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Original Article

Assessment of The Concentration of Heavy Metals and Their Effects On Soil Quality, Near The Industrial Areas of Sanganer, Jaipur District

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Abstract:

Toxic effluents from various industries destructively affect water resources, soil fertility, aquatic organisms and the integrity of the ecosystem. The effluents from the textile industries are colored due to the presence of dyes. To assess the degree and adverse environmental effects, assessment of concentration of heavy metals from industrially contaminated sites is important for the safety of properties of soil. It has been recorded that the physicochemical parameters and heavy metal levels are much higher in soil samples, which indicated that the soil in this area is extensively polluted by human activities and effluent discharge from dyeing industries. The results infer that the soil quality in Sanganer dyeing industrial area is deteriorating and potentially hazardous to public health.

Keywords: Heavy Metals, Physicochemical parameters, Soil Quality, Industrial area.

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INTRODUCTION

Pollution issues instigated by anthropogenic activities and economic development have been frightening the environment for decades(1).The discharge of toxic effluents from various industries destructively affects water resources, soil fertility, aquatic organisms and the integrity of the ecosystem(2). The effluents from the textile industries are colored due to the presence of dyes. It is difficult to predict the distinctiveness of textile wastewater by the reported values in the literature as every industry is exclusive with respect to the production, technology and chemicals used((3).

Need of the Study

Assessing the problems caused by contaminated soils typically involves soil chemistry as well as laboratory and field studies to fully assess the degree and impact of any adverse environment effects(4). Therefore, assessment of the heavy metals from industrially contaminated sites is important. This would also aid to design possibilities to evacuate major human diseases(5,8). The deadlier diseases like edema of eyelids, tumor, congestion of nasal mucous membranes and pharynx, stuffiness of the head and gastrointestinal, muscular, reproductive, neurological and genetic malfunctions caused by heavy metals have been acknowledged(6). The proposed work aims to assess heavy metal concentration in soil along with the estimation of risk of heavy metals in the contaminated area which is having long term exposure around dyeing industries in Sanganer region

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of Jaipur district. This will help to a great extent in evaluating the environmental approach for better utilization of soil from industrially contaminated areas(7).

Sampling area

For the present study, soil samples are taken from the Sectors 1-9 of Sanganer, Jaipur, Rajasthan.

Sample collection method

Soil samples were collected separately by random selection, from the surface (0–15 cm soil layer) with a small core sampler. Nine polluted areas were selected for sample collection. They were taken from the dyeing factory outlet which was in the form of slurry and also was wet. The samples which were collected, are one Kilogram in weight and kept in airtight polyethylene bags, labelled and brought to the laboratory for analysis.

Result and discussion

1. Physicochemical Parameters of Soil Samples

The metal concentrations of topsoil can be used as a powerful geochemical tool for monitoring the impact of anthropogenic activity. The physicochemical properties like pH, electrical conductivity and alkalinity of soil sample have been analysed and the results are tabulated in **Table 1.**

Table 1

Area	pH @ 27°C	Electrical Conductivity (dS/m)	Alkalinity (ppm)
Sector 1	6.93	381.40	390
Sector 2	6.82	381.20	340
Sector 3	6.75	379.80	320
Sector 4	6.68	334.70	480
Sector 5	6.56	322.00	400
Sector 6	6.74	313.50	430
Sector 7	6.86	357.20	395
Sector 8	6.75	352.10	393
Sector 9	6.65	350.00	389

*Indian standard and WHO permissible limit pH-6.70 to 7.70, EC- 600 dS/m, Alkalinity-200 ppm

2. Major and Minor trace elements in dyeing effluent disposal areas of Sanganer.

Major and minor trace elements in and around the Sanganer dyeing area(9) have also been analysed and the results are tabulated in **Table 2.**

Area	Chloride (ppm)	Phosphate (ppm)	Sulphate (ppm)	Total Organic Carbon (%)	Available Nitrogen
1	373	995	280	15.7	11127
2	369	990	270	15.4	11098
3	367	989	260	15.3	11055
4	320	930	330	19.5	11087
5	302	910	310	18.8	11011
6	298	900	320	17.7	10932
7	328	965	310	18.2	11095
8	337	952	290	17.0	11051
9	345	940	280	19.4	11008
Min	298	900	260	15.3	10932
Max	373	995	330	19.5	11127
Mean	338	952	294	17.4	11052

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*WHO permissible value of Chloride: 250 ppm, Phosphate-0.1 to 0.5 ppm , Sulphate: 200-400ppm, Total Organic Carbon: 0.05-0.75%, Available Nitrogen: 431- 646ppm

The soil samples were analysed by using atomic absorption spectroscopy, for the determination of Heavy metals(10) like Lead, Arsenic, and Copper.

Table 3 shows the measured heavy metal contents and Figure compares their concentration. The concentration varied greatly as follows: Pb: 6.55 ppm–7.97 ppm; As: 0.03 ppm– 0.53 ppm Cu: 297.35 ppm – 354.05 ppm; and Fe (Iron):15.43 ppm - 17.57 ppm.

Table 3

Area	Lead (ppm)	Arsenic (ppm)	Copper (ppm)	Iron (ppm)
1	7.87	0.53	354.05	17.08
2	7.50	0.52	352.90	15.75
3	7.34	0.49	349.83	16.32
4	6.92	0.05	311.21	17.57
5	6.78	0.03	304.80	16.49
6	6.55	0.03	297.35	15.43
7	7.97	0.32	335.81	17.25
8	7.16	0.27	328.36	16.15
9	6.68	0.21	312.78	15.83
Min	**6.55**	**0.03**	**297.35**	**15.43**
Max	**7.97**	**0.53**	**354.05**	**17.57**
Mean	**7.20**	**0.27**	**327.45**	**16.43**

* WHO permissible limit: Pb-0.01ppm, As – 0.01 ppm, Cu – 2.00 ppm, Fe (Iron)-0.1 ppm

4. Comparison of Pollution Load Index

Comparison of Average Pollution Load Index (PLI) of studied areas have been carried out and the results are summarized in

Table 4.

Area	Average Pollution Load Index (PLI)
1	1.926
2	1.854
3	1.772
4	0.503
5	0.413
6	0.369
7	1.464
8	1.260
9	1.048
Average	1.179

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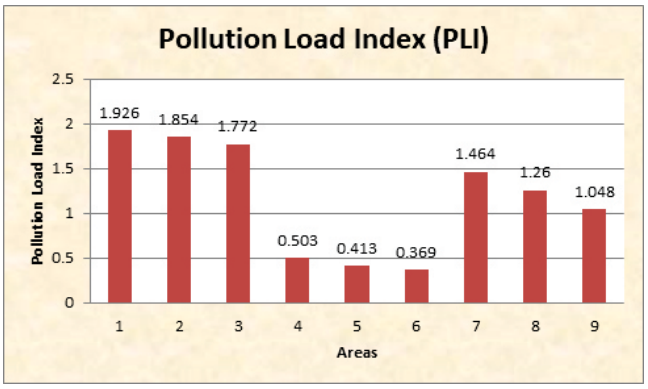

Fig.1 shows the Comparison of Pollution Load Index (PLI) in various sampling area of Sanganer.

Conclusion

This study provides a comprehensive analysis of physicochemical properties and heavy metals contents in the topsoil of the dyeing industrial area of the Sanganer region in Jaipur District. From this investigation, it is recorded that the physicochemical parameters and heavy metal levels are much higher in soil samples, which indicated that the soil in this area is extensively polluted by human activities and effluent discharge from dyeing industries. The results infer that the soil quality in Sanganer dyeing industrial area is deteriorating and potentially hazardous to public health. It is recommended that the effluents should be remediated by adopting proper effluent treatment techniques and continuous monitoring by the authorities.

CONFLICT OF INTEREST: The authors declare no conflict of interest.

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