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A Comparative Study of Marble Mine in Makrana Region with Respect to Soil Pollution

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ABSTRACT

An array of operation from mines is getting increases day by day and certainly some positive and negative environmental aspects of these activities has been generated. Marble industries increases rapidly and causes soil pollution. Soil Pollution is the most direct and hazardous impact in the mining area. Makrana is a biggest Marble cluster of India. From Marble Industries slurry powder is come out from the earth and mixed with soil. Slowly soils upper strata become destroy from this slurry. To assess the the impact of mining on soil, one of the mine was selected in the Tehsil- Makrana and District-Nagaur. The study was conducted for two summer season (April, May, June) in 2013 and 2014. There is much more variation in both the results. The results shows that in the summer season 2014 the soil is much Detroit then in 2013 .Because in 2013 mining was at the initial stage but in 2014 mining was in the process it was degrade the quality of the soil, dust, stones and boulders, water (Slurry) was mixed with the soil.Thus several changes occurs in the physical, chemical and microbiological properties of soil and soil fertility gradually deteriorates year by year.

Keywords: Mining, Upper Strata, Boulders, Nagaur.

I. INTRODUCTION

Humans cannot live far apart of nature, this is the first principle of nature monitoring fans and they cannot live in nature without destruction, so it is unexpected from humans to save the nature [1]. Marble Industry is now one of the most important industries in Rajasthan.Makrana marble is a metamorphic rock. It is found in a single deposit in India. The Makrana marble is 90–98 percent $CaCO_3$ [2]. The environmental degradation of the land due to marble mining .The processing waste of marble cutting plants comes out in the form of 'Marble Slurry'. This marble slurry is being dumped by the processing plants at the nearest site available or in the notified areas marked for dumping near the plants. When this slurry dries up, it leads to serious environmental pollution. Soil is an important part of environment. Soil originates from rocks. It develops gradually by the fragmentation and corrosion of rocks and with the accumulation of organic matter. Soil formation may require 2,000 to 20,000 years but soil differentiation from the parent material may take place in a short time of 30-50 years [3]. Marble waste from quarry operations can be unsafe and environmentally detrimental. In India, million tons of wastes from marble industries are being released from marble cutting, polishing, processing and grinding and Detroit the quality of soil. Exposing the waste material to the environment directly can cause environmental problems. Therefore, many countries have still been working on how to re-use the waste materials[4]. Many kind of soil present on the earth and earlier that was pure but due to urbanization and industrializations in India so many chemical contents mixed with these soils from atmosphere.

II. STUDY AREA

Rajasthan is situated on the north-western part of India. It covers 3, 42,239 square kilometers (132,139 square miles).The study was made on one of the states of India viz Rajasthan. The study area is located about ~95 km from the Nagaur district headquarter. Dispensary, railway station and other basic amenities are available in Makarana which is around 9 km from the mining lease area.

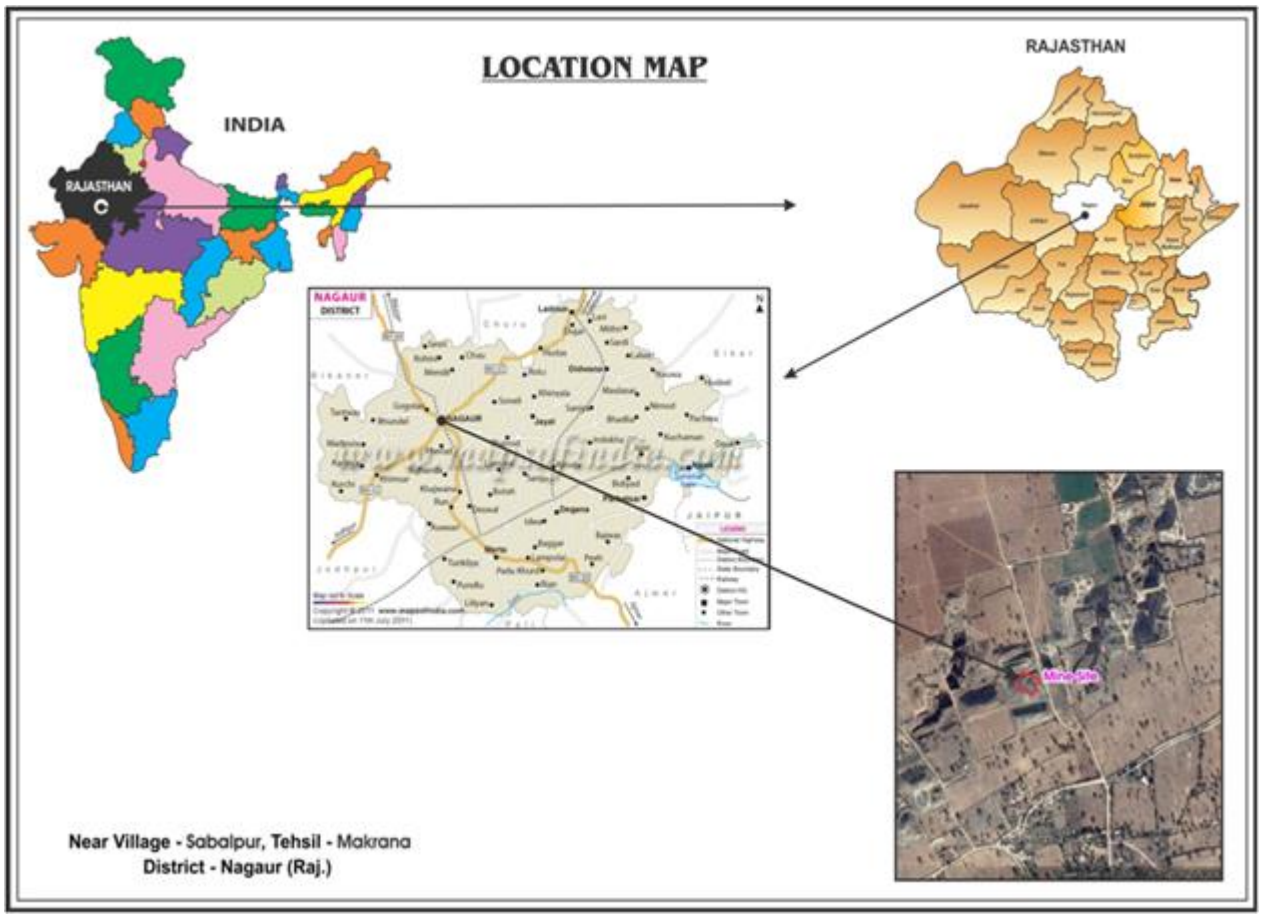


Figure 1. Showing the Location of the Study Area

III. MATERIAL AND METHOD

The study has been conducted within the buffer zone called as the study area, seven monitoring locations has been randomly selected to assess the impacts of marble mine on the soil.

To assess out the impacts of mining on the environment one mine has been selected in the Tehsil – Makrana and samples were collected and analyzed with the help of the standard methods we assessed the seasonal results of the sampling location. Sampling was done during summer season (April, May and June 2013 & 2014) for two seasons from study area. Data on concentrations were processed for different statistical parameters like arithmetic mean, minimum and maximum concentration and various percentiles values by using Analysis of Variance (ANOVA).

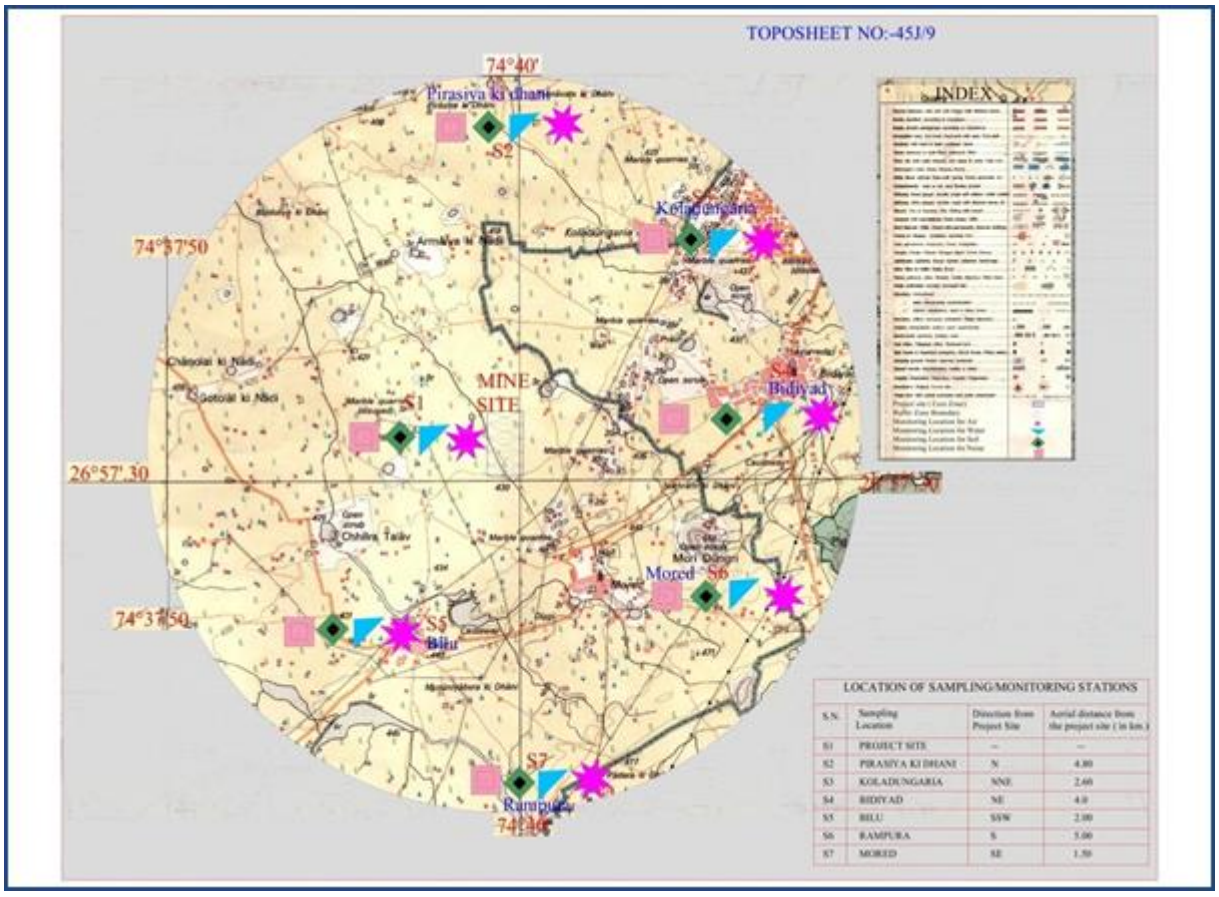


Figure 2. Key Plan showing the Sampling Location

IV. RESULT AND DISCUSSION

Baseline Environmental Data:

Environment baseline studies have been conducted during the two summer season April, May and June2013 & 2014 in respect of soil, in the core and buffer zone of 10 km radius.

Table 1. Showing the Sampling Locations in the Study Area

Sampling Station	Sampling Location	Direction from Mine site	Approx. Aerial distance from Mining Lease Boundary (in km)
S1	Project Site	-	-
S2	Village Pirosiya Ki Dhani	N	~4.80 km
S3	Village Koladungaria	NNE	~2.60 km
S4	Village Bidiyad	NE	~4.0 km
S5	Village Bilu	SSW	~2.0 km
S6	Village Rampura	S	~5.0 km
S7	Town Mored	SE	~ 1.50 km

Table 2. Soil Quality Analysis Report Study Period: Summer Season 2013

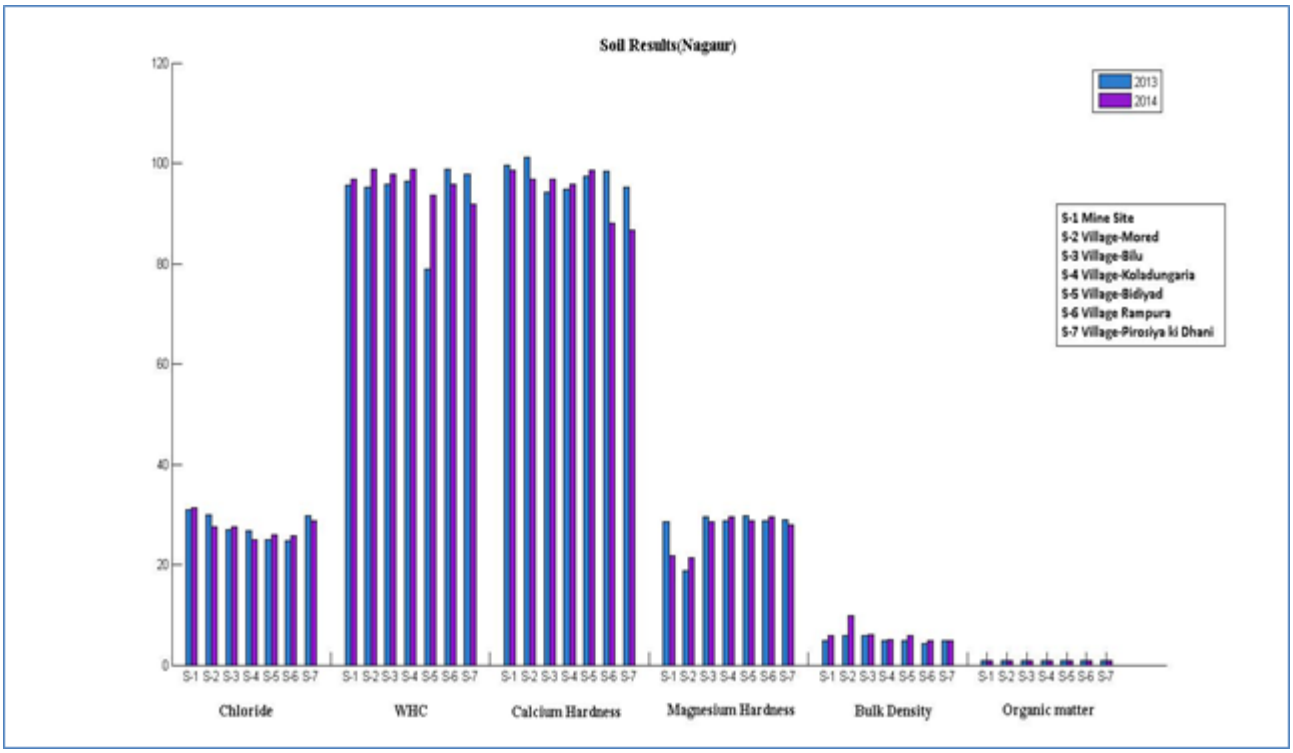
S. NO	Parameters	Mine Site	Village Mored	Village Bilu	Village Koladungaria	Village Bidiyad	Village Rampura	Village-PirosiyakiDhani
Physical Properties								
01.	pH	8.7 ±0.07	8.3±0.10	8.5±0.04*	8.3±0.21	8.4±0.20	8.4±0.11	8.7±0.23
02.	Colour	Yellowish Brown	Yellowish Brown	Blackish Brown	Yellowish Brown	Blackish Brown	Blackish Brown	Blackish Brown
03.	Bulk Density, gm/cc	3.94±0.32	4.43±0.38	4.82±0.37	3.72±0.32	3.56±0.33	3.68±0.19	4.24±0.23
04.	WHC (%)	88.05±3.05	82.37±2.85	80.85±3.99	80.14±4.81	74.14±4.91	89.78±3.12	85.46±3.82
05.	Soil Texture	Sandy Loam	Silty Loam	Silty Loam	Sandy Loam	Sandy Loam	Silty Loam	Silty Loam
Chemical Properties								
06.	Calcium as Ca, mg/100gm	94.46±2.03	88.80±4.41	79.92±5.59	82.95±7.05	85.05±4.25	85.42±3.06	83.32±3.41
07.	Magnesium as Mg, mg/100gm	17.29±2.40	15.95±0.99	20.48±2.89	25.12±1.48	24.81±2.10	25.30±1.95	22.97±1.92
08.	Chloride as Cl, mg/100gm	25.81±1.35	23.91±1.55	24.07±0.86	22.51±1.26	22.10±1.03	23.06±0.65	24.29±1.71
09.	Organic Matter (%)	0.87±0.03	0.88±0.03	0.84±0.03	0.82±0.02	0.82±0.05	0.82±0.03	0.87±0.02

Table 3.Soil Quality Analysis Report Study Period: Summer Season 2014

S. NO	Parameters	Mine Site	Village Mored	Village Bilu	Village Koladungaria	Village Bidiyad	Village Rampura	Village-PirosiyakiDhani
Physical Properties								
01.	pH	8.7 ±0.09	8.7±0.10	8.7±0.10	8.8±0.07	8.8±0.12	8.4±0.10	8.9±0.22
02.	Colour	Yellowish Brown	Yellowish Brown	Blackish Brown	Yellowish Brown	Blackish Brown	Blackish Brown	Blackish Brown
03.	Bulk Density, gm/cc	5.23±0.18	5.41±0.90	5.00±0.31	4.40±0.23	4.61±0.33	4.39±0.21	4.60±0.41
04.	WHC (%)	91.60±2.54	87.73±3.28	82.71±4.00	81.83±4.88	76.03±4.68	86.77±2.98	83.27±2.35
05.	Soil Texture	Sandy Loam	Silty Loam	Silty Loam	Sandy Loam	Sandy Loam	Silty Loam	Silty Loam
Chemical Properties								
06.	Calcium as Ca, mg/100gm	92.87±1.94	91.83±3.49	83.00±4.76	80.58±4.22	86.99±3.32	80.75±2.34	81.96±2.25
07.	Magnesium as Mg, mg/100gm	16.86±1.14	17.61±1.12	20.88±2.18	26.20±0.78	26.64±1.15	26.19±1.08	23.61±1.38
08.	Chloride as Cl, mg/100gm	26.40±1.39	24.40±1.05	25.07±0.87	23.25±1.02	22.89±0.94	24.69±0.47	24.56±1.58
09.	Organic Matter (%)	0.91±0.02	0.83±0.03	0.87±0.03	0.81±0.03	0.86±0.02	0.81±0.02	0.86±0.04

Mean ± SE (Standard Error), n=6

Figure 3. Comparative Studies Showing the Results of Soil in Summer Season 2013 & 2014



1. **Bulk Density:**Bulk Density Values were ranged in 2013 from3.56±0.33 to 4.82± 0.37 whereas in the 2014 values found from 4.39±0.21 to 5.41±0.90. In 2013 the minimum value viewed in Village- Bidiyad and maximum in the Village- Bilu was observed. In the 2014 the minimum value found in Village- Rampura and maximum value surveyed in Village- Mored**.**

2. **pH:**pH value varied in 2013 is 8.3 ± 0.21 to 8.7 ± 0.23 and and in summer season 2014 is 8.4±0.10 to 8.9±0.22. The pH value showed that marble mining Detroit the soil quality all the samples found alkaline in nature.. The minimum value observed in Village- Koladungaria and maximum value surveyed in Village- Pirasiyo Ki Dhani. From the Summer Season 2014 the minimum value observed in Village- Rampura and the maximum value in Village- PirosiyokiDhani.

3. **Chloride (Cl^-):** Chloride Values detected from 22.10±1.03 to 25.81±1.35 in 2013 and in 2014 the values varied from 22.89±0.94 to 26.40±1.39. The minimum value of Chloride was viewed in Soil sample at Village-Bidiyad and the maximum value of Chloride observed in Mine Site in both the sampling season.

4. **Calcium (Ca^{2+}):** Calcium values were observed from 79.92±5.59 to 94.46 ± 2.03 in summer season 2013. The minimum value of Calcium observed in Village-Bilu and maximum value viewed in Mine Site in Summer Season 2013 .From the 2014 the values varied from 80.58 ±4.22 to 92.87±1.94. The minimum value detected in Village – Koladungaria and the maximum observed in Mine Site.

5. **Magnesium (Mg^{2+}):** The magnesium values ranged from15.95±0.99 to 25.30±1.95 in summer season 2013 in 2014 the minimum value surveyed in 16.86±1.14 and the maximum value was found26.64±1.15. The minimum value of sample was detected in Village- Mored and maximum value was observed in Village-Rampura in 2013.In 2014 the minimum value surveyed in Mine Site and maximum value detected in Village-Bidiyad.

6. **Water Holding Capacity:** WHC Values were varied from 74.14 ± 4.91 to 89.78 ± 3.12 in 2013 and in 2014 the value ranged from 76.03 ± 1.21 to 91.60 ±2.54. In 2013 the minimum value observed in Village- Bidiyad and maximum value detected in Rampura 2013 whereas in 2014 minimum value surveyed in Village-Bidiyad and maximum observed in mine site.

7. **Organic Matter:** Organic Matter values varied in range in 2013 from 0.82 ± 0.02 to 0.87±0.03 whereas in 2014 from 0.81±0.02 to 0.91±0.02. The minimum sample was observed in Village-Koladungaria and the maximum Value viewed in Mine Site. In 2014 the minimum value surveyed in Village-Rampura and maximum observed in Mine Site.

V. OBSERVATION

From the present investigation we can observed that mining is a major cause of land pollution. Marble waste is generally left on site in the form of spoil heaps. This spoil heaps may contain a wide variety of toxic or hazardous substance which then leach into the soil due to rainfall, or are blown around by wind. This can have a great impact on the regeneration of vegetation on the site. The main impact is if the destruction of topsoil is the worst that it can turn productive land into barren land. The main cause of the mining is dust particulates and the stone crusher dust and marble slurry. From the present study we can analyze that soil sample showed that soil of the study area is highly saline sodic because of the high pH.

Chlorine is a micronutrient for plant. Plants use Chlorine in the Chloride form. Chloride are highly soluble compounds can stimulate mineralization and inhibit nitrification. Adequate chloride also helps improve resistance to many plant diseases. The chloride content in the soil found maximum in the Mine Site in both the seasons. With regards to alkalinity, due to high alkalinity the amount of bicarbonate increases which hampers the plant growth.

All soils contain some organic matter, but relatively few contain enough to be classified as organic soils. Soils have been classified as low (0.5), medium (0.5-0.75) and high organic carbon content (more then 0.75).The organic varied in the range of 0.81 to 0.91 which was the high organic content and does not support the agricultural productivity [5]

Calcium, Magnesium is macronutrients in plant nutrition. Calcium occurs in soil and plant as the divalent CationCa^{++} .The exchangeable calcium in a soil has an important relationships to soil pH and to availability of several nutrients elements. Excess calcium usually results in low solubility of other elements .The abundance of Calcium dust affects soil decreases the availability of other nutrients needed for plant growth. In the present the analyzed samples varied from 79.92 to 94.46 in Summer Season 2013 where as in summer season 2014 80.58 to 92.87.The maximum calcium content was found in near mine site sample. JyotishKatare (2013) effect of marble dust on plants in which he revealed that due to high calcium content inhibits the growth of the plants [6].

The magnesium ion, Mg^{++} is usually similar to the Calcium ion. Severe weathering, soil erosion and clay elucidations all tend to reduce the magnesium content of the surface soil. The present study the magnesium values of the analyzed samples in 2013 is from 15.95-25.30 whereas in 2014 the maximum magnesium content was found from 16.86 - 29.64.This clearly indicates that excess calcium reduces the magnesium availability.

Bulk density is the weight of soil in a given volume. Soils with a bulk density higher than 1.6g/cm3 tend to restrict the root growth. From the present investigation we have analyze that in 2013 the 3.56 to 4.82 where as in the 2014 4.39 to 5.41. This clearly states that soil results were found with a higher bulk density.

VI. CONCLUSION

Soil changes the chemical composition of soils: entering dust, rubbish, drains which create by mining and blasting cause verifying the composition of soils and decrease the quality. The main source of heavy metal contamination of soils is industrial activities. From the various physico- chemical parameters correlations shows that soil is not perfect for better growth of vegetation because the high percentage of pH and calcium is present. This means due to high salinity all parameters clearly show the soil contamination. However, we can observe from the present investigation that in summer season 2014 the soil is much Detroit then in 2013 .Because in 2013 mining was at the initial stage but in 2014 mining was in the process it was degrade the quality of the soil, dust, stones and boulders, water (Slurry) was mixed with the soil .Thus several changes occurs in the physical, chemical and microbiological properties of soil and soil fertility gradually deteriorates year by year.

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