

Solid Waste Engineering with Reference to Industrial Marble Waste of Rajasthan

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Abstract: Around 90% of the world's marble production comes from India and approximately 85% of the India's production is generated from Rajasthan. Which has about 4000 Marble mines and 1100 Gang saws (processing unit). Besides main product of marble there is considerable waste generated during mining and processing. Waste generated during quarrying or mining of marble are over burden, side burden, inter burden, ungraded material and under sized material along with Marble slurry processing and polishing.

The wastage of marble industry are responsible for many environmental problems because 70% wastes and 30% recovery only of main product contribute to the maximum. The wastes are destructible, dumping sites give dirty look, contaminate top fertile soil cover rivers/water bodies there by affecting irrigation and drinking water resources and air as well as loss to flora and fauna.

The most efficient handling of marble wastes is either scientific dumping or utilization or both. The properties of marble slurry are determined in the laboratory and given here in the average of three repetitions were taken. Sp. gravity 2.61, bulking of marble slurry is a function of moisture content. bulking is 42% which is maximum at 5% moisture by weight. bulking of sand is maximum 35% at 5% moisture by weight. fineness modulus was found to be 0.93.

Key words: - Marble slurry, Bulking, Moisture and Fineness modulus.

I. INTRODUCTION

Marble occur abundant in nature. It is used and mined many places in the world since early time. Around 90% of the world's marble production comes from India and approximately 85% of the India's production is generated from Rajasthan and almost all mining and processing activities are concentrated around Makrana where the proposed study is planned to undertake. Rajasthan has nearabout 4000 marble mines and about 1100 marble Gang saws (processing unit). Ajmer, Nagaur (Makrana), Rajsamand, Udaipur, Chittorgarh, Banswara, Alwar, Sirohi, Jaipur districts etc are known for mining of marble. At the same time it leads to growth of many processing units in respective areas. These two activities in Rajasthan have been extended in 20-25 years and have played important role in the economy of the state providing direct and

indirect employment to majority of people and therefore also raising their living standard.



The industry involves mining and processing units for the production of tiles for (walls and floors), articles also waste production and other ancillary Units. The marble industry as a whole is different from other industries by the fact that, the marble is a Dimensional Stone "which means that the marble stone is sold by size not by weight (In other words in sqm or sqft, not by tonnes or kilogramms). The selling price increases with size, all the operations as mining and processing are aimed to get slabs as big as possible. Marble slurry generation. Marble Slurry is a mixed paste of marble fines in water, generated during processing and polishing, etc. Environmental Hazards due to waste It is shaping major threat of the Environment in the state by mining and processing activities.

A. Marble Slurry Generation:-

Marble Slurry is a suspension of marble fines in water, generated during processing and polishing, etc.

B. Environmental Hazards due to waste:-

It is shaping to major threat of the Environment in the state by mining and processing activities. Nearly one thousand Gang saws and thousands of cutters are producing 15-20 lac tons of marble slurry waste which is indestructible waste and harm to general Public. Some of effects of the marble slurry may be listed as under: -

1. The waste is indestructible.
2. The sites which can be used as dumping ground are limited and gives repulsive dirty look.
3. Contamination of top fertile soil cover.
4. Contamination of the rivers and other water bodies there by adversely affecting irrigation and drinking water resources.
5. Contamination of air



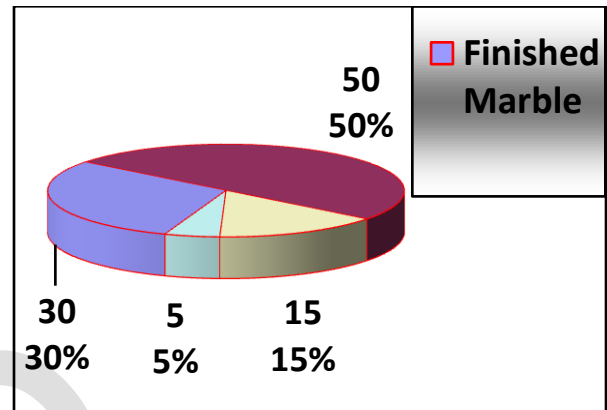
Figure – 1: Loss of vegetation



Figure – 2: Road side dumping

Public outcry, jurisdiction and intervention could deal deathblow to the growth of the marble industry. It is therefore a social responsibility of government and legal responsibility of industry to solve the problem of marble slurry

pollution. **As per Rajasthan High Court Petition No.2150/2004, it is violation of the provision of water prevention and control of pollution act 1974.**



However, the sustainable and balanced industrialization is required for development of country.

C. Conservation of Natural Resources.

The valuable national wealth is getting wasted mainly due to lack of management and technology. This waste, if used properly, can change the entire scenario of the industry.

(a) Air pollution.

This is the most hazardous impact of the marble industry. It is clear from the table 1, slurry is produced at almost every operation and it is a great problem. When it gets dry, it causes air pollution and related problems.

(b) Water pollution.

Like any other industry, the marble industry needs water in its different operations for cutting, cooling and flushing. In these operations water gets contaminated by marble slurry.

(c) Visual impacts.

Abandoned mines, dumping sites, slurry waste sites, deposition of dried slurry over almost every structure in surrounding areas gives a very bad, dirty look and aesthetic problem.

(d) Accidents due to unscientific dumping.

Due to dumping of mine waste and marble slurry on road side causing dust in air (polluting air) and creating less visibility, due to less visibility number of accidents

occurs. (refer figure no.2) In rainy season marble slurry flows over road. Due to marble slurry road becomes slippery and many accidents takes place. (refer figure no.2)

(e) *Loss to flora & fauna*

Already grown trees and bushes die out and new ones do not grow due to deposition of marble slurry. Animals also suffer for their food and shelter (refer figure no.1)

II. AIMS AND OBJECTIVES

Utilization and scientific disposal of marble slurry on a properly selected dumping sight may be better solution of the problem. For this purpose the most useful steps can be: (A) Disposal. (B) Utilization known upto now. (C) Other use.

(A) Solid waste disposal system:-

(1) Out right dumping (Municipal/Domestic waste disposal system),

(2) Processed solid waste disposal system,

(3) Both.

Proper compression and disposal is essential. 5000,000 tons slurry is generated annually which contains 4000,000 cubic meter of water. Hence an effort made to get the maximum possible water out of it and slurry be converted in the form of cakes. This can far more easily be disposed. This will help in recycling and reutilization of water, proper disposal of slurry and lowering the damage to eco-system.

1). *out right dumping (Municipal/Domestic waste disposal system):-* As it is dumping of marble slurry after drying at the production site like municipal or domestic waste.

2). *Processed solid waste disposal system:-*

- (i) *Natural process:* - Naturally separating water from marble slurry by settling process and drying in different settling and drying tanks.
- (ii) *Mechanical process:* - In this process by a mechanical filter press water is separated and cakes of slurry are formed and dried in air.

Thus the dried slurry is disposed in scientific manner after making cakes keeping in mind that the site may be supposed for construction.

(B) Utilization of marble waste/slurry known upto now:-

Even minimizing waste/slurry production the problem could only be partially solved. Therefore it is -the need to develop modes of utilization of waste/slurry. Since other

applications cannot consume such a huge amount of slurry waste, efforts are being made to utilize slurry for different civil works.

1). *Feasible Uses of Marble Waste*

It is essential to explore possibilities of alternative uses. To arrive at technically sound and financially viable technologies to utilize marble slurry / waste and also work out a framework for long term waste management in Industrial areas.

The areas where the utilization of marble waste and marble slurry needs to be explored as a substitute for conventional raw materials are as follows:-

1. As a filler material for roads and embankments.
2. For manufacture of bricks
3. Manufacture of Portland Cement
4. Manufacture of Ceramic Tiles
5. Manufacture of Thermoset Resin Composites
6. Manufacture of lime
7. Manufacture of Activated Calcium Carbonate
8. Hollow Blocks and Wall Tiles
9. Manufacture of Ground Calcium **Carbonate**

(C) Other Possible Uses of Marble Slurry / Marble Waste:-

Broadly speaking, marble slurry and marble waste, due to the high percentage of limestone in it can be used as a substitute for lime stone in most of its industrial and other applications. It can have predominantly one or more materials like calcite, dolomite or serpentine. There is a possibility of the use of marble slurry in many more industries; mainly as a substitute for limestone in the following:

1. In production of agglomerated marble.
2. In manufacture of glass.
3. In chemical manufacturing, Lime manufacture, Plastics manufacture. As dilutents and carriers of pesticides In many other chemical processes as a substitute of limestone.
4. Chemical and Industrial uses In iron and steel metallurgy as a substitute for limestone (as flux in the re- fining of metals, etc.)b) In non-ferrous metallurgy in the manufacture

of magnesium and magnesia, uranium alumina, nickel, tungsten, floatation of gold & silver.

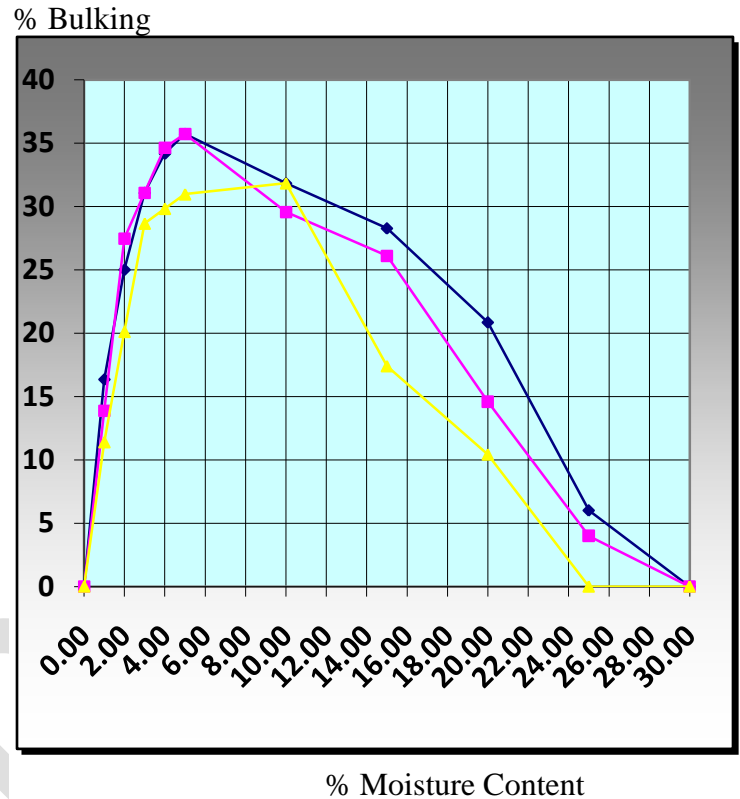
5. As a neutralizing agent and filler for paints, rubber etc.
6. As a concrete aggregate.
7. As railroad ballast.
8. In the construction of dam spillways, docks, piers, and breakwaters in the form of irregular shaped fragments of sizes from 25 - 30 cms.
9. As an Asphalt filler.
10. As an insulation material in the rick wool insulation bats and pellets.
11. As a mineral and chalking compounds based on linseed oil or plastic.
12. As a mineral feed supplement for domestic animals.
13. In waste water treatment.
14. For de sulfurising stack gases from utility and industrial plants that operate coal burning boilers.
15. In the treatment of Sewage sludge to quell obnoxious fumes.
16. In filter beds as a screened mineral aggregate.

Properties of marble slurry:-

- | | |
|-------------------------------------|---------------------|
| a. Colour | White. |
| b. Texture | Powder. |
| c. Taste | None |
| d. Particle Size | 4.75mm-75micron |
| e. Fineness Modulus | 0.93 |
| f. Natural moisture content | 0%(if under roof) |
| g. Solubility in Water | Totally in soluble. |
| h. Densification(Compare to Cement) | Lesser |
| i. Specific gravity | 2.56 |

1). Bulking of Sand and Marble Slurry:-

From the graph, worked out maximum % of bulking occurred, % of water content at maximum bulking , % of water content When bulking is zero & % of bulking for the initial water content (W) of the sample.



RESULTS

% of Maximum bulking occurred = 36% in marble slurry and 31% in fine aggregate (Sand). Yellow line for Sand and Pink & Blue for Marble slurry.

% of water content at maximum bulking for both Sand and Marble Slurry = 5%

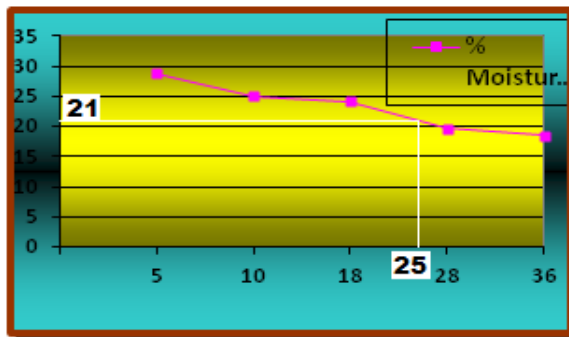
% of water content when bulking is zero= 0% and 30% for Marble slurry and 0% and 25% for sand.

CONCLUSION

A. Bulking behavior of marble slurry is near about same as of fine aggregate(sand). Bulking of Marble slurry is maximum at the same moisture content 5% as of sand. So it may used in road construction.

2. Plasticlimit of Slurry:-

%Moisture



Liquid limit (Moisture Content) by Casagrande Apparatus for 25 Blows is 21 %.

B. Marble Slurry May be used in Road construction.

Conclusion based on Examination:- AS per results of examination this material Marble slurry shows a optimum and acceptable Bulking effect and also shows Plastic limit 21% moisture content. Hence it can be used as a filler

material in Road construction and also as seal coat over finished surface of road. It can be used in curing aid by applying on surface. Also it can be used in finishing work making Marble paste and white wash.

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