STUDY OF PLANT GROWTH AND SOIL POLLUTION BY MARBLE SLURRY

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Abstract

Makrana is a biggest Marble cluster of India. Mining Industry has rapidly deteriorated quality of the natural wealth called as resources. Marble industries detorites the quality of soil by marble slurry called as soil Pollution. The present study was taken from the industrial site situated in Makrana. Soil texture is determined by the size of constituent particles which have been named differently by the international society of soil science. From the various industries marble slurry powder is come out from the various processes likes crushing, grinding polishing and mixed with soil. Slowly soils upper strata become destroy from this slurry. The experiment showed that there is no growth of the any inhibitors in the marble slurry. Marble slurry has the maximum content of magnesium and calcium carbonate. The quantity of phosphorous content was 5.60 ppm which was too high whereas soil had only 2.17 ppm available phosphorous. pH value of the slurry was found 9.1 and it was highly alkaline when it mix with the soil the soil also become alkaline and does not support to the vegetation and it losses the fertility.

Keywords: *marble industries, marble Slurry, soil pollution*

Introduction

Rajasthan is known as mineral majestic State as it produces more than 65 types of mineral and rocks. The State is endowed with vast deposits of natural rocks known as ―stones in local parlance and a few important ones amongst them are Granite, Marble, Sandstone, Limestone, Slate and Quartzite (MSME, 2017). Marble Industry is now one of the most important industries in Rajasthan. Rajasthan produces over 95% of the marble produced in India. The Makrana region is one of the very productive areas of Rajasthan as far as mineral wealth is concern, particularly the marble (biggest market for Marble cutting and selling), minerals (lime rocks, ceramic mineral etc.) and mineral based industries (grinding and polishing of various minerals, cement pipe making industries, chips and powder making) (CPCB, 2011-2012). Makrana is a town in the Nagaur district of Indian state of Rajasthan. Makrana is famous for the white stone as marble mined from the mines around it. Makrana is a small town, but it has plenty of marble outcrops. Most of the residents in this town work as marble miners. The town is well linked to railroads and other

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forms of transportation. Known for its white marble reserves, Makrana is a small town in Nagaur district, with a deposit of 56 million tonnes and 40,000 labourers working in 400 mines in the several ranges of the Aravallis. Makrana has various mining ranges, popularly known as Doongri, devi, Ulodi, Saabwali, Gulabi, Kumari, Neharkhan, Matabhar, Matabhar kumari, Chuck doongri, Chosira Doongri, devi, Saabwali, Ulodi, Chosira and Neharkhan are famous for white marble, whereas Ulodi is famous for Albeto Marble. These mines produce white-brown belt beautiful marble. Gulabi stands for pink plain and pink Adanga marble whereas almost all mines produce Adanga marbles with brown and grey sheds. Makrana marble is a metamorphic rock. It is a single deposit in India. The Makrana marble has 90 to 98 percent $CaCO_3$ (http://www.makranamarble.co.in/).

The environmental degradation of the land due to marble mining is much less than the environmental degradation caused by the waste from marble processing plants. 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 (Kushwah, 2014). 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 (Dhanwar, 2012). 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. Soil consist the trace elements. The term "trace elements" has never defined precisely. The term trace elements are related to their abundance and include elements of various chemical properties metals and metalloids. Although, trace elements are negligible constituents of soils, but are essential as micro-nutrients for plants. Certain trace elements like cobalt, zinc, magnese and copper are also present in the soil. Analysis results of trace elements are shown in Table 2. Trace element concentrations significantly differ among the soil groups and geographic regions (Kabata-Pendias, 2010). One example of this is marble industries in India. Makrana in Nagaur Distt. (Rajasthan) is the main area of marble industries. From these industries slurry powder (A by product of marble) is comes out and mixed with soil.

Materials and methods

Study Area

Makrana (Lat. $27^{o}02'25"$N; Long. 74°43'44" E) is situated at eastern margin of the Thar desert and has an ancient marble mining history.

The Makrana marble has made a perceptible dent in marble industry because of its block ability, whiteness, (high CaO 50-56 %, low MgO 0.90-1.77 %), good polishing character and lustre. It is fine grained and exhibits stable, well distributed colours, pleasing and attractive designs and patterns. The translucent varieties of

Makrana marbles are preferred over other marbles for monumental and sculptural work (Natani, 2001).

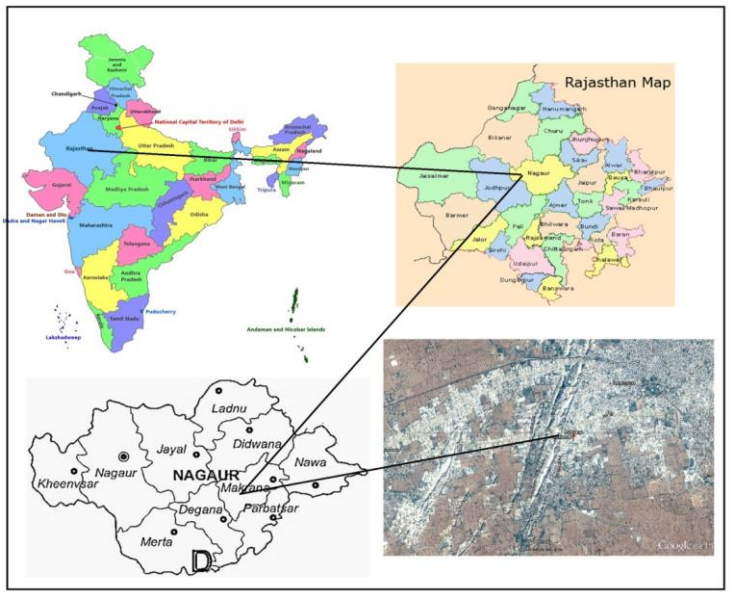

Figure1
Location map of Makrana

Soil Gravel Size

The soil texture is determined by the size of constituent particles which have been named differently by the international society of soil science. Table 1 shows the specifications of soil texture.

	S. No.	Name of Particles	Diameter of particles
(a)	1	Gravel	2.00 mm and more
	2	Coarse sand	2.00 mm to 0.2 mm
	3	Fine sand	0.2 mm to 0.02 mm
	4	Silt	0.02 mm to 0.002 mm
	5	Clay	below 0.002 mm
(b)	1	Gravel with slurry	0.1mm to 2.00 mm
	2	Coarse sand with slurry	0.1 mm to 0.2 mm
	3	Fine sand	0.20 mm to 0.02 mm
	4	Silt	0.02 mm to 0.002 mm
	5	Clay	below 0.002 mm

Table 1
(a) *Specifications of soil texture.*
(b) *List of slurry mix particles*

Soil texture: Since soil influence the flora and fauna of the area its texture is of considerable ecological interest. Soil formed with various integration of soil particles of the following main type:
Sandy soil: mainly consist of sand particles. These are loose dry and poor in nutrients. The water holding capacity of such soil is poor.

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Clay soil: Chiefly consist of clay particles. The clay particles are of colloidal dimensions. They have high plasticity and posse‘s high water holding capacity. Clay particles have very small interspaces between them so that neither water nor or can circulate freely. Such soils on getting water become water logged. Thus they are not suitable for plant growth.
Loam soil: loam soils have sand, silt and clay particles in more or less equal proportions. Such soils are the most suitable for plant growth.
Sand loam soil: Sand loam soils are those soils in which sand particles predominate.
Clay loam soil: clay loam soils have a predominance of clay particles. Both sandy and ciay loam soils are suitable for plant growth.
Silt loam soil: have predominant of silt. On getting water, silt loam becomes water logged with poor air circulation. Such soils are not suitable for plant growth.

Element	Total element in soil solution (µM)
Cobalt	< 0.006 - 0.2
Zinc	< 0.03 - 3
Manganese	< 0.03 - 68
Copper	< 0.02 - 0.6

Table 2
Analysis results of soil with reference to trace elements.

Experiment on the Growth rate of the Plants in the Makrana Area

An experiment was performed to evaluate that due to marble powder or marble slurry evalauate the growth rate of the plant (Arif et al., 2016). To perform the experiment 12 pots were taken and marked accordingly. In which 2 Pots Marble slurry was taken in No. 1 and 2. In the 3 and 4no. of pots soil was taken and in the 5, 6 no. of pots marble & soil were mixed. In the 7 and 8 No. of pots marble + soil + farm yard manure was mixed, 9 and 10 is with marble + farm Yard manure and 11 and 12 is soil + farm yard Manure.

S.No	Treatments	Pot No.	Kg/Pot
1	Marble Slurry	1,2	10
2	Soil	3,4	10
3.	Marble + Soil(1:1)	5,6	5 +5
4.	Marble + Soil(1:2)	5,6	3+7
5.	Marble + Soil + Farm Yard	7,8	3+5+2
6.	Marble + Farm Yard Manure	9,10	8+2
7	Soil + Farm Yard Manure	11,12	8+2

Table 3
Detail of the experiment with marble powder.

Results and Discussion

After the one month the Maximum seeds/pod (12.75g) was recorded with 3 kg marble powder + 5 kg soil +2 kg Farm yard Manure/ pot. The maximum seed yield

was recorded with (73.85 g) was recorded the 7& 8 no. of pots. The maximum straw yield (150.46 g) was recorded with 3 kg marble Powder +7 kg soil/pot. The maximum biological yield (180.98g) was shown in the marble 5 kg + soil 5 kg in the soil/pot.

From the above results we can concluded that that there is no growth of the any inhibitors in the marble slurry .Marble slurry has the maximum content of magnesium and calcium carbonate.

The available phosphorous content was 5.60 ppm whereas soil had only 2.17 ppm available phosphorous. pH value of the slurry was 9.1 and it was highly alkaline when it mix with the soil the soil also become alkaline and does not support to the vegetation and it losses the fertility.

Conclusion

The environmental degradation caused by the waste from marble processing plants. Soil contains a variety of elements, chemical compounds and mineral, oxygen, aluminum, silicon, calcium, magnesium, sodium, potassium and iron, chlorides, sulphates and oxides are usually present in the soil. Certain trace elements like cobalt, iodine, cadmium, arsenic, zinc and barium are also present in the soil. Particulates from marble mining have degradable effect on soil physicochemical properties and these are added burden to micro variability of soil properties of the study area. Nitrogen and phosphorus; two of the major plant nutrients reduced in concentrations within the mining areas and these increased in concentrations with distance, away from the mining areas. The organic carbon that the CEC depend on also reduced within the mining areas. All these may lead to low crop yield due to marble particulates that get deposited on soil and vegetation of the area. Apart from the soil health that would be in danger due to soil-nutrient imbalance that may set in as a result of marble particulates, the income of the subsistence farmers in the study area may be adversely affected also due to reduced crop yield they may experience.

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