Original Research Paper

Volume-8 | Issue-9 | September-2018 | PRINT ISSN No 2249-555X

Environmental Science

MONITORING AIR POLLUTION OF SURAT CITY USING ROADSIDE TREE

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ABSTRACT Air pollution is both natural and anthropogenic. In recent times, there has been significant development activity in terms of urbanization and industrialization in all cities in India. Plants play an important role in maintaining the ecological balance by actively participating in the cycling of nutrients and atmospheric gases and also provide enormous leaf area for impingement, absorption and accumulation of air pollutants to reduce the pollution level in the environment. In Surat city the fast growth in industrial projects along with vehicular growth the level of pollution has increased. The study examined air pollution indices (APTI) through Gulmohar Plant (Delonix regia) around Residential area (Adajan, Athwagate) Commercial area (Railway station, Piplod), Developing area (Vesu, New Althan) and Industrial area (Sachin GIDC, Pandesara GIDC). Four physiological and biochemical parameters were considered in calculating the APTI value, which were leaf extract pH, relative water content, ascorbic acid and total chlorophyll. The results of control site (CS) were compared to that of experimental site (ES) of each selected places. Results revels that high values of air pollution tolerance index (APTI) were recorded in Pandesara GIDC area (Industrial area) and lowest were recorded in Vesu (Developing area) area during the month of February.

KEYWORDS : Industrial area, Residential area, Commercial area, Developing area, Ascorbic acid, RWC, APTI

INTRODUCATION

"Air pollution means any solid, liquid or gaseous substances present in the atmosphere in such concentration that may tend to be injurious to human beings or other living creature or plants or property or environment" (Patel *et al*., 2012). Air pollution is one of the severe problem that the world is facing today. It deteriorates ecological condition and can be defined as fluctuation in any atmospheric constituent from the value that would have existed without human activity. Over the years, there has been a continuous growth in human population, road transportation, vehicular traffic and industries in Surat city due to which there is an increase in the concentration of gaseous and particulate pollutants. Air pollution can directly affect plants via leaves or indirectly via soil acidification. The plant species, which are more sensitive act as biological indicators of air pollution. The APTI values were calculated using the study plant *Delonix regia* species from Fabaceae. In India, it is known as Gulmohar. Its availability is high in Surat after Neem (*Azadiracta indica*) and Asopalav (*Polyalthia longifolia*), hence this species was selected for study. In APTI water content is related to the degree of pollution, pH of the plant tissue is related to the degree of air pollution since air pollutants interact with rainwater to form mixtures and solutions, depending on the type of pollutant, Chlorophyll is involved in the productivity of the plants and its level is a direct measure of leaf damage by pollutants and Ascorbic acid is an antioxidant, which contributes in protecting the plants against oxidative damage resulting from aerobic metabolism, photo-synthesis and a range of pollutants. Air pollution tolerance index has also been used to rank plant species in their order of tolerance to air pollution.

MATERIALS AND METHODS

Gulmohar plant species were selected for the study which is commonly available at both control (CS) and experimental sites (ES). The sampling at selected station was done from 25th January 2017 to 08th March 2017. The sample of leaves were cut from the tree using scissors. The leaves were kept in air tight plastic bags which were than stored at 04° C in a refrigerator for further analysis. The CS site APTI was low as compared to ES site because gardens were selected for CS site. The parameters for APTI were estimated by using standard methods

Ascorbic acid (A)

Amount of ascorbic acid was determined by weighing exactly about 100 mg of leaf sample and adding 50 mL freshly boiled cooled water + 1 test tube 1 N H2SO4 + ¼ test tube starch as an indicator in 250 mL conical flask and titrating it against 0.1 N I2 solution. The blank titration was carried out using L-Ascorbic acid instead of leaf sample.

Relative water content (R)

Fresh weight was obtained by weighing 1g of fresh leaves. The leaves were then immersed in water over night, blotted dry and then weighed to get the turgid weight. Next, the leaves were dried overnight in an oven at 70° C and reweighed to obtain the dry weight.

pH (P)

1g of leaf sample was taken and crushed well in distilled water. The extract was filtered, centrifuged and then used for measuring the pH.

Chlorophyll (T)

1.0 g of sample was taken and grinded to fine pulp using motor and pestle using about 10ml of 80% acetone. The extract was than filtered and centrifuged at 3400 rpm for 3 min. Absorbance of the extracts was read using an spectrophotometer at 663 and 645 nm.

Air pollution tolerance index of a species was calculated by using the formula given by Singh and Rao (1983)

APTI=[A(T+P)+R]/10

Table : APTI at various places during the sampling period

Date / Place	CS/ES	RWC (R)	pH (P)	TOTAL CHOLOROPHYLL (T)	Ascorbic Acid (A)	APTI	% Increase APTI
8/3/2017 (Pandesara GIDC)	CS	58.80	7.20	0.434	1.76	7.22	3.28
	ES	83.49	7.8	0.374	2.64	10.50	
8/2/2017 (Sachin GIDC)	CS	52.26	8.31	0.333	1.76	6.74	2.22
	ES	69.73	7.11	0.362	2.64	8.94	
8/2/2017 Adajan	CS	52.15	7.20	0.229	1.76	6.52	1.68
	ES	62.42	7.08	0.361	2.64	8.20	
8/2/2017 Athwagate	CS	55.41	7.43	0.243	1.76	6.88	1.32
	ES	68.55	7.39	0.281	1.76	8.20	
8/2/2017 Railway Stn	CS	56.68	7.68	0.229	3.52	8.45	1.23
	ES	69.88	7.4	0.256	3.52	9.68	
8/2/2017 New Althan	CS	63.54	8.09	0.256	2.64	8.55	0.73
	ES	65.94	7.35	0.285	3.52	9.28	

1/3/2017 Piplod	CS	66.60	7.8	0.374	1.76	8.51	0.42
	ES	64.13	7.84	0.216	1.76	7.99	
8/2/2017 Vesu	CS	44.63	7.15	0.317	2.64	6.43	0.56
	ES	47.78	8.12	0.272	2.64	6.99	

Note: Only high % increase APTI data from fortnight study is shown here
CS: Control site and ES : Experimental site

CONCLUSION:

The present study revealed that the study plant at different site responded differently to air pollutions. It was observed that plants with low pH were more susceptible, while pH around 7 was more tolerant in modifying the toxicity of SO2. The study plant Delonix regia showed good tolerance capacity and suitable sink for air pollution. This study is very useful for better controlling, understanding and management of air quality of the city. Regular water spray will help to fight against air pollutants. Since trees are the first rank fighters of air pollution a plantation and protection programme should be conducted regularly.

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