



# An investigation on changing of chemical and physical properties of soil in iron mines area of India 931

Vijay Sahu<sup>a\*</sup>, Dr. V. Muruges<sup>b</sup>, G V Rathnamala<sup>c</sup>, Vinoth Periyasamy<sup>d</sup>,  
L. Ramesh<sup>e</sup>, Ashwini R M<sup>c</sup>

<sup>a</sup>Department of Physics, Dr. CV Raman University, Bilaspur, C.G.495113, India

<sup>b</sup>Department of Civil Engineering, JCT college of engineering and technology, Coimbatore, India.

<sup>c</sup>Department of Civil Engineering, GITAM School of Technology, GITAM Deemed to be University, Bengaluru campus, Karnataka.

<sup>d</sup>Department of Civil Engineering, Galgotias College of Engineering and Technology, Greater Noida, India.

<sup>e</sup>Department of Electronics and Communication Engineering, M.Kumarasamy College of Engineering, Karur, Tamilnadu.

<sup>c</sup>Department of Civil Engineering, GITAM School of Technology, GITAM Deemed to be University, Bengaluru campus, Karnataka.

\*Email: [vijaysahuphy@gmail.com](mailto:vijaysahuphy@gmail.com)

**Abstract**— The features and properties of the soil can be greatly affected by the influence and activities of the industries and products related to it. This factor may impact on the quality of soil and its level of the fertility. In this context, this research paper has evaluated the chemical and physical characteristics of the soil in the Dantewada region for evaluating and assessing the fertility and chemical ratio status. Ten soil samples have been collected from different industrial location to analyzing the physical properties like soil texture, porosity, density and chemical properties like Na, Ca, K, Mg and available micronutrients (Fe, Zn, Cu and Mn). The assessment of the soil quality of the industrial area can help to identify the impact of the industrial wastes on soil and based on those specific measures can be taken. Thus, in the following way this research aims to aid the impact on the soil erosion and pollution to enhancing the crop productivity.

**Index Terms**— Impact, physicochemical properties, productivity, soil

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## Introduction

Soil is one of the essential resources of nature where all living things are indirectly and directly relay for fulfilling day to day needs. For this reason, this is important to make plans for developing healthy and growing soil for mankind. However, in current days the growing industries raised the amount of wastage that effectively pollutes the soil along with other natural properties. Due to this factor, soils are getting highly affected especially in the industrial areas and besides locality [1]. In order to understand this fact in-depth, this paper is going to evaluate the physical properties of the soil by taking the soil sample from Dantewada and the other four blocks. From the sample, this paper has executed the textural analysis of the soil where the percentage of the Sand, Silt and Clay has been calculated. Thus, in the following process, this paper is going to provide a broad knowledge on physical properties analysis and soil testing.

**Aim:** Aim of research article Analysis of agricultural land soil physical & chemical properties

## I. LITERATURE REVIEW

### Assessing the industrial influence on changing of physical and chemical properties of soil

Physical and chemical properties often deteriorate the condition of the soil due to mishandling and misuse of the land. The waste materials discharge through industrial activities causes adverse effect on the soil and its organic matter. On the basis of the test result, it has been found that soil pollution is developed rapidly due to the regular fall of cement dust [2]. Such dust particles effectively result in the formation of the gels of cal. Illuminate and cal. Silicate. The cement dust produced by the cement industries is considered one of the most hazardous pollutants for the soil which spread adverse effects on the surrounding environment. The main disadvantage of such activities is that it enters

into the soil as dry, occult the deposition and possibly can undermine the physical and chemical properties of the soil. It is to be noted that the change in the chemical and physical properties of soil leads to infertility that may result in a negative impact on the agricultural purpose.



**Fig. I. Changing of Physical and chemical properties of the soil**  
(Source: [3])

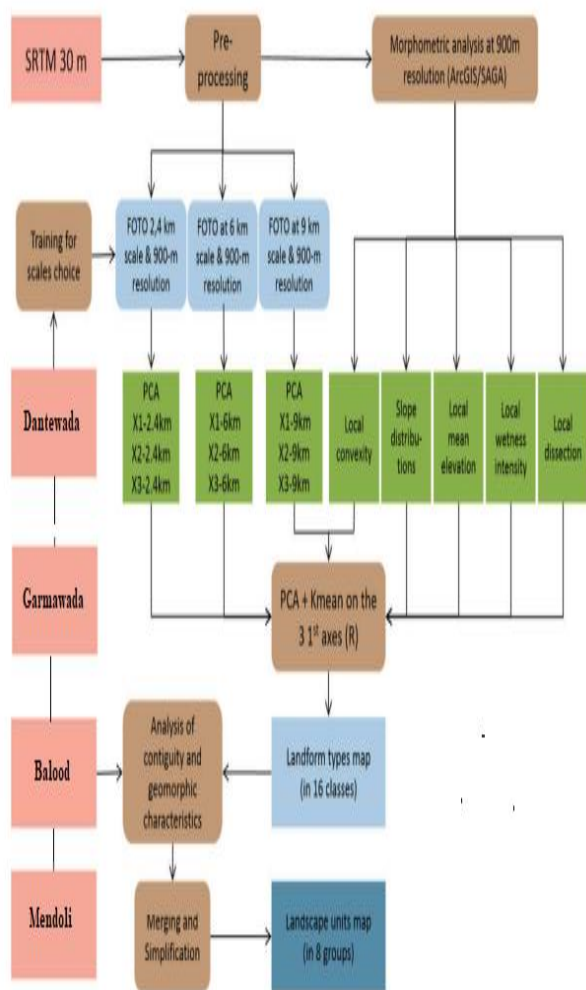
Fig. I. has demonstrated diverse reasons for changing the physical and chemical properties of soil. Due to such practices the overall health of the soil is getting hampered. In this context for studying on this



factor in depth, this study is going to perform textural analysis of the soil.

### Textural analysis of regional landform and landscape mapping

Availability of the higher technology and digital elevation models (DEM) helps to improve the spatial resolution that has been triggered interest in texture-based methods. By following the same, this paper has taken a *Shuttle Radar Topography Mission* (SRTM) to perform multiscale texture analysis [7]. This process could help to develop a spatially coherent mapping that may help to extract more knowledge from the test result.



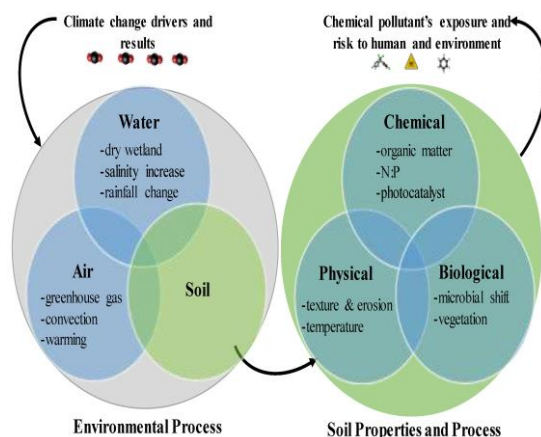
**II. Workflow of the study**  
 (Source: Created by the researcher)

The above figure has demonstrated the workflow of the study where SRTM 30 is commonly used for making the textural analysis by using FOTO algorithm. As per (Fig. I), synthetic textural variables are analyzed with physiographic criteria for building up and interpreting a map of 5 classes of texture can be demonstrated.

## II. MATERIALS AND METHODS

### Study Area

Dantewada is a district in the Indian state of Chhattishgarh. It has several industries near 18.9000°N 81.3500°E latitude and 81 D-20°37" E longitude. Dantewada city is situated on the riverbank of Dankini and Shankani rivers [4]. As per [4], major of the economy of Dantewada is depends on agro-based industries. Therefore, from this point, it can be understood that the soil quality of the chosen area plays an important role in the growth of agriculture. However, the waste products and chemicals from the up growing industries are making the soil infertile and unsuitable for agriculture. In this context, the researchers have taken a few samples from the vicinity of the industrial soil and agricultural soil in the study area.



**Fig. III. Property changing factors of soil**  
 (Source: [4])

The above figure has demonstrated both natural ways and human activities for changing the properties of the soil. However, it is to be noted that the changes of the property is not occur in same ratio at everywhere. Therefore, in order to accessing the quality of the soil of a particular location, soil sampling is the only effective way.

### Soil sampling Location in the study area

Soil sample was taken at 150 250 mm in depth from different blocks, such as *Dantewada*, *Katekayal*, *Geedam*, *Kuaakonda* and *Bade Bachel*. From these areas, three types of soil have been collected from Dantewada, such as

- Red Sandy Soil (Local name -Tikra) “plateau of Bastar”
- Red Loam Soil
- Laterite Soil (Local Name - Bhata)

### Laboratory Name

The reliability and efficiency of the testing are often varied based on the available tester of the laboratory and the proficiency of the lab experts. In such cases, it became mandatory to disclose the name of the laboratory from whether the test results are obtained. The discloser of the laboratory name helps to maintain transparency and authenticity [5].

1. “Department of soil science & agricultural chemistry “Indira Gandhi Krishi Vishwavidyalaya Krishak Nagar, Raipur Chhattisgarh
2. Govt. Soil Test Centre Bilaspur Chhattisgarh



III. ANALYSIS AND INTERPRETATION

TABLE I: PHYSICAL PROPERTIES

S.No.	Location	Textural Analysis			Soil Properties				
		Sand (%)	Silt (%)	Clay (%)	Textural Name	Particle Density	Maximum water holding capacity (%)	Bulk Density	Porosity (%)
<b>Block- Dantewada</b>									
01.	Dantewada	40	24	36	Clay Loam	2.64	54.80	1.46	44.64
02.	Gamawada	50	22	28	Clay Loam	2.62	52.33	1.48	43.52
03.	Balood	60	20	20	Loam	2.58	45.42	1.52	41.09
04.	Mendoli	50	16	34	Clay Loam	2.65	53.84	1.46	44.81
<b>Block-Katekayal</b>									
05.	Bade-Lakhapal	60	28	12	Silty Loam	2.61	48.71	1.52	41.78
06.	Gaatam	70	12	18	Sandy Loam	2.56	39.60	1.54	39.85
<b>Block -Geedam</b>									
07.	Geedam	72	12	16	Sandy Loam	2.55	40.51	1.52	41.04
08.	Karli	80	6	14	Sandy Loam	2.58	41.86	1.52	41.04
09.	Haaram	76	12	12	Loamy Sand	2.53	34.63	1.52	39.89
10.	Barsoor	82	6	12	Loamy Sand	2.51	35.23	1.52	39.50
<b>Block- Kuaakonda</b>									
11.	Kuaakonda	42	18	40	Clay Loam	2.65	54.76	1.45	45.29
12.	Jabeli	36	34	30	Silty Clay Loam	2.65	55.26	1.45	45.26
<b>Block-Bade Bachel</b>									
13.	Bade-Bachel	56	18	26	Loam	2.60	46.05	1.52	41.43
14.	Bachel	52	18	30	Clay loam	2.64	53.26	1.48	43.90
15.	Kirandul-02	82	8	10	Loamy Sand	2.55	38.00	1.52	40.28

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Table 1 has demonstrated the physical properties of the soil based upon the location. From the block of Dantewada, total of four location has been chosen, such as *Dantewada*, *Gamawada*, *Balood* and *Mendoli*. After execution of the physical analysis of the soil, 40% Sand, 24% Silt and 36% clay has been found from Dantewada. The textural name of the sample soil of the same location is Clay

Loam. Maximum of water holding capacity is 53% that is indicating the soil has adequate properties for plant growth and reproduction. However, in order to measure the level of fertility of the soil, the chemical properties are need to take under the consideration. In this context, the available chemical properties of the soil has been demonstrated below.

TABLE II. CHEMICAL PROPERTIES

S L · N O ·	LOCT ATIO N	p H V a l u e	E C	O C	Macronutrients				Micronutrients					
					d S m · 1	%	N	P	K	S	Zn	B	Fe	Mn
<b>DANTEWDA BLOCK</b>														
1	DANT EWAD A	5 · 8 M A c	0 · 9 N	0 · 9 0	188. 00L	8.96 L	212. 00M	8.7 5	0.3 71	5. 0	7.7 1	12.5 2	1 · 6 3 2	
2	GAMA WAD A	5 · 6	0 · 4	0 · 9 0	275. 00M	20.6 0M	201. 00M	15. 00	1.2 91	4. 0	14. 69	11.2 5	1 · 0 0 3 S	
3	BALO OD	5 · 7	0 · 4	0 · 4 5	351. 00M	13.4 4M	145. 00L	8.7 5D	0.2 31 D	4. 0 D	8.3 1S	12.8 2	1 · 5 6 S	
4	MEND OLI	6 · 1	0 · 4	0 · 9 0	175. 00L	7.16 L	145. 00L	10. 0L	0.2 65	6. 0S	1.2 36 D	10.3 6	2 · 3 6 9	
<b>KATEKALYAN BLOCK</b>														



5	BADE LAKH APAL	6 · 6	0 · 8	0 · 9 0		<b>250 L</b>	<b>14.3 3M</b>	<b>403 H</b>	<b>8.7 5D</b>	0.5 32 D	2. 0S	7.8 10S	12.0 1S	2 · 5 3 2 S
6	GAAT AM	5 · 9 M A c	0 · 4 N	0 · 1 5 V L		<b>213 L</b>	<b>20.6 0M</b>	<b>313 M</b>	<b>12. 50S</b>	1.1 6S	4. 0S	15. 70S	13.2 0D	1 · 7 0 S
<b>GEEDAM BLOCK</b>														
7	GEED AM	6 · 5 M A c	0 · 6 N	0 · 6 0 M		<b>200 L</b>	<b>8.96 L</b>	<b>268 M</b>	13. 75S	1.7 02S	7. 0S	11. 35S	41.5 4S	1 · 9 0 0 S
8	KARLI	7 · 6 M A I	0 · 5 N	0 · 9 0 H		<b>200 L</b>	<b>7.16 L</b>	<b>291 M</b>	10 D	1.2 2S	4. 0S	11. 85S	33.2 5S	1 · 6 9 8 S
9	HAAR AM	6 · 2 M A c	0 · 7 N	0 · 9 0 H		<b>213 L</b>	<b>10.7 5L</b>	<b>257 M</b>	11. 25S	0.7 20S	3. 0S	31. 75S	23.0 5S	0 · 6 9 8 S
10	BARS OOR	6 · 8 S I A c	0 · 3 N	0 · 7 5 M		<b>313</b>	<b>16.1 2</b>	<b>326</b>	13. 7	0.3 36 D	7. 0S	16. 36S	11.2 3S	2 · 3 3 6 S
<b>KUAAKONDA BLOCK</b>														
11	KUAK ONDA	7 · 1 M A I	0 · 2 N	0 · 3 0 V L		<b>313 M</b>	<b>11.6 4M</b>	<b>201 M</b>	21. 25S	1.2 80S	3. 0S	8.2 10S	9.17 0S	0 · 6 4 0 S

1 2	JABEL I	5 9 M A c	0 8 N	0 4 5 L		<b>363 M</b>	<b>11.6 4M</b>	<b>201 L</b>	11. 25S	1.2 00S	8. 0S	12. 60S	31.0 1S	0 5 6 5
<b>BLOCK BADE-BACHELI</b>														
1 3	BADE- BACH ELI	5 2 M A c	0 5 N	0 3 0 V L		<b>200 L</b>	<b>13.4 4M</b>	<b>268 M</b>	12. 50S	0.6 42S	4. 0S	30. 44S	13.8 1 S	2 2 0 1 S
1 4	BACH ELI	6 3 M A c	0 6 N	0 4 5 L		<b>225 L</b>	<b>13.4 4M</b>	<b>257 M</b>	11. 25S	0.3 02 D	6. 0S	23. 45S	30.8 8S	1 3 3 5 S
1 5	KIRA NDUL -02	6 8 M A c	0 6 N	0 4 5 L		<b>238 L</b>	<b>10.7 M</b>	<b>257 M</b>	13. 75 D	1.2 13S	5. 0S	16. 41S	11.3 1S	1 4 7 7 S

#### IV. DISCUSSION AND FINDINGS

On the basis of their findings, it has been noticed that the researchers have found both physical properties and chemical properties of the soil. In order to assess the physical properties a total of five blocks has been considered. The first block is the Dantewada, where 4 locations have been considered. First location is Dantewada where the particle density is 2.64 and the maximum water holding capacity is 54.80. The level of the porosity of the soil of this location is 44.64. On the other side in Gamawada, the available sand, silt and clay percentage is 50, 22 and 28 respectively. In this area the texture of the soil is again clay loam. The particle density  $\rho$  of the soil of this area is 2.62 while the porosity is 43.52. Hence, from this analysis it can be said that in the block Dantewada, the level of porosity of the soil is almost similar in each area.

Moreover, in case of Katekayal, fifth and sixth location has been chosen (e.g. Bade Lakhpal and Gaatam). In this region two kind of soil are commonly available, such as silty loam and Sandy loam. The level of puru city of this area is 41.78% and 39.85% respectively. This value is comparatively lower than Dantewada. Hence, from this one it can be said that the water holding capability of Gaatam and Bade Lakhpal area is lower.

Table II has demonstrated the chemical properties of the soil of five different blocks. The soil of each block has different levels of the macronutrients such as Nitrogen (N), Phosphorus (P), Potassium (K), Sulfur (S) and micronutrients Zinc (Zn), Boron (B), Iron (Fe), Manganese (Mn), Copper (Cu) [6]. As per the test report, Gamawada has a higher nutrient value in comparison of Dantewada. From this factor, it can be understood that continuous soil pollution is negatively affecting the quality of soil and making changes in both physical and chemical states. On the other side, in the area of the Block bade bachel, the soil of Kirandul-02 has higher macronutrients and micronutrients value in comparison to Bachel and bade-bachali [7]. After analyzing the test result, it can be understood that the pH level of the soil is getting varied based on the deposition of chemical additives like harmful pollutants.

Macronutrients and Micronutrients in the soil is one of the crucial requirements for plant growth. While on the other side, the combination of macronutrients and micronutrients give the soil its optimum health [8]. By considering this factor, this study has been developed by focusing on the physical and chemical properties of the soil, especially in the vicinity of the industrial area [8]. As per the above discussion, it has been found that Dantewada is an agro-based area where more than 80% of finance depends on agriculture. Hence, it is important to maintain fertility by minimizing the soil impact due to industrial activities like iron ore mining by National Mineral Development Corporation (NMDC).



## V. CONCLUSION

Conclusively, the soil testing technique is an effective process where the macronutrients and micronutrients value can be calculated. Based on this factor, both the physical and chemical state can be assessed that further help to understand the fertility of the soil. Hence, depending upon this factor it's become easier to suggest farmers how to treat soil properly to make it healthier for crops. Moreover, through this process, the impact of the industrial waste on the soil also can be detected that further may help to reduce soil pollution by enhancing awareness. In this study, both the physical and chemical states of the soil from the different areas have been discussed. Moreover, the researchers also show the difference in soil quality between farming soil and soil vicinity to the industrial area. From this differentiation, the basic agenda of this study has been fulfilled.

## VI. FUTURE SCOPE

Soil testing is important for diversified reasons. Starting from crops growth optimization to environment protection, everywhere quality of the soil plays a leading role. Hence, the data from this study may help in future to improve the quality of the soil by implementing soil development strategies. Moreover, the presented data also may help in the further research on the same topic in the coming future that may help other researchers.

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