AN ANALYTICAL ASSESSMENT OF MACRO AND MICRO NUTRIENT OF SOIL OF INDUSTRIAL REGION OF BILHA, BILASPUR DISTRICT (C.G.) INDIA

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ABSTRACT

The aims of this paper are analytical assessment of macro and micro analysis of soil sample. The two methods can be used qualitative and quantitative analysis for soil quality assessment. The macro elements were analyzed in laboratory are pH, N, P, S and K by physio-chemical parameters. And the micro elements such as Cu, Zn, Fe, Mn concentrations in (ppm) were estimated by Atomic Absorption Spectroscopy. After analyzing the mean values were found to be 7.7 for pH showing acidic nature of the soil. The AAS results are elevated levels of Iron (Fe) while others such as Cu, Mn, Zn were within the permissible standards of WHO. The levels of heavy metals were found to decrease in the order of: $Fe > Mn > Zn > Cu$ in soil sample collected from Bilha region of Bilaspur, Chhattisgarh.

Keywords: Macronutrients, Micronutrients, Physico-chemical analysis, AAS

INTRODUCTION

The soil forms the intermediate zone between the atmosphere and the rock cover of the earth [1]. Soil is largely a non-renewable resource and it provides the basis of ecosystems by performing many key environmental, social, and economic functions: food production (99%), nutrient and water cycling [2]. The chemistry of soil indicate that it contain several chemical components ranging from organic to inorganic compounds [3]. Heavy metals are natural constituents of the Earth's crust because they cannot be degraded or destroyed and persistent in all parts of the environment and in trace amount they are essential, but their elevated level causing harmful impact on living organisms via entering into the food chain [4, 5]. Macronutrients (N, P and K) and Micronutrients (Fe, Mn, Zn, and Cu) are important soil elements that control its fertility. The goal of soil sampling was to develop a representative estimate of the average nutrient needs for a field [6]. That serves as a natural medium for plants growth and other developmental activities [7]. Analysis of soil is carried out for the studies of various parameters like total Organic Carbon, Available Nitrogen (N), Phosphorus (P_2O_5) and Potassium [K_2O], pH [8]. And micronutrients like Fe, Mn, Zn, Cu are only easily accessible in acidic situation. Sometimes these nutrients also cross the toxic limit and high concentrations leads to toxic effects on plants [9]. Analytical spectroscopic techniques have a wide range of application to characterize different kind of materials. Atomic absorption spectrometry (AAS) is a mature analytical method for elemental determinations of elemental metals. The concentrations of four metals i.e. Cu, Zn, Mn and Fe were determined in by using AAS methods [10-13].

MATERIAL AND METHOD

 Study Area-

In the present work North & South two sides of a steel company has been selected **(Figure 1)**. Which is situated in Bilha block of Bilaspur district in Chhattisgarh.

Collection of soil sample and sampling–
Total 12 soil samples were collected from different distance at two direction **(Figure 2)**. These samples were dried at room temperature and grind in powder form and analyzed in the laboratory for the analysis of different physico-chemical properties. Soil samples were collected at 1- 100 meter distance in (South, North) two directions **(Figure 3)**.

Figure 1: Study Area

Figure 2: Soil Sample (10 m, 20 m)

Figure 3: Sample for Analysis

Chemical analysis-

The soil samples were dried for about 24 hr. and grinded more finely. In this work about different physico-chemical parameters and nutrients of soil samples were determined and results were also recorded **[14]**.

Following methods were used for estimation of various parameters are:

1. Determination of Color of Soil- by viewing soil.

2. Determination of Nitrogen (N) - Alkaline permanganate method.

3. Determination of phosphorus (P) - Olsen's method.

4. Determination of potassium (K) - Flame photometer / Neutral ammonium acetate method.

5. Determination of pH: by Digital pH Meter.

6. Determination of Micro component - AAS (Atomic absorption Spectrophotometer).

7. (Zinc, Iron, copper, Manganese) ppm

RESULT AND DISSCUSSION

The pH value measures the ratio of H^+ ions to OH^- base ions in the soil. If the soil solution has more H^+, the soil is acidic. If the OH- dominates, the soil is alkaline. The equal balance between them is neutral and its

value 7.0. Brady found that a pH range of 6.5 to 7.5 is optimal for plant nutrient availability. pH value is ranges 7.21-7.93 (Average: 7.7) in the different soil sample. The pH of the tested soils showed they were from medium acidic to slightly alkaline.

The Most of the soil sample show. Potassium was higher range in almost sample of soil. N, P, S is middle range. Excess of **Sulphur** will direct effect on the plant **(Table 2)**.

Four elements Mn, Fe, Cu and Zn were determined in 12 soil samples .Atomic absorption spectroscopy (AAS) technique has been used to achieve the aim of detection and quantitative analysis of heavy metal content in soil.

Statistical data of concentrations of metals Fe, Mn, Zn and Cu determination by AAS (All values are in ppm unit).

The result of present study indicates the significant correlation between physicochemical characters and metal concentrations **(Table 1, 2, 3, 4)**. They show varying range of micronutrient **(Table 5, 6)**. Generally, Cu was found to be in the medium category while Zn was generally high. However, the soils contained Fe and Mn above the critical limits for crop production and categorized "High".

Table 1: Analysis of pH value of soil sample

Sample	N-1	N-2	N-3	N-4	N-5	N-6	S-1	S-2	S-3	S-4	S-5	S-6
pH	7.61	7.29	7.49	7.49	7.57	7.77	7.42	7.61	7.66	7.62	7.38	7.70

Table 2: Standard value of macronutrient in soil (kg/hect)

Primary element	L	M	H	VH
Phosphorus (P)	<	12.5-25.0	<	-
Potassium (K)	<	135-320	<	-
Sulphur (S)	<	10.0-32	<	-
Nitrogen (N)	<	280-540	<	-

Table 3: Macro nutrient analysis of soil samples (N- Direction)

S. No.	Sample	Available sulphur (S)	Available Nitrogen (N)	Available pottasium (K)	Available phosphorus (p)
1	N-1	63	250	623	11.648
2	N-2	18.75	263	1184	10.752
3	N-3	16.25	238	869	11.648
4	N-4	17.50	451	859	10.752
5	N-5	22.50	250	715	15.232
6	N-6	103.75	137	756	15.232

Table 4: Macro nutrient analysis of soil samples (S- Direction)

S. No.	Sample	Available sulphur (S)	Available Nitrogen (N)	Available pottasium (K)	Available phosphorus (p)
1	S-1	81.25	163	456	9.856
2	S-2	41.25	163	487	7.168
3	S-3	103.75	125	783	6.272
4	S-4	118.75	175	787	4.48
5	S-5	83.02	137	665	3.58
6	S-6	85.12	150	1123	8.064

Table 5: Micronutrient analysis of soil sample (N- Direction)

S. No.	Sample name	Fe	Mn	Zn	Cu
1	N-1	13.71	6.384	2.982	1.443
2	N-2	11.93	3.193	1.529	1.443
3	N-3	27.35	12.11	2.930	1.728
4	N-4	9.360	9.751	2.783	3.386
5	N-5	13.71	6.104	2.619	2.220
6	N-6	14.64	2.490	2.368	3.231

Table 6: Micronutrient analysis of soil sample (S- Direction)

S. No.	Sample name	Fe	Mn	Zn	Cu
1	S-1	3.472	0.731	0.444	0.764
2	S-2	3.612	0.781	1.658	1.210
3	S-3	1.650	2.817	1.477	1.184
4	S-4	0.995	5.053	1.364	1.080
5	S-5	4.033	1.786	1.529	1.624
6	S-6	3.612	1.761	1.347	1.192

CONCLUSION

The significant correlation found between physico-chemical parameters and metal concentration implies responsibility of phyto-toxicity. Which has been used as baseline information for the further analysis of the impact of these metals on macro and micronutrient in soil of Area. This study may be useful for quantitative analysis and monitoring the levels of metal concentrations in the soil samples which are particularly useful for the purpose of information related to the genesis of soil and also to check the level of contamination.

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