

# Use of Marble Slurry in Ceramic Art Work – A Review of Solid Waste Management

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*Abstract: One of the most challenging problems of 21st century is solid waste management and stone slurry is a prime shareholder to this. Developing process to reduce waste and to facilitate reuse is the key to waste minimization. The wastage of marble industry are causing many environmental problems because 70% wastes is generated and only 30% is converted into product. The marble waste is less degradable and it contaminates top fertile soil cover, along with rivers/water resources. The most efficient solution of marble slurry pollution is its utilization. The paper review deals with the feasibility of utilizing the marble waste in various fields. Marble slurry can be easily utilized in construction industry like cement concrete, bricks etc. The utilization of marble waste in stoneware body is feasible for ceramic artwork production.*

Keywords: Marble slurry, Ceramic art work, Construction materials, Environmental pollution, Greener environment.

## Introduction

India enjoys a huge diversity of various stones and minerals. India ranks third in terms of global production of natural stones. Marble, Granite, limestone, Slate and Sandstone are the chief materials that India exports.

In 2017, Rajasthan accounted for more than 80% production of marble in India. Rajasthan, a state in North-West India is home to more than 50 types of minerals and rocks. It has a large variety of natural rock deposits, a few essentials are granite, marble, sandstone, limestone, slate and quartzite. Perhaps, nowhere in the world, any other society is found to be so engraved with stone and stone based products as it is in Rajasthan. The state has around 4000 marble mines and 1100 marble processing units which are spread over in 16 districts. The main areas known for marble mining are Kishangarh, Rajasmand, Makrana, Banswara, Jaipur and Udaipur. Various globally recognized types of marble like Makrana marble, Rajnagar Marble, andhi marble etc. have already established Rajasthan as a globally known region. A number of marble processing units and quarries in Rajasthan have significantly gone up in the past decade with the increase in demand for these stones throughout the country.

The industry involves mining and processing units for the production of tiles for walls and floors, articles, waste production and other ancillary works. The marble mining and the industry are different from other industries to the fact that, the marble is a "Dimensional Product", which means the Marble is sold by size not by weight (In other words in sq. per meter not by tones). Since the selling price increases manifolds with size, all the operations involving mining and processing are aimed to get slabs as big as possible.

As the marble processing industry continues to expand, large amounts of waste in the form of marble slurry is generated and released into the environment. A significant growth in marble slurry has been seen, but the increase in extent has not been documented. It is estimated that almost five to six mil-

lion tons of marble slurry is generated per annum. This waste slurry is dumped along road sides and near processing units, thus causing environmental degradation and escalating health problems in the surrounding areas. Fine particles matter in waste slurry causes air and water pollution. Also, the waste slurry clogs agricultural lands causing long-term damage to the soil and crops. Hence, there is a dire need to utilize this waste material in one or the other way to minimize its harmful impact on the environment. Additionally, advancement in technology finding viable options to reuse or treat this waste is not only possible, but also important.

## Marble Slurry

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

Marble slurry waste is long lasting.

The sites which can be used as dumping ground are limited and give repulsive messy look.

Dumping of marble slurry results as contamination of top fertile soil cover at dumping sites.

Adversely affecting irrigation and drinking water resources due to contamination of the rivers and other water bodies by marble slurry

A respiratory issues and irritation of the eyes and skin generates due to contamination of air.

## Impact of Marble Slurry

**Natural Resources:** The valuable national wealth is getting wasted mainly due to lack of management and technology. The development of country is only possible by sustainable balanced industrialization. This waste, if used, can change perhaps the entire scenario of the industry.

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

**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.

**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.

**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.

Accidents due to slippery roads: Marble slurry flows over roads in rainy season. Due to marble slurry road becomes slippery and many accidents take place.

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

#### Aims and Objectives

Utilization and scientific disposal of marble slurry on a properly selected dumping sight may be better solution of the problem. But now a day's production increasing day by day the Utilization is the only solution of the problem.

#### Utilization of Marble Slurry

Even minimizing slurry production the problem could only be partially solved. Therefore it is the need to develop modes of utilization of slurry. Since other applications cannot consume such a bulk amount of slurry, efforts are being made to utilize slurry for different civil works.

#### 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 and also work out a framework for long term waste management in Industrial Areas.

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

As a filler material for roads and embankments (Rajasthan PWD has refused to use Marble slurry as a filler material.)

Manufacture of bricks, Portland cement, Hollow Blocks and Wall Tiles.

Marble slurry uses in construction of Ceramic Tiles.

Manufacture of Thermoset Resin Composites.

Manufacture of lime, Activated Calcium Carbonate and Ground Calcium Carbonate.

#### Other Possible Uses of Marble Slurry

Broadly speaking, marble slurry, 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:

Production of synthetic agglomerated marble.

Chemical manufacture like Lime manufacture, Plastics manufacture and carriers of pesticides.

Chemical and Industrial uses like iron and steel metallurgy as a substitute for limestone (as flux in the refining of metals, etc.) and non-ferrous metallurgy in the manufacture of magnesium and magnesia, uranium, alumina, nickel, tungsten, floatation of gold & silver.

As a neutralizing agent and filler for paints, rubber etc.

Marble slurry uses as a concrete aggregate and as railroad ballast.

The construction of dam spillways, docks, piers, and breakwaters in the form of irregular shaped fragments of sizes ranging from 25 – 30 cm.

As an insulation material in the rick wool insulation bats and pellets.

Mineral filler for putty and chaulking compounds based on linseed oil or plastic.

Mineral feed supplement for domestic animals.

Marble slurry use in waste water treatment.

De-sulfurizing stack gases from utility and industrial plants that operate coal burning boilers.

The treatment of Sewage sludge to quell obnoxious fumes and filter beds as a screened mineral aggregate.

#### LITERATURE REVIEW

R P Singh Kushwah and Dr. PBL Chaurasiya [1] studied the effect of waste marble powder as replacement of white washing by varying percentage of waste marble powder. According to this Marble slurry can be utilized in finishing work as White wash with lime which is 50% cheaper and also effective solar heat repellent causing natural building cooling.

Ali A. Aliabdo and et al. [2], the use of marble dust in concrete production as cement replacement or as sand replacement (cement addition) gradually enhances both of the mechanical and physical properties of concrete. Marble dust showed a filler effect in concrete and had no noticeable role in the hydration process. Concrete made with marble dust as sand replacement achieved better performance compared to concrete made with marble dust as cement replacement.

A K Mishra and et al. [3], studied the use of marble dust slurry in bulk quantities in construction of road pavements layers and in embankments. The use of marble dust slurry is cost effective and protection of environment.

Dhiraj Mehta and et al. [4], studied the possibilities of using marble waste powder as an adsorbent for fluoride water treatment. Defluoridation serves a two-way path by mitigating excess fluoride as well as reducing the marble waste produced. MWP650 is an efficient adsorbent for future prospects considering its low cost, bulk availability, no necessity for regeneration as the fluoridated adsorbent can be further used by other industries.

N. Gurumoorthy [5], studied the performance of concrete contained marble dust as a partial of cement, 10%, 20%, 25% and 30%. The compressive strength was increased with addition of waste marble dust upto 25% replace by weight of cement. Further any addition of waste marble dust the compressive strength decreases. Therefore it was concluded that the most suitable percentage replacement of marble dust in concrete is 25%.

SarbjeeSingha and et al. [6], reported the similarities and highlights the contrasting behaviour of MS concrete in terms of durability, compressive and flexure strength, abrasion, permeability and ultra-pulse velocity. The strength and durability of concrete is determined by a number of factors including the physical and chemical composition of constituent ingredients as well as the microstructure of ingredient particles. Explanations for the trends observed have been derived from microstructural studies using SEM and EDS test and also the inter particle behavior of the ingredients within concrete matrix. It was found that neglecting minor variations the optimum replacement percentage for MS concrete was 15%.

SelvinYesilaya and et al. [7], the aim of this work is to assess the possibility of the recycling of marble wastes in the production of stoneware clay bodies as a raw material for ceramic artwork production. Five different clay body mixes containing marble waste up to 27% were prepared and evaluated for firing color, water emission, morphology, microstructure, thermal expansion coefficient and thermal behavior. The results of the tests show that the utilization of marble waste in stoneware body is feasible for ceramic artwork production.

S. Dhanapandiana and M. Shanthib [8], studied the Marble and granite waste content up to 50 wt% can be incorporated into Ramanathapuram clay mixture, without degrading their mechanical properties. The presence of marble and granite wastes allow one to obtain a clay brick with better properties as the conventional clay brick at low temperatures as the normally used for brick products in the brick industry, resulting in energy saving and waste reduction. The incorporation of marble and granite wastes in brick production anticipates safe for the health an environmentally friendly recycling products. Figure 1 shows firing colors of the standard and waste added stoneware clay bodies fired at 1160 °C.

### Conclusion

Marble Slurry may be used for white washing for finishing work in construction Industry. Marble slurry white washing due to use of marble slurry with lime Cost reduces up to 50% and also more white & durable.

The use of marble slurry as sand replacement has more significant effect on the mechanical properties of concrete compared with using it as cement replacement Marble slurry shows a good and acceptable strength when added in Cement Mortar and Cement Concrete Both (replacing sand). The presence of marble waste allow one to obtain a clay brick with better properties as the conventional clay brick at low temperatures as the normally used for brick products in the brick industry resulting in energy saving and waste reduction.

The incorporation of marble wastes in stoneware clay body production gives environmentally friendly recycling products. It is also suggested that the waste can be utilized in the production of other traditional ceramics and forms. It was concluded that these wastes could be evaluated in the stoneware clay body up to 27% without causing any deterioration in the dimensional stability of the products.

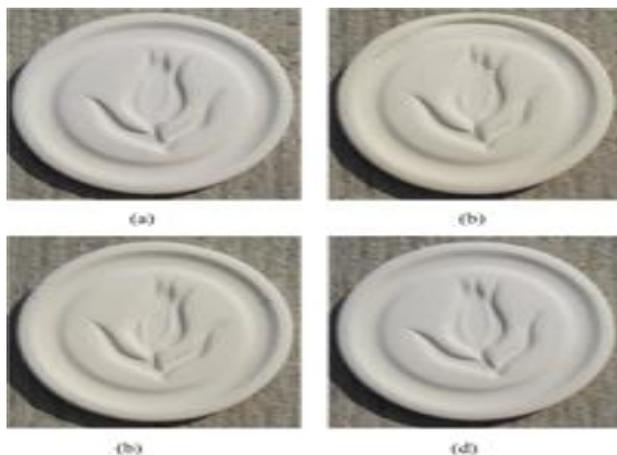


Figure 1. Firing colors of the standard and waste added stoneware clay bodises fired at 1160 °C

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