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Assessment of Physico-Chemical Quality of Soil in Rewa District of Madhya Pradesh

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Abstract: *The aim of this study was to examine the physico-chemical properties and heavy metals in soil of Rewa District. Rewa is a town state of Madhya Pradesh, India. Rewa lies between 24° 18′ and 25° 12′ north latitudes and 81° 2′ and 82° 18′. Various soil quality parameters were analyzed by using standard procedures. The readings were taken with the help of Atomic Absorption Spectrophotometer (AAS).Iron and Zinc of all the soil samples were below the recommended level (Iron 380 mg/kg and Zinc 200 mg/kg) prescribed by SQGL value.*

Keywords: *Soil Quality, Physico- chemical Parameters, Rewa District, Madhya Pradesh*

1. INTRODUCTION

Rewa is a town state of Madhya Pradesh, India. Rewa lies between 24° 18′ and 25° 12′ north latitudes and 81° 2′ and 82° 18′. It is also known as the land of white tigers. Industries included oilseed milling and cement manufacturing. There are three large cement industries, which are one of the largest in the country. The district is bounded on the north by UP On the east and south east by Sidhi, on the South by Shahdol and on the west by Satna. Metals that have been shown to be essential for plants, that lower forms of animal life and even other mammals, but essentiality for humans has not been convincingly demonstrated. The yield of crop depends on fertility and presence of micro nutrients and heavy metals in the soil [1]. Metals are widely found in nature, particularly in various mineral deposits and soil, meaning that they are available to be taken up by plants and animals that serve as food sources for humans. Heavy metals occur naturally in the ecosystem with large variations in concentration. In modern times, anthropogenic sources of heavy metals, i.e. pollution, have been introduced to the ecosystem. Living organisms require varying amounts of heavy metals. Iron, cobalt, copper, manganese, and zing are required by humans. Excessive levels can be damaging to the organism. Other heavy metals such as mercury, plutonium, and lead are toxin metals and their accumulation over time in the bodies of animals can cause serious illness. Certain elements that are normally toxic are, for certain organisms or under certain conditions, beneficial. Heavy metal toxicity can result in damaged or reduced metal and central nervous function, lower energy levels, and damage to blood composition, lungs, kidneys, liver, and other vital organs. Recent studies have shown that chemical used in agriculture, industry households and for personal care are making their way in to the environmental and that many of them are suspected endocrine disruptors [2].

The industries are located very close to human population and clearly indicate decrease in fertility and presence of various metals. The heavy metal soil contamination from mining and smelting creates a wide spectrum of hazards. Adverse environmental impacts from contaminated mining sites include risk to human health, Phytotoxicity, contamination of soil, and eco-toxicity [3].The aim of this study was to examine the physico-chemical properties and heavy metals in soil of Rewa district with a view to establish the contamination status of the soils a result of anthropogenic input. Soil samples were collected from crop land area, residential area and Industrial area in various sampling stations of Rewa district.

2. MATERIAL AND METHODS

2.1. Sample Collection

Soil samples were collected from industrial area, Residential area, and Crop field area of Rewa district during the month of March and April 2015. For testing the soil sample were collected in different

sterile plastic container cans from each station. After collection of the sample the containers were tightly capped and were immediately transported to the laboratory to avoid any unpredictable changes in the physio-chemical characteristics. Sample should be collected in clean and dry containers, and container should be rinsed thoroughly before collection of sample. Stopper the container after collection of the sample. Various soil quality parameters were analyzed by using standard procedures [4-5].

2.2. Digestion of Soil Samples for Heavy Metal Analysis

Preparation of Soil sample for heavy metal analysis- Sieving of the soil was completed with the help of 0.5mm sieves and was dried for 24 hours after drying it was made cool at room temperature. After drying soil was digested with HNO_3 and distilled water, the reading were taken with the help of Atomic Absorption Spectrophotometer (AAS).

Table1. *Sampling point and its code number*

S.No.	sampling points	Sampling area	Depth in cm.	Description of sampling points
1	Near Ramnanda higher secondary school Rewa (SC-1)	Crop area	15cm	Near Duari village Rewa
2	Laxmanpur village (SC-2)	Crop area	15cm	Near junior high school Laxmanpur rewa
3	Govt. higher secondary school Majhgawa (SC-3)	Crop area	15cm	Behind Govt. higher secondary school Rewa
4	Sagra village (SC-4)	Crop area	15cm	Front of police station Sagra Rewa
5	Near hospital Sagra village, Rewa (SC-5)	Crop area	15cm	Near hospital Sagra, Rewa
6	Near Sanskrit college Bichiya Rewa (SR-1)	Residential area	5cm	Bichiya residential area Rewa
7	Shilpi plaza Rewa (SR-2)	Residential area	5cm	Near Pili kothi Rewa
8	Railway station Rewa (SR-3)	Residential area	5cm	Near railway station Rewa
9	Sanjay Gandhi hospital Rewa (SR-4)	Residential area	5cm	Near first gate SG hospital Rewa
10	Bharat petroleum Padara, Rewa (SR-5)	Residential area	5cm	Road side of Bharat petroleum Padara, Rewa
11	JP cement plant Rewa (SI-1)	Industrial area	10cm	Main gate JP cement plant Rewa
12	Birla Kevil plant Chorahata, Rewa (SI-2)	Industrial area	10cm	Near Vindhya ITI institute Chorahata,Rewa
13	Bela cement plant Maddepur, Rewa (SI-3)	Industrial area	10cm	Near main gate Bela cement plant Rewa
14	Gun factory Rewa (SI-4)	Industrial area	10cm	Front of main gate gun factory Rewa
15	Vindhya telelinks Ltd. Navbasta Rewa (SI-5)	Industrial area	10cm	Main gate of Vindhya telelinks Navbasta Rewa

Tabel2. *Physico -chemical properties of Soil samples collected from different sampling station of Rewa District all the result are shown*

Parameters	**Crop and area**					**Residential area**					**Industrial area**					**Mean**	**S.D**	**C.V**
	SC1	*SC2*	*SC3*	*SC4*	*SC5*	*SR1*	*SR2*	*SR3*	*SR4*	*SR5*	*SI1*	*SI2*	*SI3*	*SI4*	*SI5*			
sTEMP.^{O}C	24.0	26.0	25.0	24.0	26.2	25.0	29.1	26.0	24.0	27.0	28.0	27.2	30.5	28.2	26.5	26.447	1.935	7.316
PH	7.4	7.6	6.5	7.8	7.7	6.1	7.3	7.4	8.3	8.5	7.9	8.0	8.4	6.3	7.6	7.520	0.730	9.710
EC m mhos/cm	0.27	0.13	0.29	0.19	0.32	0.28	0.05	0.31	0.02	0.25	0.35	0.22	0.45	0.33	0.25	0.247	0.113	45.781
Ni mg/kg	5.9	ND	11.3	36.5	ND	13.7	19.8	11.5	52.4	17.2	66.5	15.2	56.9	4.7	21.5	25.623	21.089	82.305
Fe mg/kg	63.5	45.1	37.4	42.3	27.5	64.2	42.4	81.4	65.8	34.2	154.0	65.3	76.0	52.5	43.2	59.653	30.538	51.192
Pb mg/kg	5.0	7.3	3.8	8.4	17.3	9.1	22.4	6.5	35.2	27.8	54.6	42.6	66.4	23.5	32.3	24.147	19.190	79.474
Cu mg/kg	14.2	ND	23.2	39.4	ND	29.6	22.8	16.1	73.6	69.5	88.9	38.2	53.0	32.6	44.6	41.977	26.139	62.270
Zn mg/kg	2.1	4.2	5.6	7.2	5.6	8.3	6.0	3.1	7.02	9.4	6.0	8.4	15.6	4.2	7.4	6.675	3.194	47.849

Table3. *SQGL Value for soil*

Parameter	SQGL Value in mg/kg
Ni	50
Fe	380
Pb	140
Cu	63
Zn	200

3. RESULTS AND DISCUSSION

In the present study soil samples were collected from Rewa District. Soil samples were subjected for the analysis of physical and chemical parameters, like temperature, pH, electrical conductivity, and heavy metal (Nickel, Iron, Lead, Copper and Zinc). Analyzed samples data were show in **table-2** and graphical representations of data were show in **figure 1-4**. The SQGL values of physico-chemical parameters shown in **table-3.**

3.1. Physico-Chemical Analysis

In the present investigation the temperature ranged between 24^{o}C to 30.5^{o}C, the highest temperature (30.5^{o}C) was recorded in (SI_3) Bela cement plant while the lowest value (24^{0}C) was observed in (SC_1) Ramnanda higher secondary school Duari Rewa. The pH of all the soil samples varied from 6.1 to 8.5, the highest pH was observed 8.5 at sampling location (SR_5) Bharat petrolium Rewa and the minimum value 6.1 (SR_1) Bichiya areas. The mean value of pH was the found 7.52 are shown in **table-2.** Tripathi et al, 2014[6] Studies of Physico chemical characteristics of soil in Shahdol District of Vindhya platue and reported the temperature was observed to be 28.64 ^{0}C to 42.28 ^{0}C. PH was observed ranged from 6.4 to 8.4. Tripathi et al, 2015[7] determined of soil in Sidhi District and reported the pH concentration of soil is 5.6 to 8.4. The electrical conductivity of the range from 0.02 to 0.45 m.mhos cm^{-1}, the highest electrical conductivity was recorded 0.45 in (SI_3) Bela cement plant. Mandal et al, 2010[8] studied Nagpur soil and recorded EC 0.21 to 0.49 mhos/cm.

3.2. Heavy Metal

The heavy metal concentration in the soil samples of Rewa district with their means, standard deviations and coefficient variation are presented in table-2 Nickel content was found range from 4.7 to 66.5 mg /kg. The highest (66.5 mg /kg) nickel was observed in (SI_1) J P cement plant while the lowest (4.7 mg /kg) nickel was observed in (SI_4) Gun factory Rewa. Iron concentration was observed range between 27.5 to 154.0 mg /kg. Tripathi et al, 2015 [9] Studied the heavy metal analysis of soil sample collected from around Satna district and reported Iron content range between 59.7 to 157.2 mg/kg . Lead concentration range between 3.8 to 66.4 mg/ kg the highest lead was observed in (SI_3) Bela cement plant area. All Lead content of the entire sample were below the recommended level Govil et al, 2008 [10] studied contamination of katedan industrial of Hyderabad and reported the lead content 0.5 mg/ kg to 140 mg/ kg. Cupper concentration was found range between 14.2 to 88.9mg /kg. Values of Cupper content at sampling location(SI_1) J P cement plant (88.9 mg /kg), (SR_4) near Sanjay Gandhi hospital (73.6 mg /kg) and (SR5) Bharat petrolium Padara Rewa (69.5 mg /kg) are higher than the SQGL recommended level value as 63 mg/kg. Kumar et al 2012 [11] worked on heavy metal pollution assessment in industrial area soil of Mysore city and reported copper concentration ranged from 16.0-20.3 mg/kg. Zinc concentration range between 2.1 to 15.6 mg /kg. The highest zinc (15.6) was observed in (SI_3) Bela cement plant while the lowest value of zinc was observed (2.1) in (SC_1) Duari Rewa. Chahal et al, 2014 [12] studied evaluation of heavy metals contamination and its genotoxicity in agricultural soil of Amritsar, Punjab, India reported the zinc content range from 73-320 mg/kg.

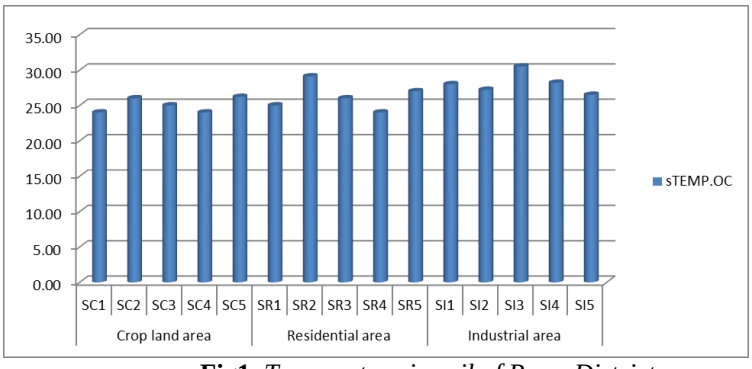

Fig1. *Temperature in soil of Rewa District*

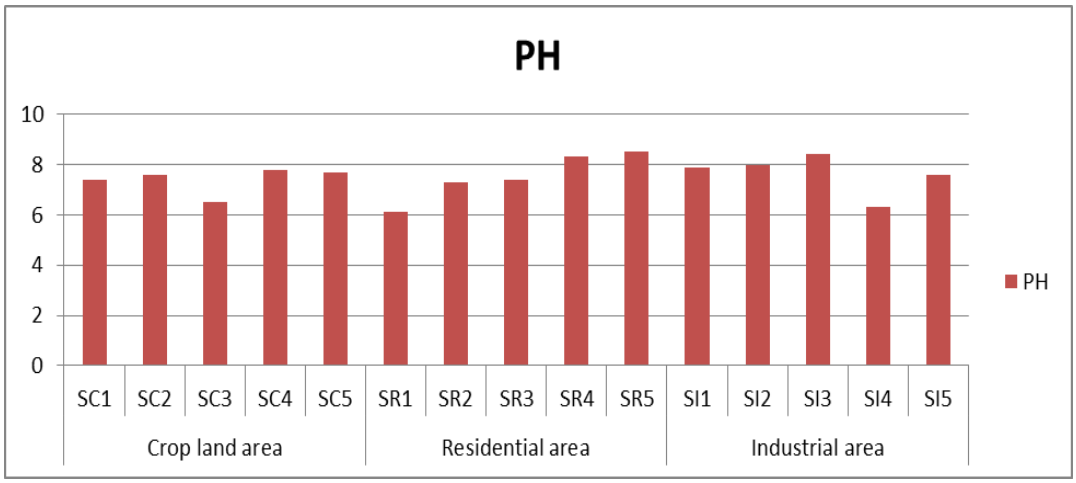

Fig2. *pH concentration in soil of Rewa District*

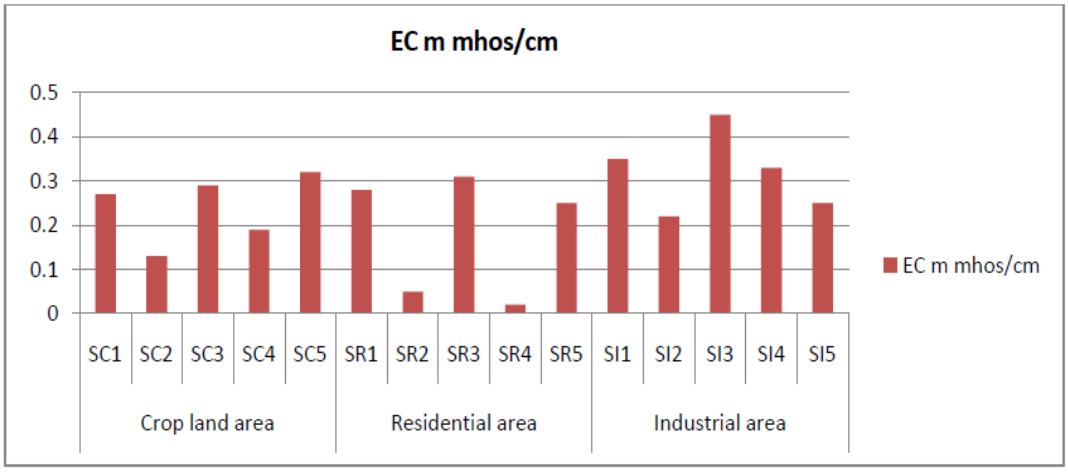

Fig3. *EC presented in soil of Rewa District*

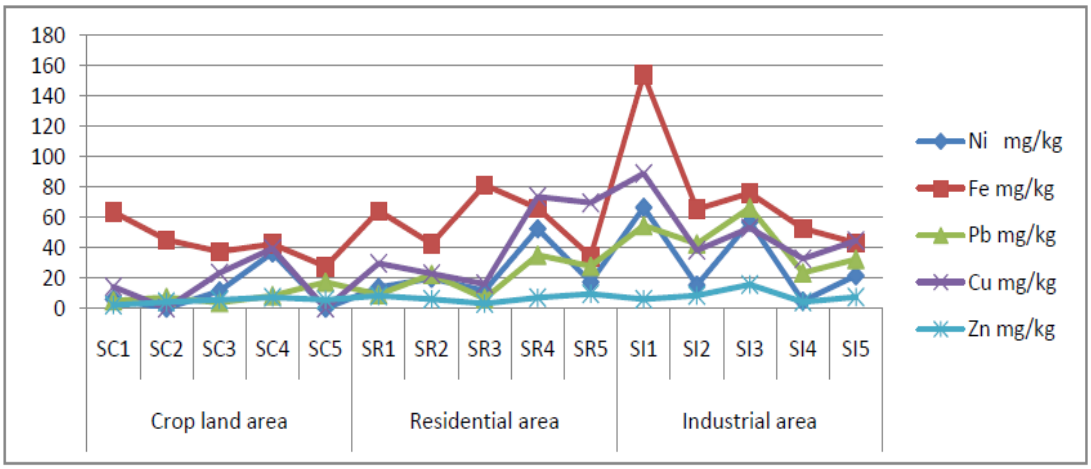

Fig4. *Metal content in soil of Rewa District*

4. CONCLUSION

Fifteen soil samples were collected from three different area of Rewa District. The values ranges of different parameters temperature (22 to28 c) pH-7.60 to8.80, EC 0.69 to3.20, Fe- 27.5 to154.0 mg/kg, Cu-14.2 to 88.9mg/kg and Zn 2.1 to 15.6 mg/kg were found in soil of Rewa district. Iron and Zinc of all the soil samples were below the recommended level (Iron 380 mg/kg and Zinc 200 mg/kg) prescribed by SQGL value. Nickel and Copper values were observed at sampling station SI1 (J.P. cement plant) and SR4 (Sanjay Gandhi Hospital) are higher than the SQGL value. The results confirm the sources of contamination to be anthropogenic from Industrial, urban and other anthropogenic activities in Rewa soil which has lead to the contamination of soil in the study area.

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