EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 9
Issue: 5
241-246
Year: 2022

EVALUATION OF THE IMPACTS OF MINING ACTIVITY ON SOIL ENVIRONMENT AND HUMAN HEALTH

Divya J., Vasudha Ranjan*[1] and Kiran T.[2]

Assistant Professor, Department of Environmental Science, JSS Academy of Higher Education and Research, Mysore-15.
[1]Research Scholar, Department of Environmental Science, JSS Academy of Higher Education and Research, Mysore-15.

***Corresponding Author: Vasudha Ranjan**
Research Scholar, Department of Environmental Science, JSS Academy of Higher Education and Research, Mysore-15.

Article Received on 26/02/2022 **Article Revised on 16/03/2022** **Article Accepted on 06/04/2022**

ABSTRACT
Mining activity is one of the anthropogenic sources of environmental pollution. During the present investigation, a composite soil samples were collected around the National Mineral Development Corporation (NMDC) mining area from 08 locations to evaluate the soil quality. From the present investigation, it has been found that, the pH and Electrical conductivity of the soil samples found to be within the normal range. In all the soil samples, higher percentage of organic carbon was observed compared to the normal range**.** Calcium concentration was found to be within the normal range. In all the soil samples magnesium, potassium concentration was found to be higher than the normal range. From the analysis, it was found that, in some of the soil sampling locations around the National Mineral Development Corporation mining area, the soil pH was found to be acidic which indicates impact of mining activity on soil pH. Considerable management options are needed to control the deterioration of soil quality. From the survey of mining workers, it was reported that, the majority of the mining workers are suffering from respiratory problems and mining related accidents. From the overall investigation, it was observed that, proper environmental and health system management is required in order to prevent further environmental degradation and occupational health hazards.

KEYWORDS: Mining, Health effects, Soil Quality and NMDC.

I. INTRODUCTION
Mining is a process of extraction of minerals from ore. The mining process commercially received wider attention due to its greater economic importance. Apart from its beneficial effects, it has got significant negative impacts on environment and the mining workers. Many researchers are stated that, mining activity results in deterioration of original land scape, contamination of water resources, reduction in soil quality and health related problems of mining workers. Based on the above concept, an attempt has been made to evaluate the environment quality and health impacts to mining workers in National Mineral Development Corporation. This industry in located in Bellary which mainly involves in the exploration of wide range of minerals such as iron, copper, rock phosphate, lime stone, dolomite, gypsum, bentonite, magnesite, tin, tungsten, graphite, beach sand etc. The present study aims to evaluate the soil quality in an around National Mineral Development Corporation (NMDC) mining area and survey of health impacts of mining activity on mining workers. The present study has been conducted with the fallowing objectives:

- To collect the information about the mining area
- To analyses the soil quality around the national mineral development corporation mining corporation
- To understand survey regarding occupational health related aspects of mining workers
- To correlate between mining activity and health of mining workers
- To identify the possible effect of mining activity on soil environment

II. MATERIALS AND METHODS
Brief history of the study area: National mineral development corporation (NMDC) was established in 1958 by Government of India as a fully owned public enterprise. The company is under the administrative control of the ministry of steel, Government of India. It involved in the exploration of wide range of minerals such as Iron Ore, Copper, Rock Phosphate, Lime stone, Dolomite, Gypsum, Bentonite, Magenesite, Diamond,

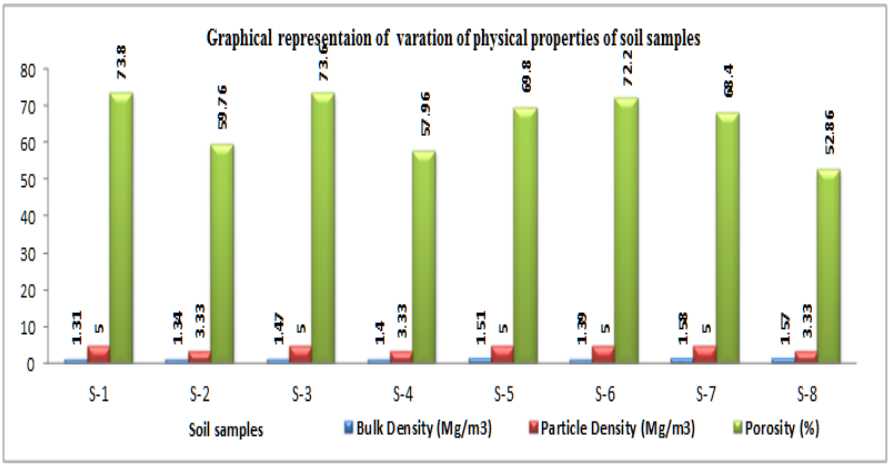
Tin, Tungsten, Graphite, Beach Sands, etc. NMDC is India's largest iron producer and exporter, presently it is producing more than 30 million tonnes of iron ore from three fully mechanized mines such as, Bailadila Deposit - 14/11, Bailadila Deposit-5, 10/11A (Chhattisgarh State) and Donimalai Iron Ore Mines (Karnataka State), which are awarded ISO 9001-2000 certification. The company has made valuable and substantial contribution to the national efforts in mineral sector. During the last five decades and has been accorded the status of schedule-A Public Sector Company. In recognition to the company's growing status and consistent excellent performance, it has been categorized by the Department of Public Enterprises as 'Navaratna' Public Sector Enterprise in 2008.

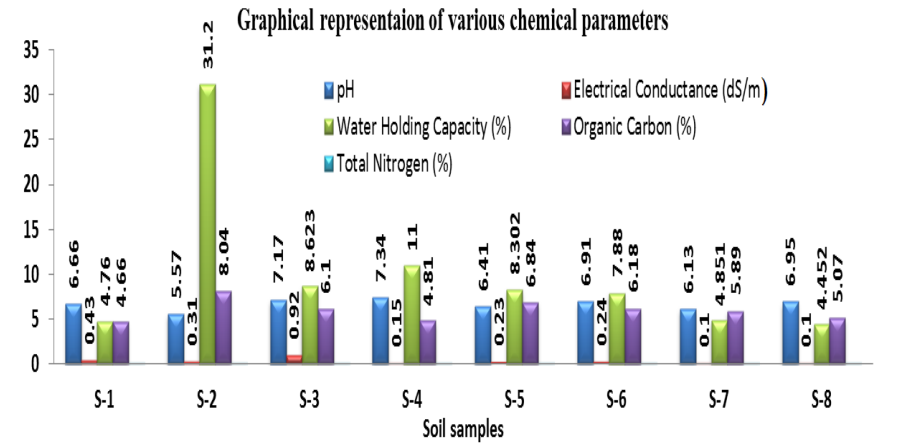
The Operating Mines are as fallows.
Bailadila iron ore mine Kirandui Complex, Bailadila iron ore mine, Bacheli Complex, Donimalai iron ore mining., Panna diamond ore mining.
Collection of soil samples: A composite soil samples were collected around the National Mineral Development Corporation mining area at different locations in 0-15 cm depth. After collection the soil samples were air-dried, ground and sieved through 2mm sieve and stored in polythene bags until the analysis.
Analysis of soil samples: The soil samples were analyzed for pH, Electrical conductivity, organic carbon, water holding capacity, calcium, magnesium, potassium, sodium, total nitrogen, bulk density, particle density, porosity.
Experimental work: The soil pH was measured in 1:5 soil/water suspensions using the glass electrode pH meter. The Electrical conductivity of the soil extract was determined by using conductivity meter. The organic carbon was determined by was potassium dichromate wet oxidation method The total nitrogen was determined by kjeldhal distillation method and The sodium and potassium concentrations were determined by flame photometry and the estimation of calcium and magnesium was done by EDTA titrimetric method and the bulk density and particle density were determined by volumetric flask method.

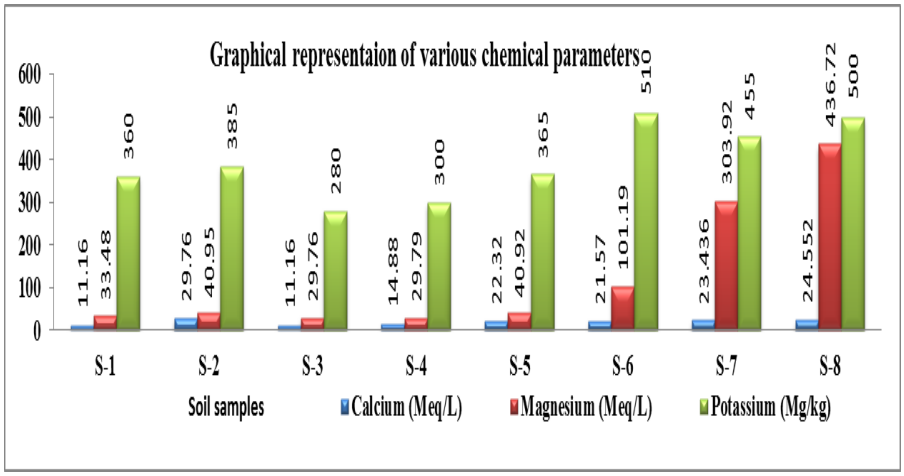
III. RESULTS AND DISCUSSIONS

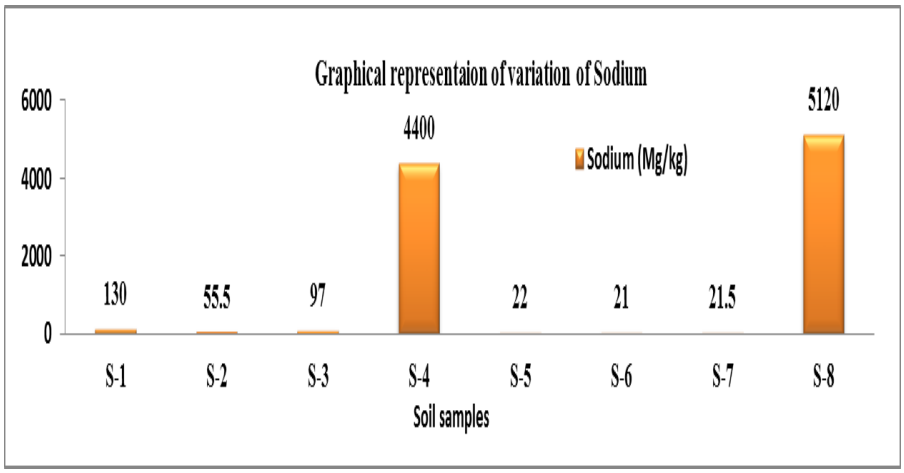
Table I: Soil analysis results.

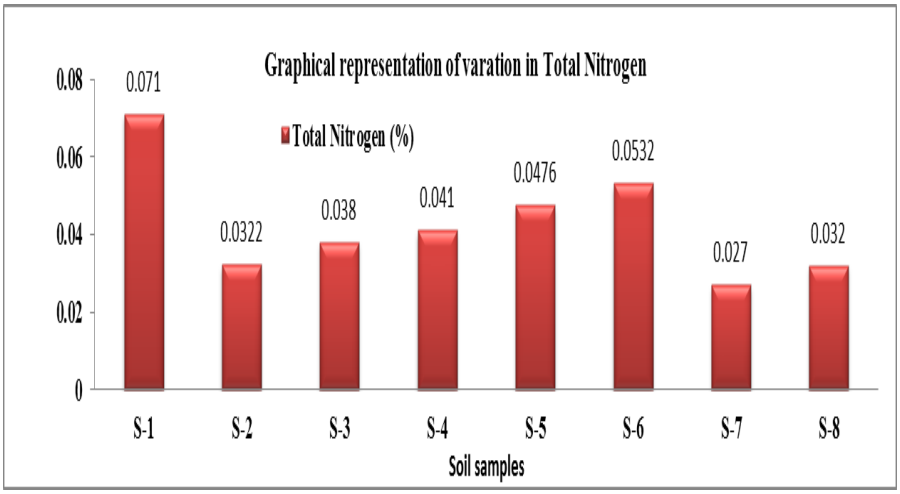
Parameters	Units	Normal Range	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8
Bulk Density	Mg/m^3	1-1.65	1.31	1.34	1.47	1.40	1.51	1.39	1.58	1.57
Particle Density	Mg/m^3	2-2.65	5	3.33	5.0	3.33	5	5	5	3.33
Porosity	%	30-55	73.8	59.76	73.6	57.96	69.8	72.2	68.4	52.86
pH		6.5-7.5	6.66	5.57	7.17	7.34	6.41	6.91	6.13	6.95
Electrical Conductance	ds/m	0-2	0.43	0.31	0.92	0.15	0.23	0.24	0.10	0.10
Water Holding Capacity	%		4.76	31.2	8.623	11	8.302	7.88	4.851	4.452
Organic Carbon	%	0.50-0.75	4.66	8.04	6.10	4.81	6.84	6.18	5.89	5.07
Calcium	Meq/L	10-30	11.160	29.760	11.160	14.880	22.320	21.57	23.436	24.552
Magnesium	Meq/L	5-10	33.48	40.95	29.76	29.79	40.92	101.19	303.92	436.72
Potassium	Mg/kg	50-125	360	385	280	300	365	510	455	500
Sodium	Mg/kg	40-160	130	55.5	97	4400	22	21	21.5	5120
Total Nitrogen	%		0.071	0.0322	0.038	0.041	0.047	0.0532	0.027	0.032




Graphical representaion of various chemical parameters
pH
Electrical Conductance (dS/m)
Water Holding Capacity (%)
Organic Carbon (%)
Total Nitrogen (%)
35
30
25
20
15
10
5
0
6.66
0.43
4.76
4.66
5.57
0.31
31.2
8.04
7.17
0.92
8.623
6.1
7.34
0.15
11
4.81
6.41
0.23
8.302
6.84
6.91
0.24
7.88
6.18
6.13
0.1
4.851
5.89
6.95
0.1
4.452
5.07
S-1
S-2
S-3
S-4
S-5
S-6
S-7
S-8
Soil samples


Graphical representaion of various chemical parameters
600
500
400
300
200
100
0
11.16
33.48
360
29.76
40.95
385
11.16
29.76
280
14.88
29.79
300
22.32
40.92
365
21.57
101.19
510
23.436
303.92
455
24.552
436.72
500
S-1
S-2
S-3
S-4
S-5
S-6
S-7
S-8
Soil samples
Calcium (Meq/L)
Magnesium (Meq/L)
Potassium (Mg/kg)


Graphical representaion of variation of Sodium
6000
4000
2000
0
130
55.5
97
4400
22
21
21.5
5120
Sodium (Mg/kg)
S-1
S-2
S-3
S-4
S-5
S-6
S-7
S-8
Soil samples



DISCUSSIONS

Bulk density: The present study on soil samples shows a bulk density range from 1.31 to 1.58 mg/m^3. Higher bulk density values were recorded in S.[7] Lower bulk density values were recorded in S.[1] In comparison with the normal bulk density range of soil, it was found that, the bulk density of all the samples was found to be within the normal range. Bulk density is related to total porosity or pore space present in the soil for air and water movement. Lower bulk density implies greater pore space and improved aeration, developing a suitable environment for biological activity.

Particle density: The present study on soil samples shows a particle density range from 3.0 to 5 mg/m^3. Higher particle density values are recorded in S,[1,5,6] and S.[7] In comparison with the normal particle density range of soil, it was found that, the particle densities of all the samples were found to be higher than the normal range. High particle density indicates the presence of rich iron in soils ex: ferromagnesian mineral density range from 2.9 to 3.5 mg/m^3 and the density of iron oxides and other heavy minerals can exceed 5 mg/m^3.

Porosity: The present study on soil samples show a porosity range from 52.86 to 73.8%. Higher porosity values were recorded in S.[1] Lower porosity values were recorded in S.[8] In comparison with the porosity range of soil, it was found that, the porosity of all the samples were found to be higher than the normal range. The pore space of soil varies with respect to soil texture, shape of individual soil particles, organic carbon content.

pH: The present study on soil samples shows a pH range from 5.57 to 7.34. Higher pH values were recorded in S.[4] and lowest pH values were recorded in S[2,5 and 7] In comparison with normal pH range for soil, it was found that, except in S,[2,5 and 7] the pH of all other soil samples were found to be within the normal range and it is lime free and it is satisfactory for cultivation of selective plants.

Electrical conductivity: The present study on soil samples shows an electrical conductivity ranges from 0.10 to 0.92 ds/m. higher electrical conductivity were recorded in S[3] and lowest electrical conductivity values were recorded in S[7 and 8] In comparison with the normal range, the electrical conductivity values were found to be within the normal range.

Water holding capacity: The present study on soil samples shows a value range from 4.45 to 31.2%. Higher water holding capacity was recorded in S[2] and lowest water holding capacity was recorded in S.[8] High water holding capacity indicates the presence of high pore space present in between the soil particles which helps to retain more amount of water.

Organic carbon: The present study on soil samples shows an organic carbon range from 4.66 to 8.04%. Higher organic carbon was recorded in S[2] and lowest organic carbon values were recorded in S[1] In comparison with normal range, it was found that, the percentage of organic carbon in some of the soil samples was found to be higher. The high organic carbon is due to the accumulation of crops residues on the soil surface.

Calcium: The present study on soil samples shows calcium ranges from 1.16 to 29.76 meq/L. Higher calcium were recorded in S[2] and lowest calcium were recorded in S[1] and S[3] In comparison with the normal range of soil samples the calcium concentrations were found to be within the normal range. In soil the negatively charged nitrate ions carry positively charged basic cations, such as calcium, magnesium, sodium and potassium in order to maintain the electrical charges on the soil particles. The depletion of the basic cations will accelerate the acidification process in soil which is another reason for decreases in soil pH.

Magnesium: The present study on soil samples shows a magnesium range from 29.7 to 436.72 meq/L. Higher magnesium was recorded in S[8] and the lowest magnesium values was recorded in S.[3] In comparison with the normal range of soil samples the magnesium

concentration were found to be higher than the normal range.

Potassium: The present study on the soil samples shows a potassium range from 280 to 510 mg/kg. Higher potassium was recorded in S[6] and the lowest potassium value was recorded in S.[3] In comparison with the normal range of soil samples, the potassium concentrations were found to be higher than the normal range.

Sodium: The present study on soil samples shows a sodium range from 21 to 5120 mg/kg. Higher sodium values were recorded in S[8] and the lower sodium values were recorded in S.[6] In comparison with the normal sodium range of the soil, it was found that, the sodium concentration of the soil samples were found to be within the normal range except S[4] and S.[8]

Total nitrogen: The present study on soil samples shows a total nitrogen range from 0.027 to 0.071%. Higher total nitrogen values were recorded in S.[1] Lower total nitrogen values were recorded in S[7] in comparison to the normal range of total nitrogen in the soil.

IV. SUMMARY AND CONCLUSIONS

The results of the present study involve analysis of soil samples in and around National Mineral Development Corporation. Totally eight soil samples were collected in around NMDC mining corporation to evaluate the soil quality and impacts of mining activity on health of mining workers from the analysis following observation were made.

1) Most of the soil samples found to be acidic in nature.
2) Electrical Conductivity was found to be within the normal range.
3) The soil sample has got good water retention capacity.
4) In all the soil sample the organic carbon percentages was found to be higher.
5) In case of magnesium and potassium it was found to be higher than the normal range.
6) In case of sodium except samples S[4] and[8] in rest of the soil samples the values were found to be within the normal range.
7) From the survey of mining workers, it was found that, most of the mining workers frequently affected with mining accidents, injuries, skin burn problems and respiratory related diseases, so effective management strategies are required in order to prevent environmental degradation as well as to improve the health of mining workers.

Survey results of occupational health hazards of mining workers

From the survey of hazards of mining workers following observations were made. The survey methods are implemented to collect information regarding health effects of mining workers during their shift wise work. For the survey, questionnaires have been prepared and supplied to the selected employees to get desired information.

Apart from questioners direct interviews were also conducted and some literature reference materials were also collected from the concern person. From the overall survey following observation were made.

1) Employers work in shift wise.
2) To provide safety to the employers, safety equipment has been supplied but which is not up to the mark.
3) Some people/workers are frequently affected with health issues at the work such as transportation, processing and other mining activities.
4) While processing of minerals some workers were affected with leg fractures during breaking of metal pieces.
5) While loading of ores some workers affected with head injuries.
6) While moving of heavy machines such as dumpers a death of two persons has been reported.

V. Suggestions

From the survey of mining workers, it was observed that, majority of the mining workers in the study area are suffering from respiratory problems and mining related accidents. From the overall investigation, it was found that, proper environmental and health management is required in order to prevent further environmental degradation and occupational health hazards.

REFERENCES

1. Aawaar G. The Economic Impact of Mining Sector Investment in Ghana, Undergraduate Dissertation, Faculty of Social Sciences, Kwame Nkrumah University of Science and Technology, 2006.
2. Ahanger Faroz Ahmad, Sharma Harendra K. Rather Mukhmoor Ahmad and RJ. Impact of mining activities on various environmental attributes with specific reference to health impacts in shatabdipuram, Gwalior, India. International journals of environmental science, 2004; 3(6): 81-87.
3. Akabzaa T. and Darimani A. Impact of Mining Sector Investment in Ghana: A case study of the Tarkwa Mining Region, A Draft Report, 2001.
4. Alday J.G., Marrs R.H., and Martinez- Ruiz, C. Vegetation succession on reclaimed coal wastes in Spain, the influence of soil and environmental factors. Applied Vegetation Science, 2011; 14: 84-94.
5. Anderson J.M., and Ingram, J.S.I. Tropical soil biology and fertility. A handbook of methods. Oxford University Press, USA, 1992; 2.
6. Aryee B. "Ghana's Mining Sector: Its Contribution to the National Economy. Resources Policy, 2001; 27.
7. Awudi B.K., the Role of Foreign Direct Investment (FDI) in the Mining Sector of Ghana and the Environment, 2002.
8. Bahrami, Emadodin I Atashi, M.R., and Bork, H.R. Land-use change and soil degradation: a case study,

North of Iran. Agriculture and biology Journal of North America, 2010; 4: 600-605.
9. Banerjee S.K, Das, P.K., and Mishra T.K. Microbial and nutritional characteristics of coal mine overburden spoils in relation to vegetation development. Journal of Indian Society and Soil Science, 2000; 48: 63-68.
10. Baruah B.K, Baruah, S.Kalitha, and SK Choudhury, Impact analysis of opencast mining on land use /land cover using remote sensing and GIS techniques in ledo, Imperial Journal of Interdisciplinary Research, 2016; 2, (8).
11. Beukes J, Mukhopadhyay J, and Gutzmer J, Genesis of high-grade iron ores of the Archean iron ore group around Noamundi, India. Economic Geology, 2008; 103: 365-386.
12. Gevorg Tepanosyan, LilitSahakyan, OlgaBelyaeva Shushanik Asmaryan Armen Saghatelyan, Continuous impact of mining activities on soil heavy metals levels and human health. Science of the Total Environment, 2018; 639: 900-909.
13. Leila Benidire, Loubna Benidire, Ali Boularbah, Impacts of mining activities on soil properties: case studies from Morocco mine sites. Soil Science Annual, 2020; 71(4): 395–407.
14. Paul K. Essandoh, Mohammed Takase and Isaac Mbir Bryant, Impact of Small-Scale Mining Activities on Physicochemical Properties of Soils in Dunkwa East Municipality of Ghana, The Scientific World Journal, 2021; 1-13.
15. S.R Warhate, M.K.N. Yenkie, M. D. Chaudhar and W. K. Pokale, Impacts of Mining Activities on Water and Soil, Journal Of Environ. Science & Engg. 2006; 48(2): 81-90, 326-335.