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Assessment of Ambient Air Quality in Hyderabad through Gaseous Pollutants Present in Air

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ABSTRACT

Present paper deals with the Assessment of Air Quality in Hyderabad by Using Physical and Biochemical Parameters. 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. 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: Assessment, Air Quality and Gaseous Pollutants

I. INTRODUCTION

Air pollution is responsible for innumerable problems like ozone depletion, green house effect, acid deposition, diseases outbreak, physico- chemical changes of soil etc. (Hagemann, et al., 2015) which consequently have serious effects on the biotic and abiotic components of the environment. Apart from destroying the aquatic life in lakes and streams, acid rain can also corrode metals, damage surfaces of buildings and monuments, and cause soil acidification (Miyajan and Desai, 2014).

Urban air pollution is rapidly becoming an environmental problem of public concern. It can influence public health and local regional weather and climate (Elampari et al., 2010). Plants play an important role in monitoring and maintaining the ecological balance by actively participating in the cycling of nutrients and gases like carbon dioxide, oxygen and also provide enormous leaf area for impingement, absorption and accumulation of air pollutants to reduce the pollution level in the air environment (Escobedo et al., 2008).

Plants in the urban environment generally suffer from the visible injury such as chlorosis, necrosis and reduced plant growth. Acid rain can kill trees, destroy the leaves of plants, can infiltrate soil by making it unsuitable for purposes of nutrition and habitation (Joshi and Bora, 2011). Ozone holes in the upper atmosphere can allow excessive ultraviolet radiation from the sun to enter the Earth causing damage to trees and plants (Tripathi and Gautam, 2007). Ozone in the lower atmosphere can prevent plant respiration by blocking stomata (openings in leaves) and negatively affecting plants “photosynthesis rates” which will stunt plant growth. Ozone can also decay plant cells directly by entering stomata (Liu and Ding, 2008).

II. MATERIAL AND METHODS

The study area:

Hyderabad is the 5th largest capital city of the southern Indian state of Telangana occupying 650 sq.km along the bank of Musi River, Hyderabad and Secunderabad are the twin cities with it suburb extending up to 60 km. The Hyderabad city is situated in $1^0 11^1$ of the Northern longitude and $78^0 27^1$ of the eastern longitude. The Highest point in the city is Banjara Hills, $22^0 6^1$ above MSL. The normal rainfall of the district is 787.4 mm. Its climate is hot and humid type.

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.

Urban air pollution is rapidly becoming an environmental problem of public concern (Mahecha et al., 2013). It can influence public health and local regional weather and climate. Plants play an important role in monitoring and maintaining the ecological balance by actively participating in the cycling of nutrients and gases like carbon dioxide, oxygen and also provide enormous leaf area for impingement, absorption and accumulation of air pollutants to reduce the pollution level in the air environment (Harsha et al., 2015).

Method of measuring Sugars (total, reducing and nonreducing) and starch.

A: Measurement of Sugars (Nelson, 1944):

100mg plant material was weighed and homogenate with 10ml80% ethanol. It was centrifuged for 10rpm for 10minutes. Supernatant 1 wascollected; while 10 ml 80% ethanol was added again to the residue, centrifuge itand supernatant 2 was mixed with supernatant 1. Residue was discarded.

B: Total sugars:

To 1ml alcoholic aliquot, 1ml 1N H2SO4 was added and heatedat 490 C in water bath for 30 minutes for hydrolysis of the mixture. 1-2 drop of methyl red indicator was added. 1N NaOH was added drop wise for the neutralization (color was to yellow from pink). 1ml Nelson Somogyi's reagentwas added to it and the tube was kept in boiling water bath for 20 minutes.After cooling of the test tube, 1ml arsenomolybdate was added and finalvolume was made up to 20ml with DW. O.D. was noted at 540nm. Blank was prepared in the same manner.

C: Reducing sugars:

To 1ml alcoholic aliquot, Nelson Somogyi's reagent was added and kept in boiling waterbath for 20min. After cooling of the test tube, 1ml arsenomolybdate was added and final volume was made upto 20ml withDW. O.D. was noted at 540nm. Blank was prepared in the same manner.

Non-reducing sugar= Total sugar – Reducing sugar.

The result was expressed as mg/gm plant material.

D: Measurement of Starch (Chinoy, 1939):

100mg plant material was weighed and homogenate with 10ml80% ethanol. It was centrifuged for 10minutes. Supernatant 1 was collected; while 10 ml 80% ethanol was added again to the residue centrifuge it and supernatant 2 was mixed with supernatant 1 and removed. Residue was used for

starch estimation. The residue was dissolved in 20ml 0.7% KOH and boiled for gelatinization for 40 minutes. It was centrifuged after cooling and 1ml aliquot (Supernatant), 0.5ml 20% acetic acid; 1ml citrate buffer (0.05M, pH 5.0) and 1ml KI were added and incubated at room temperature for 10minutes. O.D.was taken at 600nm. Blank was prepared in the same manner.The result was expressed as μg/gm plant material.

3.4.8 Total Phenols Estimation (TP): Phenolic compounds are having wide bioactivity including antioxidant properties. The antioxidant activity of phenolic compound is due to hydroxyl functional group, however otherfactors eg.presence of electron withdrawing or releasing group in the aromatic ring having hydroxyl moiety will increase or decrease the activity. The phenols contain hydroxyls that are responsible for the radical scavenging effect mainly due to redox property.

The total phenolic content was determined using Folin–Ciocalteu reagent with analytical grade gallic acid as the standard 25.1 ml of extract or standard solution (25 mg/ml) was added to deionized water (60 ml) and Folin–Ciocalteu phenol reagents (5.0 ml). After 5 minutes, 20% sodium carbonate (15.0 ml) was added to the mixture. After being kept in darkness for 2hrs, the absorbance was measured at 760 nm using a spectrophotometer (Shimadzu). The same solution was used as blank without the extraction solution. Amounts of TP were calculated based on gallic acid standard.

$$\text{Total Phenols \%} = \frac{A_{sample} \times W_{standard} \times 50}{A_{standard} \times W_{sample} \times 50} \times 100\%$$

The results were expressed as gallic acid equivalents (GAE) mg/mg of dry extract.

3.4.9 Biochemical analysis

Total soluble carbohydrates were estimated quantitatively by using Anthrone's method. Total soluble carbohydrate was calculated with the help of a reference curve using D- glucose as standard. The reducing sugar content was estimated following the method of Lindsay (1973). The quantitative estimation of Proteins was done by using Lowry et al., (1951) method. Folin-Lowry's method is the most commonly used method for determination of proteins in cell free extract because of its high sensitivity. The method was outlined by Lee and Takahashi (1966).

III. RESULTS AND DISCUSSION

Trees are major capital assets in cities. Trees are on the job 24 hours every day working for all of us to improve our environment and quality of life. *Acacia nilotica.L. Azadirachta indica.L. Bauhinia variegate.L. Bougainvillea spectabilis. comm. Cassia tora.L. Calotropis procera.T.Aiton. Delonix regia.Hook. Ficus religiosa.L. Peltaforum ferrigoenum. Benth. Pongamia pinnata.L. Polyalthia longifolia.Sonn. Terminalia catapa.L.* These twelve trees were selected as they were present approximately on every site.

From this study tolerant species can be known which can be used as guidelines for tree plantation. This is the first study in Hyderabad city on effect of air pollution on physiology and metabolism of plants growing at diverse cross-roads.

There are several parameters to judge air quality but three major pollutants Sulphurdioxide, oxides of nitrogen and Suspended Particulate Matter (SPM) gives a fair idea of pollution load carried by air (Kuddus et al., 2011 and Pawar and Rane, 2015). In the present study ambient air quality is assessed by analyzing three parameters Sulphurdioxide, oxides of Nitrogen, Total Suspended Particulate Matter and Respirable Suspended Particulate Matter at 3 sites.

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 Bollaram 13.93µg/m³, Site-2 Koti 4.97µg/m³ and at site-3 Shivam4.86µg/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 Bollarum 27.47µg/m³, Site-2 Koti 27.99µg/m³ and site-3 23.83µg/m³ 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.

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 indicatalasees the less particulatate matter in the Residential site than the other two sites.

IV. 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& 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. . Terminaliacatapa.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 acts 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. The increase activity of Enzymes in the plants of site-3 Shivam may be due to the low level concentrations of air pollutants SO2, NO_x, Particulate Matter in the air. SO_2 concentration was within the permissible limit at Site-1 IDA Bollaram 13.93µg/m³, Site-2 Koti 4.97µg/m³ and at site-3 Shivam4.86µg/m³given by WHO [2005] 20 µg/m³, USA [2010] 365 µg/m³, and Indian National Standards [2009] 80 µg/m³.

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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.

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