereby improving the Quality of air. Such plants should be grown on sites of high pollution. The 6 tolerant plants can be used for planting in the site-1 and site-2. Sensitive plants act as Bio-indicators of pollution. The gradual decrease in the concentration of carbohydrates, protein, sugars of site-1 plants indicatalasees physiological activity of a plant and it determines the sensitivity of plants to Air Pollution.

AQI for SO_2 indicated Good Category at Site-1, Site-2 and site-3 Air Pollution poses little or no risk indicating the green color. AQI for NO_x Indicated Hazardous and very unhealthy category of Air

Pollution at Site-1, Site-2 and Site-3. AQI for RSPM indicated Moderate category (Table: 2). Members of Sensitive Groups experience more serious health effects. AQI for TSPM indicated Hazardous Category at site-1, Very unhealthy Category at site-2 and Unhealthy Category at site-3.

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Table-1 : Comparative Ambient Air Quality Standards

S. No.	Pollutant	Averaging Time	WHO (2005)	USA (2010)	Indian National Standards		Site-1 IDA Bollarum [Nov 2009 -Oct 2011]		Site-2 Koti [Nov 2009-Oct 2011]		Site-3 Shivam [Nov 2009-Oct 2011]	
					Industrial, Residential Rural & other areas	Sensitive Area	I Year	II Year	I Year	II Year	I Year	II Year
1	Respirable Suspended Particulate matter (p m-10)	Annual	20 $\mu g/m^3$	50 $\mu g/m^3$	60 $\mu g/m^3$	60 $\mu g/m^3$	84.75	82.91	71.08	72.0	52.75	62.45
2	Nitrogen Dioxide	Annual	40 $\mu g/m^3$	100 $\mu g/m^3$	20 $\mu g/m^3$	30 $\mu g/m^3$	31.19	23.74	28.88	27.11	24.63	23.02
3	Sulphur Dioxide	Annual	20 $\mu g/m^3$	79 $\mu g/m^3$	80.0 $\mu g/m^3$	80.0 $\mu g/m^3$	18.65	9.22	5.13	4.80	5.08	4.64

Table 2. The Air Quality Index (AQI) divided into six Categories of health concern rating by EPA (2009)

Air Quality Index (AQI) Values	Air Quality of Health Concern	Colors
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon