International Journal of Scientific Research in Biological Sciences
Research Paper Volume-2, Issue-3 ISSN: 2347-7520

Biomonitoring of Road Side Air Pollution Using Ascorbic ACID Content of Selected Trees at Ujjain

Ranjana Gupta[1]* and Madhu Purohit[2]

[1*,2]Govt. Madhav Vigyan Mahavidhalaya, Ujjain (M. P.) Pin- 456010

Available online at www.isroset.org

Received: 04/May/2015 Revised: 18/May/2015 Accepted: 06/Jun/2015 Published: 30/Jun/2015

Abstract- Air pollution is one of the severe problems facing the world today due to contineous changes in the environment resulting from human activities such as vehicular traffic and industries. Air pollution can directly affect plants via leaves or indirectly via soil acidification. Screening of plants for their sensitivity level to air pollutants is important because the sensitive plants can serve as bio-indicators and the tolerant plants as sink for controlling air pollution in urban and industrial areas. Ascorbic acid is a natural de-toxicant which may prevent the damaging effect of air pollutants in plant tissues. The level of this acid declines on pollutant exposure. The present study indicated that different road side trees responded differently against air pollution due to automobile exhaust. *Ficus religiosa* was found to be the most tolerant species while *Santalum album* and *Aegle marmelose* were found to be susceptible species.

Keywords- Air pollution, ascorbic acid, automobile exhaust, bio-indicators, de-toxicant, industries, tolerant.

INTRODUCTION

Rapid industrialization and vehicular traffic especially in the urban areas of India is a great threat to air quality. Identification and categorization of plants into sensitive and tolerant group is important because the former can serve as indicators and the latter as sinks for the air pollutants in urban and industrial areas. The efficiency of plants in absorbing pollutants is such that it can produce pockets of clean air (Gilbert,1968). Tree act as sink of air pollutants and thus reduce their concentration in the air (Prajapati and Tripathi, 2008).

Several studies have shown the impact of automobile exhaust on road side vegetation through their visible and non visible effects (Agrawal et al.,2004,Dwivedi and Tripathi,2007,Joshi and Swami, 2007,) .Air pollutants like SO_2, NO_2, SPM, and RSPM, are responsible for reduction of biological and physiological response of various plants and crops grown in polluted areas (Joshi and Chawhan, 2008).The use of plants as bio-indicators of air pollution has long been established because they are the initial acceptors of air pollutants due to having scavenging property for many air pollutants (Joshi and Swami,2009).Plant shows varying degree of sensitivity and tolerance to air pollution stress. Bio-monitoring is an important tool to evaluate the impact of air pollution being cost effective and valuable method to evaluate the effect of air pollutants.

The variation in the biochemical parameter in the leaves was used as an indicator of air pollution for early diagnosis of stress or as a marker for physiological damage prior to the onset of visible injury symptoms (Madan and Mukherji, 2000, Joshi and Swami, 2007, Tripathi et. al., 2009). Ascorbic acid content (Hoque et.al., 2007) have been used in the evaluation of the impact of air pollution on plants. Ascorbic acid is a very important antioxidant synthesized in response to oxidative stress. It is thus regarded as an indicator of tolerance level of plant to oxidative damage. The present study was aimed to assess the impact of vehicular pollution on road side trees by evaluating the effect on ascorbic acid content of selected tree species growing along the roads of different areas of Ujjain.

MATERIALS AND METHODS-

Study area- Ujjain is located at 23^0 11" North longitude and 70^0 50″ latitude at a height of 1678 ft from mean sea level. Ujjain is situated at the bank of river Kshipra and tropic of cancer passes through it.

Sampling stations- Following sampling stations were selected for the study.

a. Reference area (Vikram vatika/Univ.campus)
b. Dewas road (Highway)
c. Maksi road (Industrial area)
d. Mahakal road (Ecocity area)

Selections of tree species-10 tree species, commonly found in the above areas were selected for the study.

Sample collection and ascorbic acid estimation- Leaf samples for estimation of ascorbic acid were collected from all the sites early in the morning (January 2012).Leaf of nearly equal size and similar age were taken from the same height from ground level. Ascorbic acid content was measured by volumetric method (S.R.Thimmaiah, 1999).

Ambient air quality monitoring- Data of SO_2, NO_2, RSPM, and TSPM for the month of January (2012) were collected from the local office of M.P. State Pollution Control Board, Ujjain.

Table 1: Ambiant air quality data for SO_2

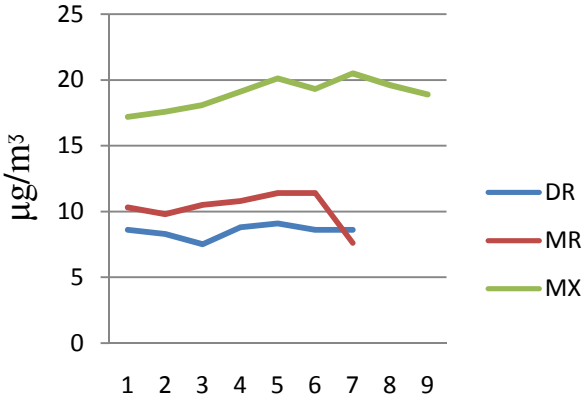

Table 2: Ambiant air quality data for NO_2

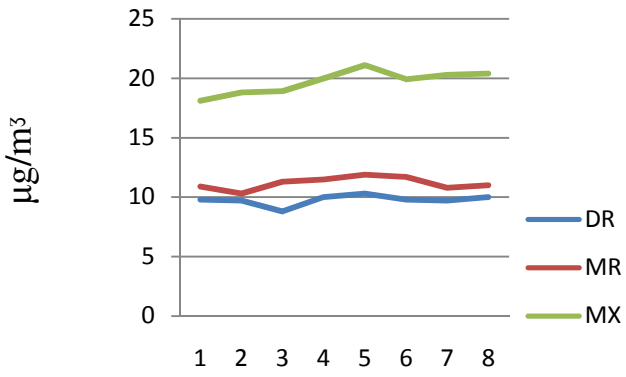

Table 3: Ambient air quality data for RSPM

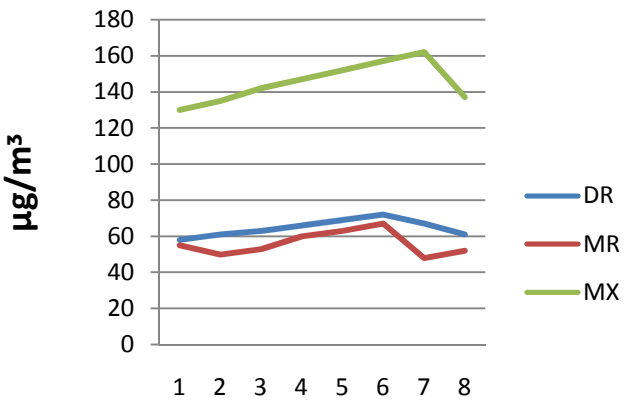

Table 4: Ambient air quality data for TSPM

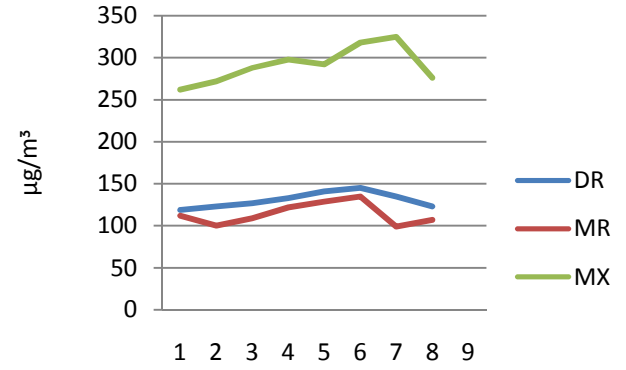

Table: - Ascorbic acid content* of various road side trees from different areas of Ujjain

S.No.	Plant name	Reference area	Dewas road	Mahakal road	Maksi road
1	*Aegle marmelose*	1.700	1.032	0.782	0.215
2	*Annona squmosa*	1.800	1.015	0.615	0.765
3	*Ficus religiosa*	2.300	1.615	1.432	1.350
4	*Mangifera indica*	2.150	1.650	1.500	1.600
5	*Melia azadirach*	1.932	1.332	1.250	0.950
6	*Mytragyna pervifolia*	1.800	1.265	1.082	1.000
7	*Polyalthia longifolia*	1.860	1.315	1.265	1.132
8	*Pongamia pinnata*	1.950	1.415	1.300	1.182
9	*Psidum guajava*	1.732	1.200	1.150	0.965
10	*Santalum album*	1.582	1.065	0.665	0.632

Note: *mg/100g of leaf sample

RESULT AND DISCUSSION

Ascorbic acid is an important metabolite which activates the resistance mechanism under pollution stress in plants. Maximum ascorbic acid content was recorded in all the ten tree species growing in the University campus/ Vikram vatika (Refrence area). It showed reduction in all the plants growing in the polluted areas(Table). Reduction in ascorbic acid content of samples collected from polluted site was also reported by Chauhan (2010), Deeplakshmi et.al.(2013) and Tanee and Albert (2013).Maximum reduction was noted in plant samples of Maksi road area showing maximum air pollution(Fig.1-4). All leaf samples of Dewas road area were showing minimum reduction in ascorbic acid content. Ascorbic acid is a strong reducer playing an important role in photosynthesis. High pH may increase the efficiency of conversion of hexose sugar to ascorbic acid and it is related to the tolerance to pollution. (Escobedo et. al., 2008). Reduction in ascorbic acid is attributed to increased rate of production of reactive oxygen species (ROS) during photo-oxidation of SO_2 to SO_3 (Jyothi and Jaya 2010).

Different tree species showed different response against air pollution. *Aegle marmelose* and *Santalum album* were found to be the most susceptible species showing maximum reduction in ascorbic acid content as compared to reference area. In contrast, *Ficus religiosa* and *Mangifera indica* showed the minimum reduction. Differential behavior of various trees against dust deposition was noted by Jain and Kutty (2014).

REFERENCES

[1]. Agrawal, S.B. Singh A., Rathore D. (2004). Interactive effect of air pollution and nutrients on biochemical processes and yield of wheat grown in peri-urban areas of Allahabad city. Ecoprint 11: 1-6.

[2]. Deepalakshmi, A.P., Ramakrishnaiah H., Ramchandra Y.L., and Radhika R.N. (2013). Road side plants as Bio-indicators of urban air pollution. *IOSR of Environmental science, toxicology and food technology (IOSR-JESTFT) e-ISSR: 2319-2402, p-ISSN: 2319-2399. Volume 3, PP 10-14.*

[3]. Chauhan A. Joshi P.C. (2008). Effect of ambient air pollution on photosynthetic pigments on some selected trees in urban area. Ecology, *Environment and Conservations.* 14 (4): 23-27.

[4]. Cheng,F. Y., K. O. Burkey, J. M Robinson, (2007). Leaf extracellular Ascorbic in relation to O_3 tolerance of to soyabean cultivars, *Environ Pollut*. (150), 355 - 362.

[5]. Dwivedi A.K., Tripathi B.D. (2007). Pollution tolerance and distribution pattern of plants in surrounding area of coal-fired industries, *J. Environ. Biol.* 28(2): 257-263.

[6]. Escobedo,F.J.Wagner,et.al., (2008). Analyzing the cost effectiveness of Santiago, Chile's policy of using urban forest to improve air quality, *J. of Environmental Management*. 86:148-157.

[7]. Gilbert O.L., (1968). Biological indicators of air pollution. University of New caslte upon Tyne, Great Britain.

[8]. Hoque MA, Banu MNA, Okuma E. (2007). Exogenous proline and glycinebetaine increase Naclinduced ascorbate-glutathione cycle enzymes activities, and Praline improves salt tolerance more than glycinebetaine in tobacco bright yellow-2 suspension cultured cells, journal plant physiol.Vol. 164, PP. 1457-1468.

[9]. Jain A. and Kutty, S. (2014). Biomonitoring of dust pollution of road side of Harda using Air Pollution Tolerence Index (APTI).

[10]. Joshi,P.C. and A.Swami (2007). Physiological responses of some tree species under roadside automobile pollution stress around city of Haridwar, India, Environmentalist, Vol.27, PP.365-374.

[11]. Joshi,P.C.Swami, A. (2009). Air pollution induced changes in the photosynthetic pigment of selected plant species. J. Environ. Biol. 30:295-298.

[12]. J.S. Jyothi, and Jaya, (2010), Evaluation of air pollution tolerance index of selected plant species along roadsides in Thiruvananthapuram, Kerala. *Journal of Environmental Biology*, 31, 379-386.

[13]. Margeson, J. H. (1977). Evaluation of the sodium Arsenite method for measurement of NO_2 in ambient air. *Journal of the Air Pollution Control Association.* 27: 553-556.

[14]. Prajapati. S.K. and B.D.Tripathi. (2008). Seasonal variation of leaf dist accumulation and pigment content in plant species exposed to urban particulates pollution. J.Env.Quality.37: 865-870.

[15]. Thimmaiah S.R., (1999). Standard method of biochemical analysis. Mrs. Usha Raj Kumar for Kalyani Publishers, New Delhi- 100 02, 278-279.

[16]. Tripathi A. K. Gautam M. (2007). Biochemical Parameters of plants as indicators of air pollution. J. Evn. Biol.28 (1): 127-32.

