

Physico-Chemical Characteristics of Soil in three Different Areas of Maihar City

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Abstract: *Maihar is a tehsil of satna district in the state of Madhya Pradesh, India. It is known for the temple of the revered mother goddess Sharda situated in Trikut hill. The town is a road and rail junction. It is located at 24.27°N 80.75°E. The physico-chemical parameters (i.e. temperature, pH, EC,) N, P, K and also heavy metals (Mn, Co, Cu, Zn, Ni) has been examined in the soil sample of Maihar tehsil in Satna District. The readings were taken with the help of Atomic Absorption Spectrophotometer (AAS) and the value of Zn, Cd, Cu, Ni and Co was calculated by running standards of these metals. Various soil quality parameters were analyzed by using standard procedures. Temperature, pH, EC, N, P and K were found to be within the SQGL recommended level.*

Keywords: *Physico- chemical parameters, Soil, Maihar Tehsil, Satna District*

1. INTRODUCTION

Maihar is a tehsil of satna district in the state of Madhya Pradesh, India. It is known for the temple of the revered mother goddess Sharda situated in Trikut hill. The town is a road and rail junction. It is located at 24.27°N 80.75°E. It has an average elevation of 376 meter. There is an important distribution centre for infrastructure product. There are three main industries of cement manufacturing, which are a large cement plant in whole city. The factory complex and the township are situated at Sarlanagar about 8 km away from Maihar town on the Dhanwahi road. Two new cement factories KJS cement and Reliance cement are also setting up there cement factory here. Maihar has many educational institute affiliated with Awadhesh Pratap Singh university.

The fertility of the soil depends on the concentration of N, P, and K, organic and inorganic material. The physico-chemical Properties such as moisture content, pH, EC, Nitrogen as a Fertilizer required for the growth of plant. Potassium is used for flowering purpose also require for protein synthesis, photosynthesis. Phosphate is used for growth of root in plant ^[1] Environmental hazards of many chemicals are also much concern because these chemical compound like herbicides are largely responsible for effecting the soil micro-organisms and enzymes, which are responsible for oxidization, mineralization, reduction, immobilization and turnover of nutrients and other organic compounds in soil ^[2].

The most important sources of heavy metals in the environment are the anthropogenic activities such as mining, smelting procedure, steel and iron industries, chemical industries; traffic, agriculture as well as domestic activities. Chemical and metallurgical industries are the most important source of heavy metals in soils. Heavy metals are important environmental pollutants they are a threat to the environment and to human health, because they are not biodegradable as they are retained indefinitely in the ecological systems and in the food chain ^[3]. The physico-chemical parameters (i.e. temperature, pH, EC,) N, P, K and also heavy metals (Mn, Co, Cu, Zn, Ni) has been examined in the soil sample of Maihar tehsil in Satna District.

2. MATERIAL AND METHODS

The sampling stations were chosen at different site of the study area, for testing the soil samples were collected in polythene bags from each station. Sample should be collected in clean; dry polythene. Temperature, pH, N, P, K and heavy metal analyzed in the soil samples during the month of March 2015. Various soil quality parameters were analyzed by using standard procedures ^[4-5].

2.1. Digestion of Soil Samples for Heavy Metal Analysis

Sieving of the soil was completed with the help of 0.5 mm sieves and was dried for 24 hours after drying it was made cool at room temperature. After drying soil was digested with Nitric acid and distilled water. The readings were taken with the help of Atomic Absorption Spectrophotometer (AAS) and the value of Zn, Cd, Cu, Ni and Co was calculated by running standards of these metals. The sampling locations are presented in table -1

RESIDENTIAL AREA

S.No.	Sampling Location	Depth in cm	Description of the sampling location
1.	Rajnagar ,Maihar	15 cm	Near Indian Oil Petrol Pump, Rajnagar, Maihar
2.	Katni Road Maihar	15 cm	Infront of BRC Bhavan Katni road maihar
3.	Maharaja Agrasen Chouk, Maihar	15 cm	Near Maharaja Agrasen Chouk Mihar
4.	Maa Sharda Mandir, Maihar	15 cm	Near Mata mandir ,Maihar
5.	Maihar Bus Stand ,Maihar	15 cm	Behind Nagar Palika Office, Maihar
6.	Sarla Nagar Road, Maihar		Near Taxi Stand Sarla Nagar road, Maihar

INDUSTRIAL AREA

S. No.	Sampling Location	Depth (cm)	Description of Sampling Location
1.	KJS cement Plant Gate No.2	15 cm	KJS cement Plant Rajnagar ,Maihar
2.	Birla Gold Cement Plant, Sarlanagar, Maihar	15 cm	Near transport office, KJs Cement Plant, Maihar
3.	Reliance cement plant Bharouli, Maihar	15 cm	Near ETP plant, Reliance cement plant, Maihar

CROP LAND AREA

S. No.	Sampling Location	Depth (cm)	Description of Sampling station
1.	Vill-Sonavari, Maihar	15 cm	Near Sonvari cropland area
2.	Kherva Railway crossing, Maihar	15 cm	Near Kherva railway crossing, Bharouli ,Maihar
3.	Near Vill- Jeetnagar, Maihar	15 cm	Infront of Bharat Petrol pump, Jeetnagar, Maihar
4.	Vill- Pondi Maihar	15 cm	Near Aanganvadi centre, Pondi Maihar
5.	Near Swami vivekanand vidyapeeth, Maihar	15 cm	Vill-Oila Satna Road, Maihar
6.	Vill-Rajnagar, Riwa Road ,Maihar	15 cm	Near Bear Beal Public School, Rajnagar, Maihar

3. RESULT AND DISCUSSION

In the present study fifteen soil Samples were collected from three different areas of Maihar City. Analysis Physico-chemical characteristics of soil in Maihar tehsil of Satna district, all the results are shown in-table 2 and figure-1 to 33.

3.1. Temperature, pH and EC

Temperature of all soil samples shows variation between 26.5⁰C to 36.2⁰C. The maximum temp value (36.2) was detected in (MSI₁) KJS cement plant and minimum temp value (26.5) was recorded in (MSC₂) near kherva railway crossing. pH concentration was observed between 6.95 to 7.90 range. The highest pH value (7.90) was analysed in (MSI₁) KJS cement plant. Tripathi et al, 2015^[6] determined of soil in Sidhi District and reported the pH concentration of soil is 5.6 to 8.4. Electrical conductivity shows variation between 0.04 to 0.47 mhos/cm. The high EC value (0.47) was recorded in (MSC₂) near kherva railway crossing and low EC value (0.04) was observed in (MSR₁) near Indian oil petrol pump, Rajnagar. Mandal et al, 2010^[7] studied Nagpurpur soil and recorded EC 0.21 to 0.49 mhos/cm.

3.2. Nitrogen, Phosphorous and Potassium

In the present study nitrogen concentration were recorded ranged from 4.2 to 30.10 mg/kg. The highest nitrogen content (30.10) was detected in (MSR₆) near taxi stand sarlanagar. The phosphorous concentration in soil varied between 0.18 to 4.89 mg/kg. Maximum concentration of phosphorous (4.89) was detected in (MSI₃) Reliance cement plant, Bharauli, Maihar and minimum concentration of Phosphorous (0.18) was recorded in (MSR₁) Near rajnagar Maihar. The concentration of Potassium in all soil samples varied from 3.9 to 19.6 mg/kg. The highest potassium content (19.6) was observed in (MSC₅) near vill Oila Satna Road Maihar. Concentrations of Nitrogen, Phosphorous and Potassium for the samples were below the recommended level. Tripathi et al, 2014^[8] studied Umaria soil and reported nitrogen, phosphorous and potassium are found to be 8.86 to 41.50, 0.25 to 1.16, 30 to 70 mg/kg.

3.3. Heavy Metal Analysis

Concentration of manganese, Iron and Zinc ranged from 1.25 to 12.49 mg/kg, 8.9 to 73.0 mg/kg, and 10.08 to 22.26 mg/kg respectively. The maximum manganese concentration (12.49) was detected in (MSI₂) Birla gold cement plant Maihar and the highest iron concentration (73.0) was observed in (MSC₃) near aanganvadi centre, Pondi Maihar. The maximum Zinc concentration (22.26) was detected in (MSC₂) near kherva railway crossing. The concentrations of Manganese, Zinc, and Iron for all the samples were below the recommended level as 20mg/kg, 200 mg/kg, and 380 mg/kg respectively. Shivakumar et al, 2012^[9] studied physico-chemical profile of soil along the banks of Amaravati river banks in Karur areas of Tamil Nadu and reported iron content range between 6.14 to 9.85 mg/kg

Concentration of cobalt in soil samples ranging from 2.3 to 21.5 mg/kg. Samples (MSI₁) KJS cement plant (21.5), (MSI₂) Birla gold cement plant (18.6), (MSR₃) Maharaja Agrasen chok (10.4), (MSC₂) near kherva railway crossing (15.8) exceed the permissible limit set by SQGL value. Krishna ^[10] et al, 2005 studied Thane Belapur Industrial Area Soil and reported cobalt concentration is found to be 44.8 to 101.6 mg/kg.

Copper Concentration in soil varied between 4.3 to 92.6 mg/kg. The highest copper concentration (92.6) was observed in (MSI₁) KJS cement plant while lowest copper concentration (4.3) was analysed in (MSR₄) Maa Sharda Mandir Maihar. Values of copper concentration at sampling station (MSI₁) KJS cement plant (92.6) and (MSI₂) Birla gold cement plant (87.4) are above permissible limit prescribed by SQGL value. Tripathi et al, 2013^[11] studied the characterization of diffuse chemical pollution and reported that concentration of copper ranged from 0.25 to 87.20 mg/kg.

Table2. Physico-chemical Characteristics of Soil in Three Different Area of Maihar City

Parameter	Temp	pH	EC	N	P	K	Mn	Fe	Co	Cu	Zn	
												mhos/cm
Industrial site	MSI1	36.2	7.90	0.10	8.2	0.26	14.2	8.71	63.4	21.5	92.6	16.2
	MSI2	32.5	7.28	0.32	28.35	1.52	9.5	12.49	56.0	18.6	87.4	11.8
	MSI3	30.4	7.21	0.06	19.10	4.89	12.7	6.85	29.0	6.2	55.2	10.08
Residential Site	MSR1	26.5	7.30	0.04	21.9	0.18	5.6	5.85	11.6	ND	7.5	ND
	MSR2	30.2	7.43	0.19	6.31	0.76	17.5	10.3	8.9	5.6	ND	21.62
	MSR3	27.0	7.10	0.11	16.0	0.20	15.0	4.33	24.1	10.4	11.3	ND
	MSR4	26.7	7.08	0.15	14.6	1.26	ND	1.25	32.0	2.3	4.3	13.4
	MSR5	28.0	7.33	0.08	8.4	0.27	9.8	6.41	17.5	ND	ND	ND
	MSR6	30.0	7.68	0.33	30.10	0.36	ND	7.50	10.0	4.5	32.1	ND
Cropland Site	MSC1	28.6	7.21	0.25	11.6	0.23	16.0	5.66	36.3	7.2	27.5	13.20
	MSC2	26.5	7.18	0.47	19.3	1.16	12.7	4.53	27.2	15.8	16.6	22.26
	MSC3	27.8	7.20	0.14	4.2	0.49	9.7	5.40	73.0	3.6	ND	16.52
	MSC4	27.0	6.95	0.19	21.5	3.13	11.6	6.31	42.1	2.8	9.0	21.48
	MSC5	28.3	7.35	0.12	18.3	2.79	19.6	9.75	30.7	5.4	5.8	15.32
	MSC6	31.1	6.98	0.16	7.4	0.56	3.9	9.81	23.8	ND	ND	11.0
Mean	Mean	29.120	7.279	0.181	15.684	1.236	12.138	7.010	32.373	8.658	31.755	15.716
	S.D.	2.693	0.250	0.117	7.963	1.407	5.959	2.834	19.215	6.780	31.060	8.096
	C.V.	9.247	3.434	65.002	50.77	113.898	49.089	40.434	59.352	78.3	97.811	51.509

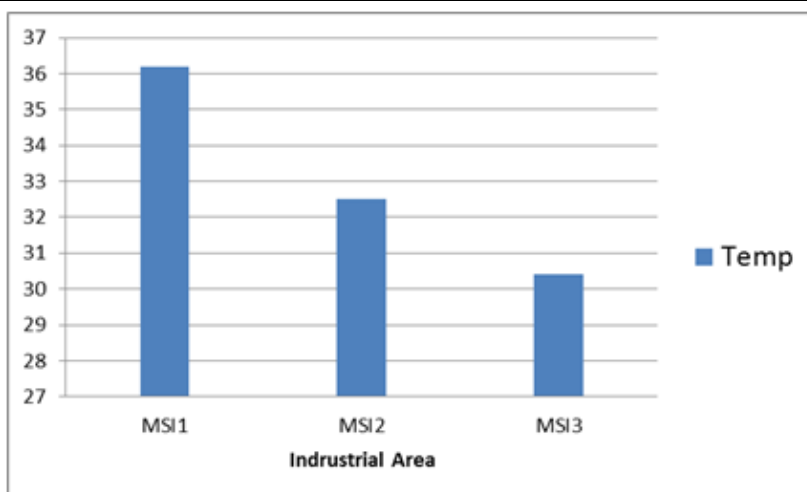


Figure1. Temperature of soil in Industrial Area of Maihar City

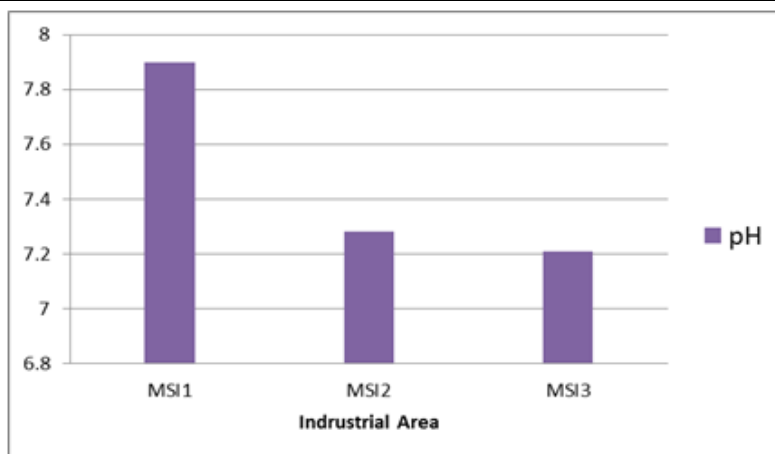


Figure2. pH Concentration of soil in Industrial Area of Maihar City

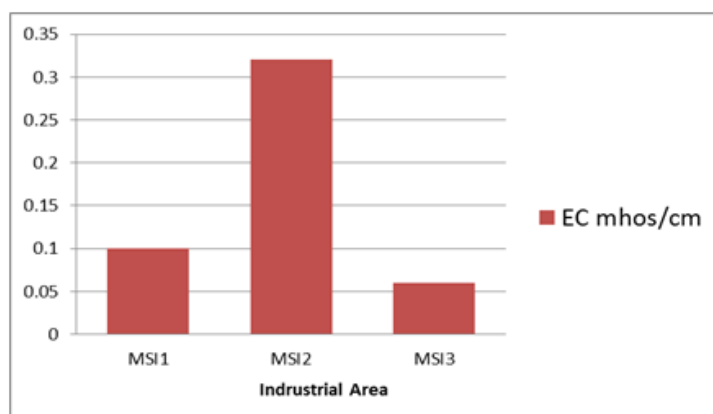


Figure3. EC of soil in Industrial Area of Maihar City

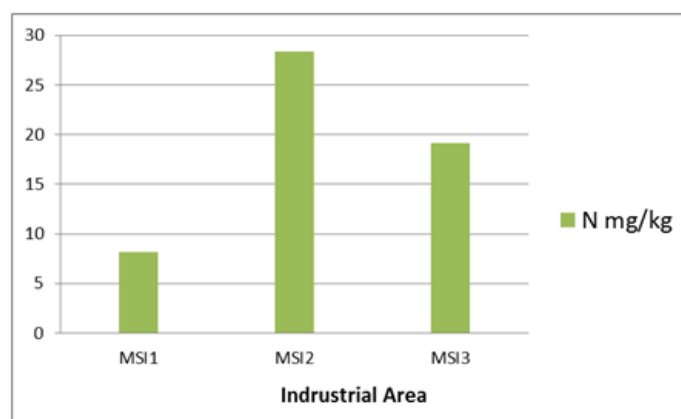


Figure4. Nitrogen Concentration of soil in Industrial Area of Maihar Ci

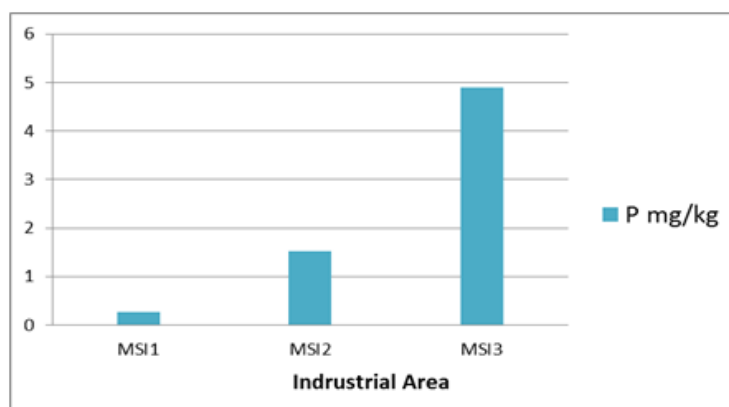


Figure5. Phosphorus concentration of soil in Industrial Area of Maihar City

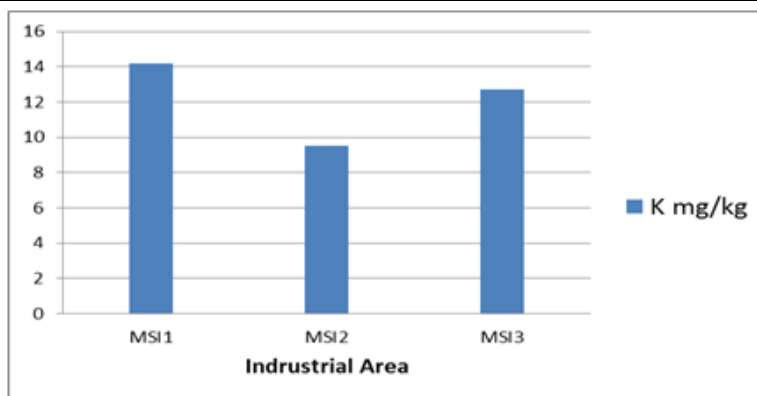


Figure6. Potassium concentration of soil in Industrial Area of Maihar City

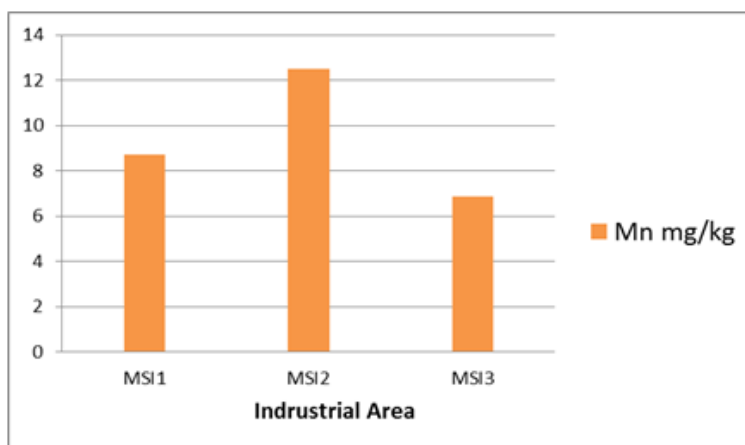


Figure7. Magnesium concentration of soil in Industrial Area of Maihar City

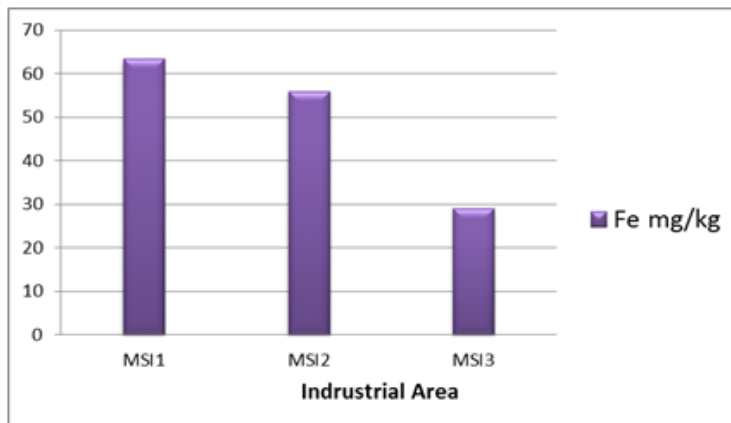


Figure8. Iron concentration of soil in Industrial Area of Maihar City

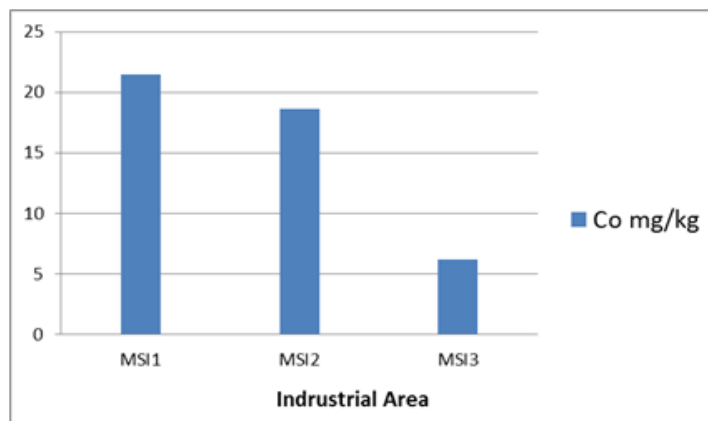


Figure9. Cobalt concentration of soil in Industrial Area of Maihar City

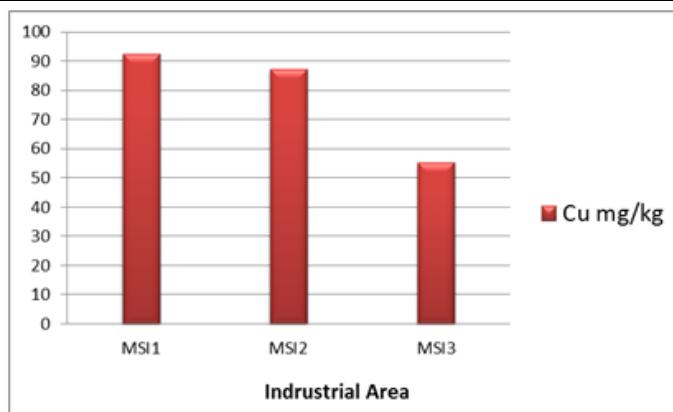


Figure10. Copper concentration of soil in Industrial Area of Maihar City

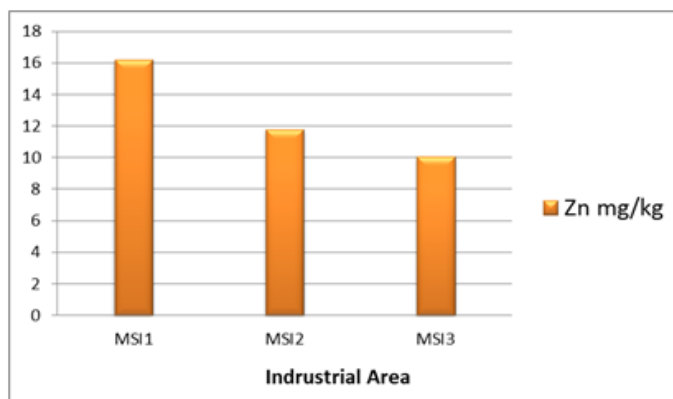


Figure11. Zinc concentration of Soil in Industrial Area of Maihar City

RESIDENTIAL AREA:

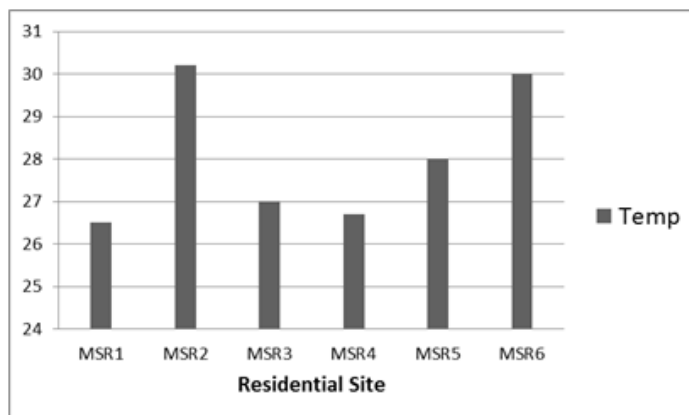


Figure12. Temperature of soil in Residential Area of Maihar City

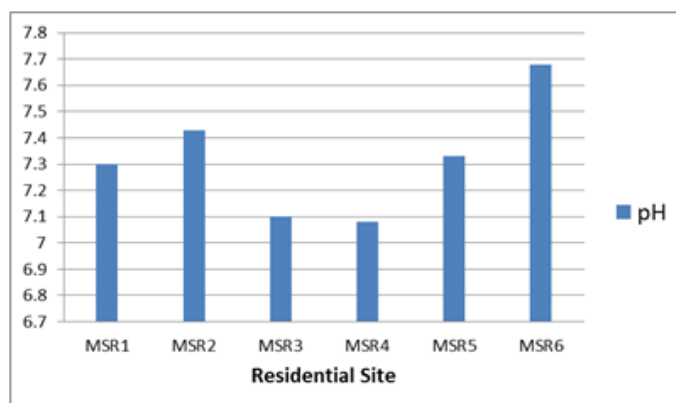


Figure13. pH Concentration of soil in Residential Area of Maihar City

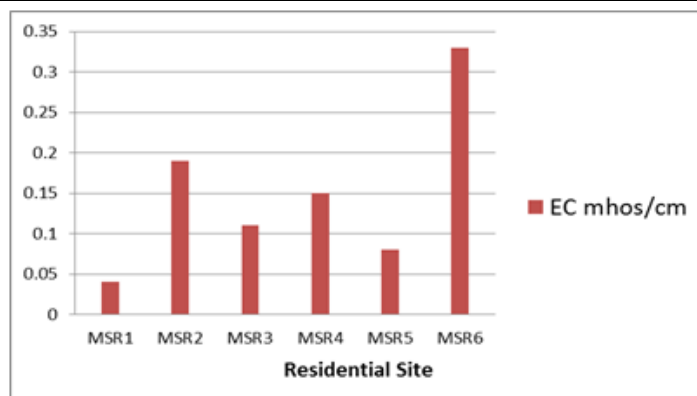


Figure14. EC of soil in Residential Area of Maihar City

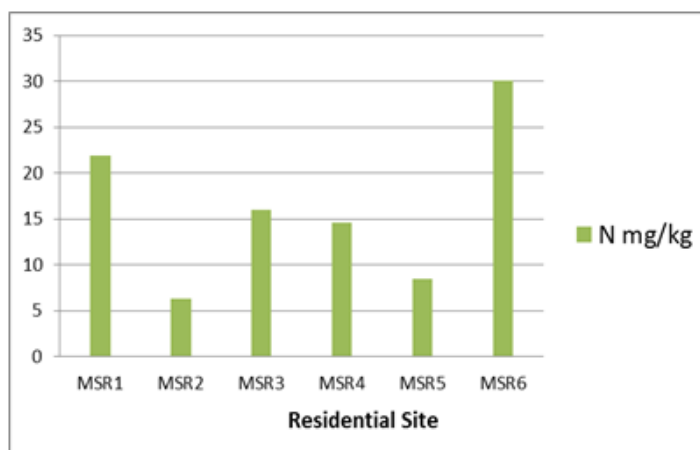


Figure15. Nitrogen Concentration of soil in Residential Area of Maihar City

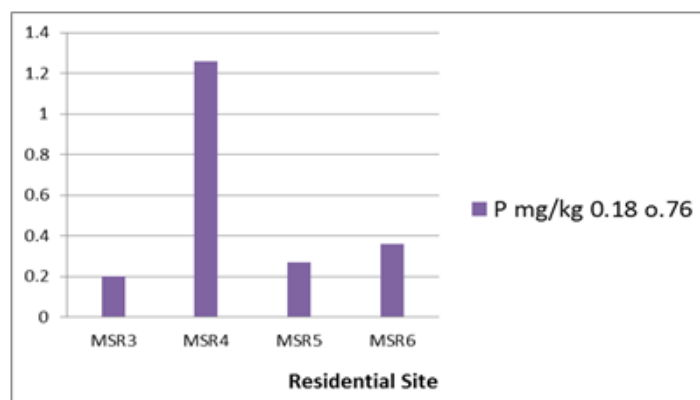


Figure16. Phosphorus Concentration of soil in Residential Area of Maihar City

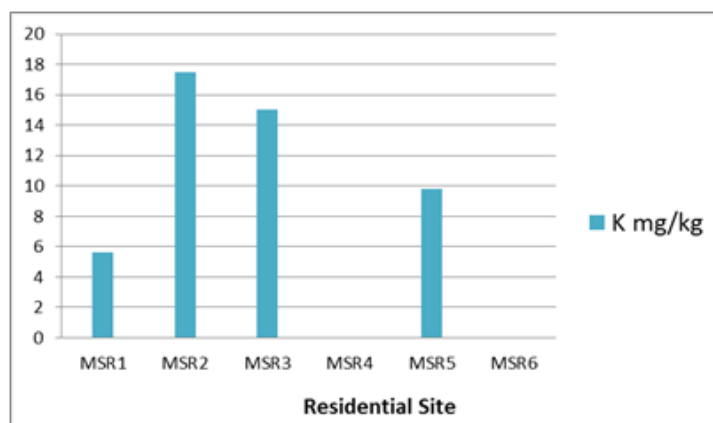


Figure17. Potassium concentration of soil in Residential Area of Maihar City

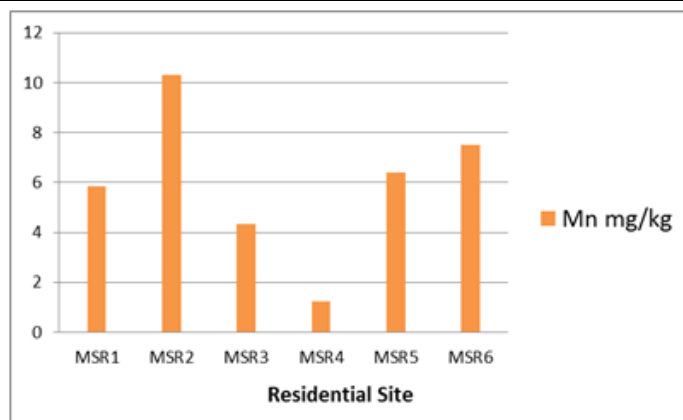


Figure18. Magnesium concentration of soil in Residential Area of Maihar City

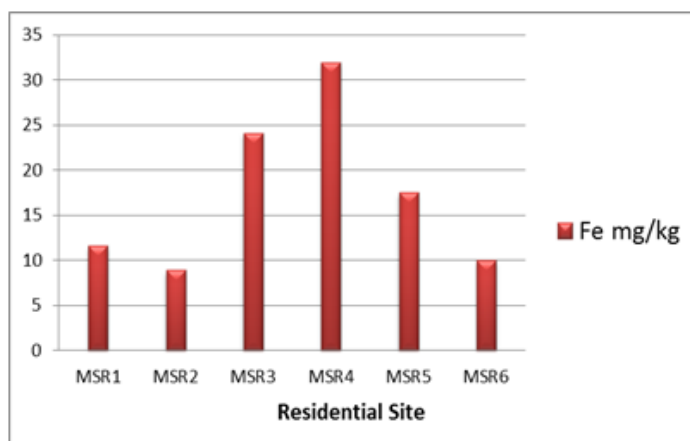


Figure19. Iron concentration of soil in Residential Area of Maihar City

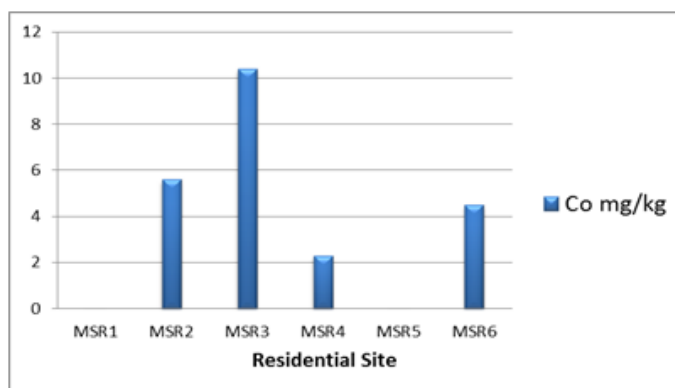


Figure20. Cobalt concentration of soil in Residential Area of Maihar City

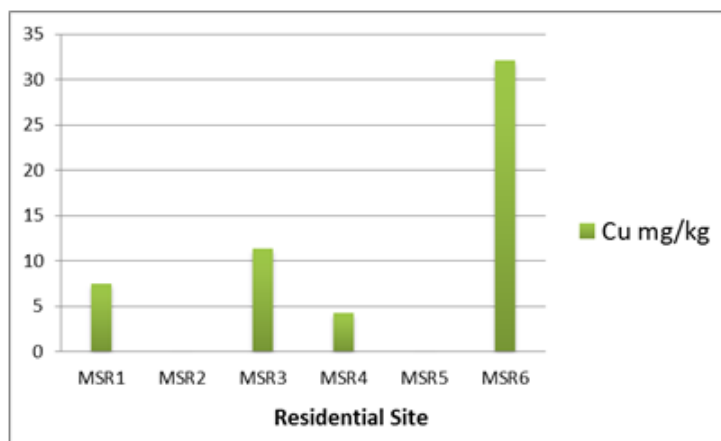


Figure21. Copper concentration of soil in Residential Area of Maihar City

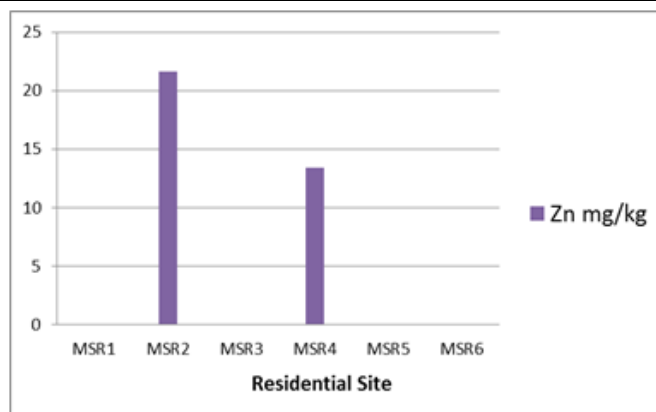


Figure22. Zinc concentration of Soil in Residential Area of Maihar City

CROPLAND AREA

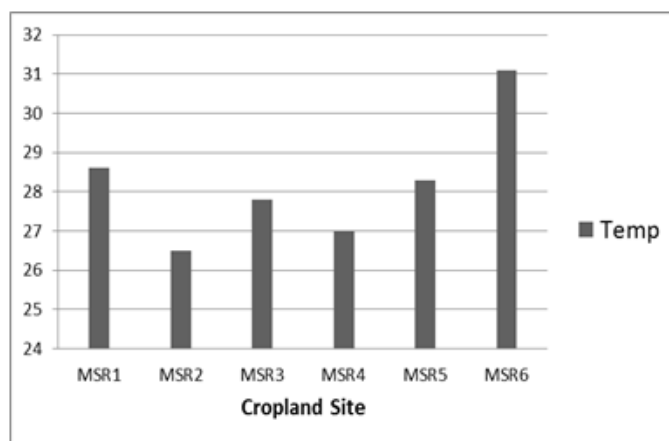


Figure23. Temperature of soil in Cropland Area of Maihar City

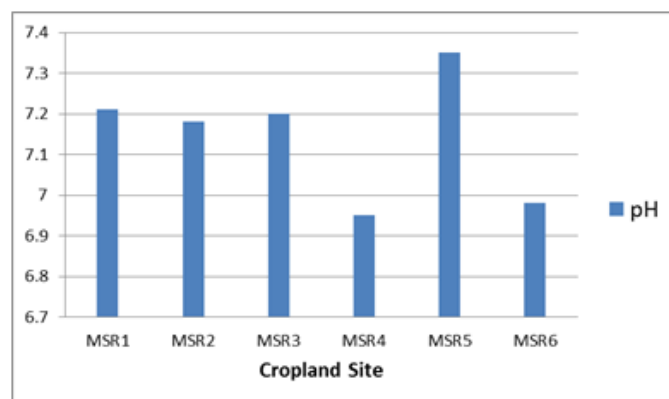


Figure24. pH Concentration of soil in Cropland Area of Maihar City

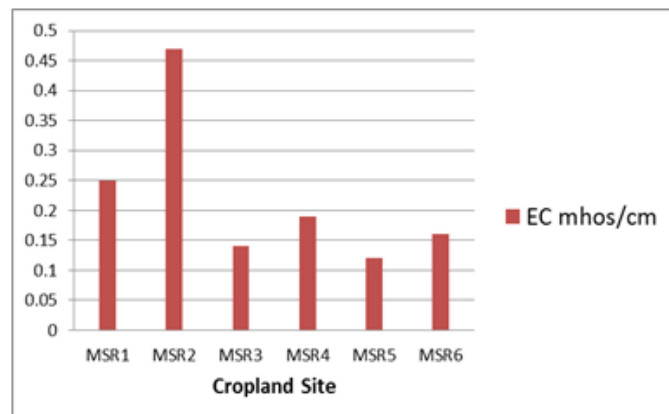


Figure25. EC of soil in Cropland Area of Maihar City

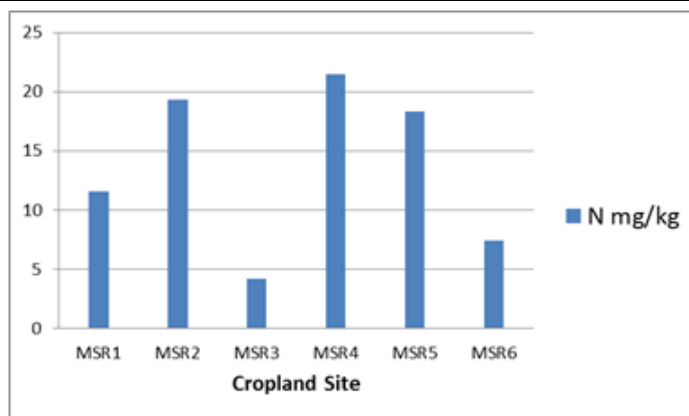


Figure26. Nitrogen Concentration of soil in Cropland Area of Maihar City

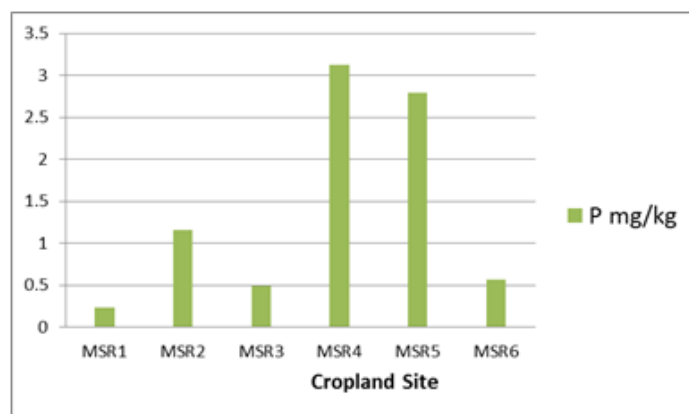


Figure27. Phosphorus concentration of soil in Cropland Area of Maihar City

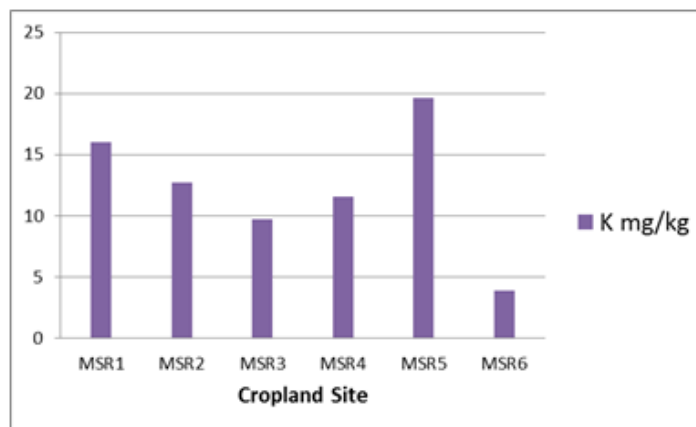


Figure28. Potassium concentration of soil in Cropland Area of Maihar City

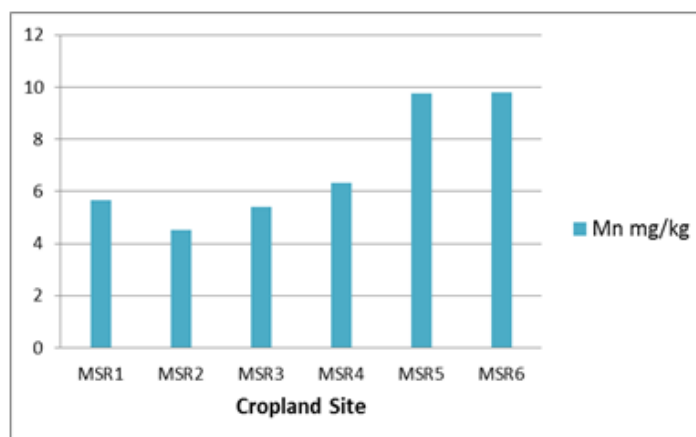


Figure29. Magnesium concentration of soil in Cropland Area of Maihar City

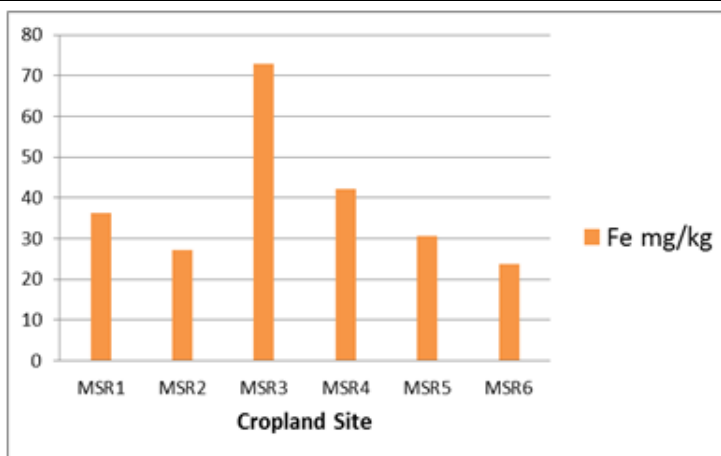


Figure30. Iron concentration of soil in Cropland Area of Maihar City

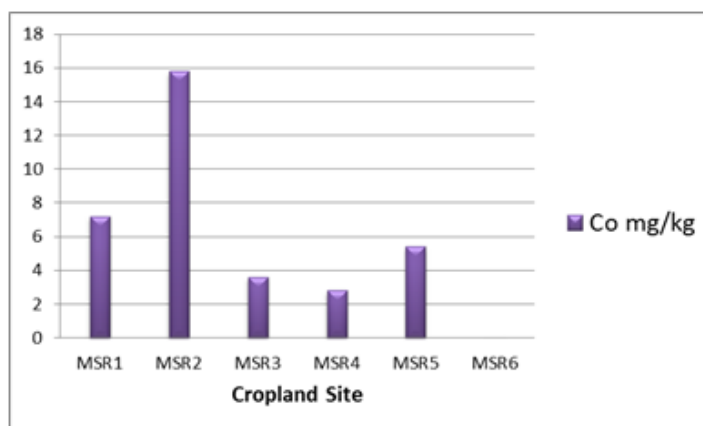


Figure31. Cobalt concentration of soil in Cropland Area of Maihar City

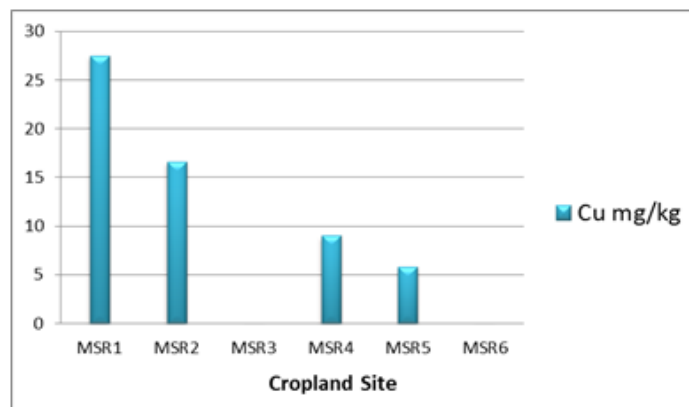


Figure32. Copper concentration of soil in Industrial Area of Maihar City

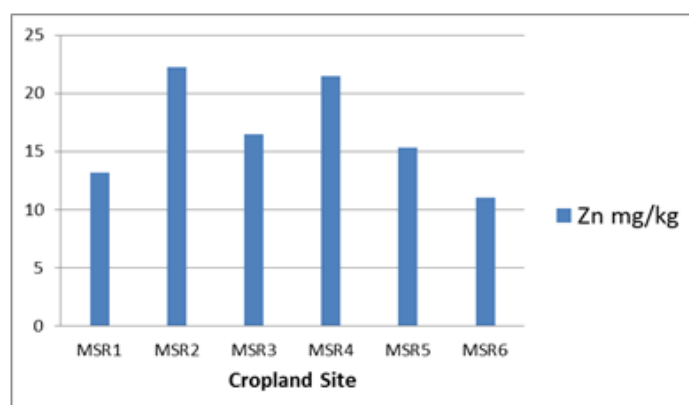


Figure33. Zinc concentration of Soil in Industrial Area of Maihar City

4. CONCLUSIONS

Fifteen Soil samples were collected from Maihar city. Laboratory tests such as Temperature, pH, EC, N, P, K, Mn, Fe, Co, Cu and Zn etc were performed for the analysis of soil samples. All the results are compared with soil quality standard. Temperature, pH, EC, N, P and K were found to be within the SQGL recommended level. Cobalt concentration at sampling station (MSI₁) KJS cement Plant, (MSI₂) Birla Gold Cement plant, (MSR₃) Maharaja Agrasen chouk , (MSC₂) near kherva railway crossing are found more than the SQGL recommended Level. Copper concentrations were found at all the sampling station were below the recommended level except (MSI₁) KJS cement plant and (MSI₂) Birla gold cement plant. From obtain results it is suggested to monitor the soil quality and assess periodically to prevent the further contamination.

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