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PHYSICO-CHEMICAL STUDIES OF ROADSIDE SOIL AT TEHSIL - AMBAH (MORENA) M.P.

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ABSTRACT

This study was carried out to investigate the impact of traffic on the characteristics of heavy metals in roadside soil of Morena, India. Traffic activities are considered as one major sources of heavy metal pollution in roadside soil. The contaminated soil have different soil pH, electrical conductance, moisture content, bulk density, water holding capacity and other physico-chemical properties when compared to natural soil. The presence of heavy metals like Cu, Cr, Fe, Pb, Zn and Mn in the roadside soil was also considerable.

Key words: Morena, Physico-chemical Studies, Roadside soil, Heavy metals.

INTRODUCTION

A study of heavy metals in roadside soil is critical in assessing the potential environmental impacts of automobile emission on the soil. Roads are important infrastructure that play a major role in stimulating social and economic activities and their construction has also resulted in heavy environmental pollution[1,2]. The source of Cu in the roadside soils was indicated being due to corrosion of metallic parts of cars derived from engine wear, thrust bearing, brushing and bearing metals[3,4]. Little interest has been focused on the contamination of roadside soil by other heavy metals. But metals, such as Cu, Fe, Zn and Cd are essential components of many alloys, wire, tires and many industrial processes and could be released into the roadside soil and plants as a result of machanical abrasion and normal wear[5]. The Pb is converted to PbO and PbO_2, which is then transformed into volatile $PbCl_2$, $PbBr_2$ and PbBrCl by the addition of dichloro- or dibromomethane to the gasoline. Therefore, Pb compounds are emitted into the atmosphere from vehicle exhaust gases using Pb added petrolium products[6]. Roadside soils in urban areas all over the world are pointer of heavy metal contamination from a variety of sources mostly of anthropogenic influences.

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Major metal pollutants of the roadside environments are released from fluel burning, wear out of tyres, leakage of oils and corrosion of batteries and metallic parts such as radiators, etc.[7]

The pollution of soils by heavy metals from automobile sources is a serious environmental issue. Results show that roadside soil near motorways is heavily polluted by heavy metals from automobiles[8,9]. The soil and the shrubs near the road are immediate receptors of the contaminants generated by plying of various types of vechicles through exhaust emission and other processes. Vehicular emission are known as the single most important contributor to the atmospheric pollution. The vehicle associates components constitute nearly 70% of the contaminants input to roadside soil[10], the rest of the input being from surface binders used in road constructions, dust fall and precipitation, road surface erosion, animal wasts, vegetable debris etc. Vehicular emission and evaporative emissions contents may contain unburnt hydrocarbons including polycyclic hydrocarbons and trace metals like Pb, Cd, Zn, Cu, Mn, Fe, etc. The retention of various contaminants by the soil results in modification of its physico-chemical characteristics such as pH, conductance, texture etc.[11] Thus, it is expected that the roadside soil has a high degree of contamination and its quality is a definitive indicator of vehicular pollution.

The location of Morena city is between the two important and historical cities Agra and Gwalior by national highway NH3. The quality of roadside soil along the major roads of known high traffic density of Morena will be studied at different locations. The present study is a modest attempt to understand the impact of vehicular emission on the Ambah-Morena roadside soil. For this purpose, physico-chemical characteristics of the roadside soil samples were studied carefully during 2013-14.

EXPERIMENTAL

Materials and methods

Surface soil samples were collected from the roadside at 10 locations in high traffic density areas of Ambah-Morena. The sampling locations with distance and direction from the reference point, (Agriculture-Center Morena) zero traffic zone, are given in Table 1. The reference point is atleast 30 km away from all forms of traffic is therefore considered as “Control”. Samples were collected from the distance of 2, 9, 16, 25, and 30 km in the polythene bags for analytical studies. The samples were analysed for a number of physical and chemical parameters as per standard procedure[12,13].

Table 1: The sampling location with distance from the reference point

S. No.	Location	Distance from roadside
1(a)	**Badfara**	Roadside
1(b)	....	Agricultural
2(a)	**Ranpur**	Roadside
2(b)	....	Agricultural
3(a)	**Dimni**	Roadside
3(b)	....	Agricultural
4(a)	**Jigni**	Roadside
4(b)	....	Agricultural
5(a)	**Mudiya khera**	Roadside
5(b)	....	Agricultural

RESULTS AND DISCUSSION

The results of the analysis are presented in Tables 2 and 3. The values represent averages of at least five measurements. The pH of the roadside soil was found to be 8.26 (Table 2), while in the agricultural soil, it was found to be 7.92. The electrical conductivity values were also higher than that of agricultural site (roadside 0.56 and agricultural 0.34 dsm^{-1}), indicating the input of some soluble electrolytes in the roadside soil due to various traffic related activities. Moisture content of the roadside, and agricultural site were found to be 13.50, 17.59%. Bulk density of soils is almost similar to all over the studied soils of Ambah- Morena. It ranges from 1.64-1.60 g cc^{-1} and indicates that the porosity of soil almost similar to each of the sites. In the roadside soil, WHC was found to be 41.34%, whereas in the agricultural sites, WHC was 43.31% (Table 2).

Nitrogen is the main constituent of plants and animal protein and it is the most abundant element in the atmosphere. It is available to producers in different forms as NO_2, NO_x, NH_3, urea, etc. In the roadside soil was found this was 253 kg ha^{-1}, while in the agricultural soil, it was comparatively higher 269.4 kg ha^{-1} (Table 3). The variation in P-content was also observed at roadside (13.9 kg ha^{-1}) as compared to agricultural site was slightly higher (15.2 kg ha^{-1}), K-content was observed at roadside (318.8 kg ha^{-1}) as compared to agricultural 372.0 kg ha^{-1} and S-content was observed at roadside (13.7 kg ha^{-1}) as compared to agricultural 10.3 kg ha^{-1}.

Table 2: Physicochemical properties of different sites soils at Ambah-Morena

S. No.	pH		EC (dsm^{-1})		Moisture content (%)		Bulk density (g cc^{-1})		WHC (%)	
	Roadside	Agricultural	Roadside	Agricultural	Roadside	Agricultural	Roadside	Agricultural	Roadside	Agricultural
1	8.23	8.05	0.51	0.21	13.26	18.53	1.87	1.64	38.26	39.05
2	8.27	7.93	0.32	0.15	13.12	17.52	1.38	1.43	40.72	44.93
3	8.32	8.29	0.42	0.23	13.21	16.46	1.56	1.62	42.18	41.65
4	8.37	8.21	0.64	0.41	14.32	18.25	1.65	1.72	43.78	47.67
5	8.12	7.16	0.91	0.72	13.63	17.23	1.76	1.63	41.78	43.28
Average	**8.26**	**7.92**	**0.56**	**0.34**	**13.50**	**17.59**	**1.64**	**1.60**	**41.34**	**43.31**

Table 3: Physicochemical properties of different sites soils at Ambah-Morena

S. No.	N (kg ha^{-1})		P (kg ha^{-1})		K (kg ha^{-1})		S (kg ha^{-1})	
	Roadside	Agricultural	Roadside	Agricultural	Roadside	Agricultural	Roadside	Agricultural
1	262.3	287.4	14.6	10.7	221.7	253.2	12.6	10.2
2	245.6	265.8	17.2	16.7	279.9	391.3	11.2	9.4
3	235.4	276.5	11.2	19.2	310.8	315.5	15.8	12.2
4	245.2	266.2	17.4	14.2	358.2	451.2	12.7	8.2
5	276.5	251.2	9.2	15.6	423.4	449.2	16.3	11.7
Average	**253**	**269.4**	**13.9**	**15.2**	**318.8**	**372.0**	**13.7**	**10.3**

Six heavy metals Cu, Cr, Fe, Pb, Zn and Mn were estimated in all the roadside and agricultural soil samples (Table 4). Pronounced contamination was observed for Cu (roadside 8.5 mg kg^{-1}, agricultural 14.9 mg kg^{-1}), Cr (roadside 25.1 mg kg^{-1}, agricultural 30.5

mg kg^{-1}), Fe (roadside 12.0 mg kg^{-1}, agricultural 6.3 mg kg^{-1}), Pb (roadside 19.8 mg kg^{-1}, agricultural 3.9 mg kg^{-1}), Zn (roadside 2.66 mg kg^{-1}, agricultural 0.85 mg kg^{-1}) and Mn (roadside 39.06 mg kg^{-1}, agricultural 24.74 mg kg^{-1}).

Table 4: Physicochemical properties of different sites soils at Ambah-Morena

S. No.	**Cu (mg kg^{-1})**		**Cr (mg kg^{-1})**		**Fe (mg kg^{-1})**		**Pb (mg kg^{-1})**		**Zn (mg kg^{-1})**		**Mn (mg kg^{-1})**	
	Roadside	**Agricultural**	**Roadside**	**Agricultural**	**Roadside**	**Agricultural**	**Roadside**	**Agricultural**	**Roadside**	**Agricultural**	**Roadside**	**Agricultural**
1	9.8	10.7	25.2	30.2	15.6	8.3	22.3	3.6	2.82	0.78	39.02	28.36
2	10.4	14.3	31.6	35.4	8.6	3.5	36.5	5.7	3.25	0.96	24.65	12.53
3	6.7	15.6	27.2	32.6	6.2	3.8	20.3	4.3	3.17	0.82	17.84	7.46
4	7.2	15.8	22.5	28.2	11.2	7.4	12.3	2.8	1.02	0.65	48.65	27.96
5	8.7	18.5	19.2	26.3	18.5	8.7	7.8	3.2	3.06	1.06	65.16	47.42
Average	**8.5**	**14.9**	**25.1**	**30.5**	**12.0**	**6.3**	**19.8**	**3.9**	**2.66**	**0.85**	**39.06**	**24.74**

CONCLUSION

The present study shows conclusively that three is a large input of contaminants from vehicular emission and associated activities to the roadside soil as compared to soil away from road. These inputs impair the quality of the soil nearby reducing its capacity to support plant life, but represent better results compared with NH_3 on highway of high traffic density at Morena (M.P.). While there may be some amount of favourable impact due to a few contributions, most other contaminants interfere with the natural properties of soil. The cumulative contamination effect of long-term exposure to traffic activities cannot be neglected, more importantly for the road-side farmland soil, which is associated with the food chain and public health. The results presented in the paper highlight the impact of vehicular exhausts leading to contamination of soils with heavy metals.

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