

SULPHUR CONTENT IN FOLIAGE OF ROADSIDE NATIVE PLANTS AND SOIL ALONG THE MAIN SUPER HIGHWAY IN THE OUTSKIRTS OF KARACHI

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SUMMARY: The levels of sulphur in the foliage of Calotropis procera, Prosopis juliflora and Senna holosericea and the soil samples collected near the super highway was mostly highest as compared do the other distances. With increase in the distance from the road, the levels of sulphur decreased. In few cases, there was little correlation between the concentrations of sulphur and the distance from the highway but the results were insignificant. Automobile activities has been considered as one of the cause of sulphur pollution along the roads.

Key Words: Sulphur content, calotropis procera, prosopis juliflora, senna holosericea.

INTRODUCTION

The traffic density in the city of Karachi is increasing greatly in the recent years. It has been estimated that at the end of the century, the number of vehicles would be more than two millions (KDA Traffic Engineering Bureau Report). Most of the vehicles are faulty and emits black smoke on the roads. Atmosphere of the city is polluted from the burning of gasoline, soot and smog from diesel. High level of smoke and tarry deposit was recorded in the city (1). Shams and Iqbal (14) have suggested that variation in the atmospheric temperature, atmospheric relative humidity, light intensity, wind velocity and soil temperature in the city were mainly attributed to auto emissions.

Sulphur is more injurious in the form of acid rain, which may cause environmental intoxication (6). At the low concentration, plants can utilize atmospheric SO₂ as sulphur nutrient (4,5,17). But when its concentration reaches above a certain level, it becomes toxic to plants and

reports to produce various physiological and biochemical changes in plants (12). Nyborg (13) observed the effects of SO₂ emission on the precipitation and sulphur accumulation in soil. Miszalski and Mydlarz (11) had found a decrease in net photosynthetic rate in tomato plants after fumigation them with SO₂. Several plant damage with SO₂ fumigation was also reported by many other workers (8,10,15). Iqbal (7) has found the amount of sulphur in foliage of roadside plantation and soil, whereas, Lawrey and Hale (9) have studied sulphur and lead accumulation in specimens of lichen.

The aim of this study was to investigate the levels of sulphur in some native plants and soil at different distances from the super highway in the outskirts of Karachi city.

MATERIALS AND METHODS

The leaves of the three most dominant species e.g. *Calotropis procera* (Willd.) R. Br., *Prosopis juliflora* DC. and *Senna holosericea* (Fresen.) were collected / from 4.5, 9.0 and 13.5

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meters away from the super highway near Karachi. The surface soil samples were also collected from the same distance. The leaves of these species were oven dried for 24 hours at 80°C and then carefully grinded in a grinder. 0.2 gm of dry plant material was digested with HNO₃ and perchloric acid in a fumigation chamber. The total sulphur was determined by the method of Butters and Chenery (2). Available sulphur in the soil samples was estimated by Turbidimetric method of Chesnin and Yien (3).

Data were assessed by analysis of variance techniques, Steel and Torrie (16). Differences among distances were determined statistically significant at the 5% (p<0.05).

RESULTS AND DISCUSSION

The amount of sulphur in the leaves of *C. procera*, *P. juliflora* and *Senna holosericea* collected from three different distances was determined around the super highway near Karachi. The amount of sulphur was highest in all the samples collected from a distance of 4.5 meters from the highway, whereas, reverse was the case at a distance of 13.5 meters from the highway except with little discrepancy (Table 1). The concentration of sulphur in the leaves

Table 1: Concentration of total sulphur (mg kg⁻¹) in plant foliage and available sulphur (mg kg⁻¹) in surface soils near Super Highway.

Distance from Super Highway Meters	Calotropis procera	Prosopis juliflora	Senna holosericea	Surface soils
4.5	a 159±10.4	a 150±16.0	a 165±5.4	a 77±4.1
9.0	b 113±12.5	a 122±3.8	a 169±1.4	b 36±0.7
13.5	b 106±30.4	a 126±6.7	a 162±4.6	b 37±1.5

Statistical significance determined by analysis of variance. Numbers followed by the same letter in the same column are not significantly different (p<0.01) according to the Student- Newman-Keuls multiple range test (Steel and Torrie, 1960). ± Standard Error

of *C. procera* was 159 mg kg⁻¹ at 4.5 meters distance and decreased with increasing distance from the super highway. The level of sulphur in the leaves of *C. procera* was significant (p<0.05) between 4.5 and 9.0 meters and 4.5

and 13.5 meters, respectively. The sulphur concentration in *P. juliflora* was also maximum with the increase in distance, but at the 13.5 meters distance from the highway, a little higher concentration was recorded than that of the 9.0 meters distance. However, the results were not significant. In the case of *S. holosericea* there was not much difference in the total sulphur concentration of leaves in the sample collected from different distances.

The soil analysis of available sulphur demonstrated a highly significant difference (p<0.05) between the soil samples collected from various distances from the super highway (Table 1). The highest available sulphur was recorded at 4.5 meters from the highway, whereas at the other two distances, the available sulphur was low.

Similar type of study was also conducted by Iqbal (7) in the center of the city. He found relatively high amount of total sulphur in the foliage of *Ficus bengalensis*, *Eucalyptus* sp. and *Gauicum offinale* and available sulphur in the soil at different points in the city. In the control area, relatively low levels of sulphur was recorded. In the present study, the levels of sulphur in plants and soil was not as great as was observed by Iqbal (7). The main reason is that, the levels of sulphur pollution along the super highway was less because of low traffic density as compared to M.A. Jinnah road and Gruminder in the city center (7). The other factor could be the dispersion of atmospheric pollutants including sulphur to a longer distance because of less interference from the multistoried buildings in the area. The city center, including M.A. Jinnah road and Gruminder is a density populated area, consist of multistoried buildings along the roads, which ultimately stop the dispersion of pollutants to a longer distance due to low wind speed (14).

A correlation was found between the total concentration in foliage of the plants and the level of available sulphur in soil. This has shown that the higher levels of sulphur in plants and soil particularly near to the highway is due to the emissions from the auto vehicle activities.

REFERENCES

1. Beg MAA, Yousufzai AHK, Mahmood SN : Air Pollution in Karachi. Part I Survey of smoke concentration. Pak J Sci Ind Res,

30:60-70, 1987.

2. Butters B and Chennery EM : A rapid method for the determination of total sulphur in soils and plants. *Analyst Lond*, 84:239-245, 1959.

3. Chesnin L and Yien CH : Turbidimetric determination of available sulphates. *Soil Sci Soc Proc Amer*, 15:149-151, 1950.

4. Faller N : Schwefeldioxid aus der Luft als entscheidende Nährstoffquelle für die Pflanze. *Landwirtsch Forsch*, 18:48-54, 1970.

5. Faller N : Plant nutrient sulphur - SO₂ vs. SO₂. *Sulphur Inst J*, 7:5-6, 1971.

6. Ietel A : A mechanism of the effects of SO₂ pollution on the microflora of forest soils. *J Occup Med*, 30:684-686, 1988.

7. Iqbal MZ : Accumulation of sulphur in foliage of roadside plantation and soil in Karachi city. *Trop Ecol*, 29:1-5, 1988.

8. Lalman and Singh B : Phytotoxic influence of sulfur dioxide pollution on leaf growth of *Vigna mungo* L. *J Environ Biol*, 11:111-120, 1990.

9. Lawrey JD and Hale ME : Lichen evidence for changes in atmospheric pollution in Shenandoah national Park, Virginia. *The Bryologist*, 91:21-23, 1988.

10. Marschner H : Mineral nutrition in higher plants. *Academic Press Inc (London) Ltd*, 1986.

11. Miszalski Z and Mydlarz : SO₂ influence on photosynthesis of tomato plants (*Lycopersicon esculentum* L.) at different carbon dioxide concentration. *Photosynthetica (Prague)*, 24:2-8, 1990.

12. Mudd JB and Kozlowski TT : Responses of plants to air pollution. *Academic Press, New York*, p xii+383, 1975.

13. Nyborg M : Effect of SO₂ emissions on precipitation and sulphur accumulation in soil : The first International Seminar On "Acid precipitation and the forest ecosystem" at Alberta, Canada, July, 1975.

14. Shams ZI and Iqbal MZ : Study of some important climatic and bioclimatic parameters of Karachi city centre. *Pak JZ Sci Ind Res*, 29:23-29, 1986.

15. Singh N, Singh SN, Srivastava K, Yunus M, Ahmad KJ, Sharma SC, Sharga AN : Relative sensitivity and tolerance of some *Gladiolus* cultivars to SO₂. *Ann Bot (London)*, 65:41-44, 1990.

16. Steel RG and Torrie JH : Principles and procedures of Statistics. *McGraw Hill, New York*, 1960.

17. Thomas MD, Hendricks RH, Collier TR, Hill GR : The utilization of sulphate and sulphur dioxide for the sulphur nutrition of alfalfa. *Plant Physiol*, 18:345-371, 1943.

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