

**Guidelines for utilization of slurry generated from
Marble/Granite processing units to prevent its
unregulated dumping on land or low-lying areas**



CENTRAL POLLUTION CONTROL BOARD

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Guidelines for utilization of slurry generated from Marble/Granite processing units to prevent its unregulated dumping on land or low-lying areas

1.0 Background

The Original Application (OA) No. 164 of 2022; Srinivas Rao & Ors. Versus State of Andhra Pradesh was filed before the Hon'ble National Green Tribunal, Principal Bench (NGT). The Grievance in the OA was regarding unscientific dumping of marble slurry on agricultural land near Harischandrapuram Railway Station, Kotabommali Mandal, Srikakulam District, Andhra Pradesh, affecting the environment, agricultural land and public health.

The Hon'ble NGT vide order dated 28.09.2022 in above mentioned OA No. 164 of 2022 disposed of the matter and directed CPCB *“to issue guidelines for utilization of marble slurry and to prevent its unregulated dumping on land or low-lying areas or otherwise”*. Further, the matter was transferred to the Hon'ble NGT, Southern Zone Bench, Chennai in March, 2024, and was renumbered as OA No. 78 of 2024 (SZ).

In compliance of the above-mentioned direction passed by the Hon'ble NGT, CPCB pursued the matter with SPCBs/PCCS for providing inventory of Marble/Granite processing units. In response, inventory of Marble/Granite processing units has been received from SPCBs/PCCs, namely Andhra Pradesh, Assam, Andaman & Nicobar, Chandigarh, Daman & Diu, Delhi, Goa, Gujarat, Jammu & Kashmir, Lakshadweep, Meghalaya, Mizoram, Nagaland, Odisha, Punjab, Sikkim, Tamil Nadu, Telangana, Tripura and Uttarakhand. Among these the major Marble/Granite processing units are in Rajasthan (3556) followed by Tamil Nadu (823), Telangana (377), Andhra Pradesh (316), Gujarat (153), Odisha (59) and Daman & Diu (24). Approximately 5 to 6 million tonnes of slurry is generated annually from marble processing units in Rajasthan alone.

The Central Pollution Control Board (CPCB) also carried out studies in the state of Rajasthan, Gujarat, and Andhra Pradesh to assess the environmental impacts associated with marble and granite processing units and dumping sites. The study also covered current slurry disposal and utilization practices being adopted by industries. CPCB interacted with concerned Research and Technical institutions such as CSIR- Central Building Research Institute (CBRI), Roorkee, Uttarakhand; CSIR-Advanced Materials and Processes Research Institute (AMPRI), Bhopal, Madhya Pradesh; CSIR-Central Road Research Institute (CRRI), Delhi; National Council for Cement and Building Materials (NCB), Ballabgarh, Haryana; CSIR-Central Glass & Ceramic Research Institute (CGCRI), Khurja, Uttar Pradesh; Building Materials and Technology Promotion Council (BMTPC), Delhi; Bureau of Indian Standards (BIS) and industry associations to obtain research findings, pilot studies, and technology assessments related to the sustainable utilization of Marble and Granite slurry.

An Expert Committee comprising representative from CSIR-AMPRI, CSIR-AMPRI, NCB, Andhra Pradesh Pollution Control Board (APPCCB), Rajasthan State Pollution Control Board (RSPCB) and CPCB was constituted by CPCB to deliberate and finalize the Guidelines for utilization of slurry generated from Marble/Granite processing units to prevent its unregulated dumping on land or low-lying areas.

2.0 Introduction

The Marble & Granite cutting & polishing units generate slurry which is a mixture of fine Marble/Granite particles and water. If slurry is not managed properly it may cause environmental issues. Unregulated and unscientific dumping of Marble/Granite slurry may lead to contamination of surface water, groundwater, soil and deterioration of ambient air quality due to emission of dust upon drying. Therefore, slurry management, disposal and its utilization, are essential to mitigate environmental pollution.

3.0 Characteristics of Marble/Granite Slurry

Table-1: Typical Physical characteristic of Marble and Granite slurry

Characteristics	Marble Slurry Value/Range	Granite Slurry Value/Range
Major minerals composition	Predominantly calcite (CaCO_3), dolomite ($\text{CaMg}(\text{CO}_3)_2$)	Predominantly silica (SiO_2), feldspar, quartz
Particle Size Distribution	< 45 μm to 300 μm	< 50 μm to 250 μm
Particle Density	2.70 – 3.00 g/cm^3	2.65 – 2.75 g/cm^3
Bulk Density	0.9 – 1.4 g/cm^3	1.2 – 1.7 g/cm^3
Moisture Content during generation	35 – 45%	30 – 40%
Moisture Content during disposal	5 – 25%	5 – 20%
Loss on Ignition (LoI)	23 – 35%	1 – 5%
Specific Gravity	~2.59 -2.60	~2.65–2.70

Source: Mentioned under Reference Nos.1, 5 & 6

Table-2: Typical Chemical characteristics of Marble and Granite slurry

Chemical Characteristics	Marble	Granite	Calcitic Marble Slurry (Makrana)	Dolomitic Marble Slurry (Rajsamand, Udaipur, Kishangarh)
Lime (CaO)	28-32%	1-4 %	39.4 - 47.4%	26.4 - 47.4%
Magnesium Oxide (MgO)	20-25%	0.5-1%	4 - 8%	15.86 - 22.10%
Silica (SiO_2)	3-30% (varied with variety)	72-75%	4.2 - 10.2	4.98 - 13.64%
Alkalinity	-	-	Alkaline	Alkaline

Source: Mentioned under Reference No. 2

4.0 Marble & Granite processing

The processing of Marble and Granite starts with the transportation of mined blocks to the processing unit. Upon arrival, the large, rough, and unpolished blocks are unloaded using gantry cranes. The first stage of processing involves the use of a dressing machine to remove the non-uniform outer surfaces of the blocks, resulting in smooth, rectangular shapes suitable for slicing. Once dressed, the blocks are cut into slabs using gang saws, which typically consist of 75 to 125 parallel blades. Single-blade saws have a thickness ranging from 4 to 5 mm, and are used to slice the blocks into slabs that are generally 15 to 25 mm thick. In case of granite which is much harder than marble, multi-cutter machines equipped with diamond-tipped circular saws are commonly used.

Out of every 25 mm thickness of Marble/Granite block, 4 to 5 mm thick block (equivalent to blade thickness) turns into powder during cutting process. Water is continuously sprinkled on block to reduce heat generation. The water requirement is met through water tankers and recycled water. Approx. 20-2% of total weight of processed marble turns into marble slurry, which contains 35-45% water. Slabs are further trimmed and shaped using edge cutting machines. Slabs are polished using abrasive polishing machines for a glossy finish.

5.0 Water requirement & its management

Marble/Granite processing operations are water-intensive, primarily for cooling during the cutting process. Each marble/Granite block processed on a gang saw/multi cutters generates about 30% waste comprising 20-25% Marble/Granite slurry and 5-10% broken edges/slabs. On average, 0.1-0.2 kilolitres of water is consumed for processing 1 ton of marble or granite. The processing units typically install sedimentation tanks (horizontal zig-zag or vertical) to settle the Marble/Granite dust from the slurry. The supernatant water is recycled back into the process, minimizing freshwater intake. On average, 20-40 Tonnes of marble block are processed on one gangsaw per day.

For this level of processing with water recycling via settling tanks, the daily net water loss through evaporation and retention in the slurry is estimated 1-1.5 kL per gang saw. Flocculants/coagulants are sometimes used to enhance settling. Filter press is also one of the options, being used to dewater slurry. The settled semi-solid slurry is then transported by tankers for disposal.

6.0 Slurry Generation

During processing of Marble/Granite blocks (cutting, polishing), slurry is generated (around 20-25% of the block weight), which typically contains 35-45% water. Annually, this results in large volumes, estimated to be 5 to 6 million tonnes of marble slurry generation from processing units in Rajasthan alone

7.0 Management and Handling of Marble/Granite Slurry (Current Practices)

The sludge accumulated in the settling tanks are removed by using slurry pumps and stacked/stored within their premises temporarily. After drying, it is disposed in low lying areas or sent for its utilization to ceramic units/wallputti plants as reported during in-depth study in Rajasthan and Gujarat. Due to non-availability of designated site for dumping the slurry waste, the units are disposing the waste in low lying areas, along road sides or in unauthorized lands causing environmental nuisance. In Rajasthan, slurry disposal sites have been identified by the Rajasthan State Industrial Development & Investment Corporation Ltd. (RIICO) and marble associations to prevent unregulated dumping.

As reported, Rajasthan State Pollution Control Board (RSPCB) highlighted successful initiatives for the utilization of Kota stone slurry. In Makrana, ACC Cement has adopted the use of Kota stone slurry generated by approximately 600 units, replacing up to 2 lakh tonnes per annum of limestone in cement manufacturing. In Jalor (approx. 1200 units) and Abu Road (approx. 250 units), nearly 10 lakh tonnes per annum of slurry is generated. The region

has five designated dumping yards. Due to increasing industrial utilization, including cement and construction applications, nearly 80% of the accumulated slurry has been cleaned up from these sites.

Additionally, CBRI has developed technology for converting Kota stone slurry into ceramic tiles. The technique has been transferred to RSPCB as a potential solution for value-added product development from stone waste.

8.0 Environmental Issues

The unregulated dumping of Marble/Granite slurry may cause environmental issues. Runoff from dumping sites or direct dumping may contaminate surface water and groundwater. Dried slurry is airborne due to wind or vehicular movement, resulting in Particulate Matter emissions. Dumping of Marble/Granite slurry may contaminate soil by reducing its permeability and water-holding capacity.

9.0 Guidelines for Storage, Management, Handling, and Utilization of Marble/Granite Slurry

Unregulated dumping of slurry generated during processing of Marble/Granite may cause environmental nuisance. Therefore, following guidelines shall be followed for its utilization to prevent improper disposal of marble/granite slurry. These guidelines will be applicable to existing and new marble/granite processing units.

9.1 Storage, Management and Handling of slurry at Unit Premises:

- The Units shall make necessary arrangements for temporary storage of slurry within their own premises before sending for its utilization. The storage area should be lined with impervious materials (e.g., HDPE or concrete lining) to prevent seepage into soil and groundwater.

- The Units should maintain logbooks for quantity of Marble/Granite processed, slurry generated, stored, transported including tanker details, MoU/Agreement with end user.

9.2 Measures to Prevent Unregulated Dumping

- The dedicated vehicles used for slurry transportation shall be equipped with GPS tracking systems to monitor vehicle movement and prevent illegal dumping. The GPS tracking system shall be managed by the respective industry associations. Vehicles should be properly covered to prevent spillage and control dust emissions during transportation.
- SPCBs/PCCs/Local administration/revenue department shall ensure that slurry is not discharged onto land or into any water body.

9.3 Utilization of Marble/Granite Slurry

9.3.1 Options for Utilizations of Marble Slurry

i. Cement Manufacturing

Marble slurry can be used as a raw mix component (replacing limestone) in Ordinary Portland Cement (OPC) manufacturing, subject to quality suitability (especially MgO content) and moisture reduction. As per National Council for Cement and Building Materials (NCB), the use of marble slurry in clinker manufacturing can typically range up to 15%. However, the actual percentage may vary depending on the characteristics of other raw materials used by the cement plant and specific process requirements.

To utilize marble slurry in clinker manufacturing plants as above, nearby marble associations have to tie up with cement industries with mutual agreement.

ii. Road Construction

Marble slurry (20-35%) can be mixed with soil for constructing sub-grade layers in road pavements, as demonstrated by Central Road Research Institute (CRRI). CSIR-CRRI has conducted studies at laboratory as well as in the field (pilot study) for the utilization of marble slurry in road construction. CRRI concluded that its engineering properties are suitable for road construction. Based on the CRRI study, the Indian Road Congress (IRC) has published a guideline IRC, SP:132 (2022) for utilization in embankment and subgrade road construction. The title of the guidelines is "Guidelines on the use of industrial wastes for road embankment and subgrade construction". Marble Units/Marble associations may have tie up with regulatory authorities such as PWDs, NHAI, particularly in marble-producing regions. In addition, the marble/granite slurry can be gainfully utilized into Wet Mix Macadam (WMM).

iii. Geo-polymeric Concrete for road construction and pathway components for infrastructural development

Centre for Advanced Radiation Shielding and Geo-Polymeric Materials (CARS&GM) of CSIR-Advanced Materials and Processes Research Institute (AMPRI), Bhopal is having Patented technologies for bulk utilization of fly-ash for making geo-polymeric eco-friendly, low embodied energy concrete for infrastructural applications. Bulk utilization of Granite and Marble Slurry can be done for development of Fly Ash based geo-polymeric concrete for road construction and pathway components i.e. Precast Paving Blocks, Curb Stones, divider stones etc. for infrastructural applications. The use of marble slurry in

Fly ash based geopolymer concrete can typically range upto 10%-20%, the actual percentage may vary depending on the characteristics of raw materials used and specific process requirements

iv. Hybrid Composite Wood

Patented technology exists with CSIR-AMPRI for large scale recycling of marble, granite and stone wastes stream for manufacturing high performance hybrid composite wood for building construction industries, furniture industries, transport system, partition and floor & wall panels, door & door frames and architectural cladding panels.

v. Low-Cost Binder

Technology exists to use marble slurry as a low-cost binder (e.g., mixed 1:3 with sand) for non-load bearing structures, plasters, etc., as per IS specifications and PWD approvals. CSIR-CBRI developed a low-carbon cementations binder using waste limestone slurry.

vi. Tiles, Blocks, and Building Materials

CBRI has conducted studies and developed technologies for the manufacture of flooring and wall tiles, bricks, concrete, and paver blocks using marble and Kota stone slurry. CBRI has also developed technology for converting Kota stone slurry into ceramic tiles and this has been transferred to the Rajasthan State Pollution Control Board (RSPCB) as a value-added waste utilization solution. SPCBs/PCCs shall incorporate such utilization of marble slurry in Consent to Operate (CTO) conditions issued to stone processing units. Marble slurry is already being utilized by ceramic and construction material manufacturing units for the production of tiles, blocks, precast components, concrete, bricks, and other building products. Processing units should continue and expand such utilization by supplying marble slurry to nearby ceramic and construction units. They shall maintain proper records of the quantity of slurry dispatched and the details of

recipient units and such details should be submitted biannually to the respective SPCBs/PCCs.

vii. Filler Material

Marble slurry can be used as a filler (15-20%) in mineral grinding (feldspar, soda, quartz).

viii. Manufacture of Lime

Limestone is the primary raw material used in the production of lime. Slurry containing high calcium carbonate may be used as a partial or complete substitute for limestone, subject to suitability and technical feasibility.

ix. Other Potential Uses

Marble slurry can be used to produce putty, poultry feed ingredients, calcium powder, and Artifacts. It can also be used as a de-sulphurising agent in power plants or for synthetic gypsum production (especially with low MgO slurry). Based on its SiO_2/LoI content, it could be used as a flux in the iron/steel industry. It can also be used to manufacture calcium nitrate fertilizer.

9.3.2 Option for Utilizations of Granite Slurry

i. Geo-polymeric Concrete:

Bulk utilization of Granite Slurry can be done for development of Fly Ash based geo-polymeric concrete for road construction and pathway components i.e. Precast Paving Blocks, Curb Stones, divider stones etc. for infrastructural applications. The use of granite slurry in Fly ash based geo-polymer concrete can typically range upto 15%-20%, the actual percentage may vary depending on the characteristics of raw

materials used and specific process requirements. CSIR-AMPRI has Patented technology on Fly ash based Geo-polymeric Concrete.

ii. Hybrid Composite Wood

Granite slurry can be used for building and furniture industries. CSIR-AMPRI has Patented technology on utilization of stone waste for value added products.

iii. Other Potential Applications

Granite slurry, due to its higher silica and alumina content, may have potential in brick/tile manufacturing, filler in mineral industries and aggregate replacement in concrete/masonry units.

10.0 Database management

- The concern SPCBs/PCCs should develop an online portal to capture the quantity of Marble and Granite Slurry generation and to provide its availability to all user industries.
- All user industries should be registered and mapped within the portal, and access should be granted to both slurry generators and end-users. This centralized platform will serve as a valuable tool for monitoring the generation and utilization status of marble and granite slurry across India, promoting transparency, traceability, and sustainable resource management
- The portal should include a comprehensive mapping of all dumping sites both common disposal sites and those located at individual processing plants. Additionally, it should capture and display data on monthly slurry production volumes and quality parameters. Quality information, such as MgO content, should be uploaded

based on testing conducted by ISO 17025/NABL-accredited laboratories.

11.0 Regulatory Mechanism

- All Marble/Granite processing units shall obtain CTE/CTO under the Water (Prevention and Control of Pollution) Act, 1974, and the Air (Prevention and Control of Pollution) Act, 1981 from the concerned SPCB/PCC.
- SPCBs/PCCs, while granting or renewing CTO, should ensure that units engaged in processing, cutting, or polishing of marble or granite shall submit the utilization plan for the slurry generated by the unit.
- Slurry utilization plan shall be included as one of the condition of the CTO, and compliance shall be monitored by the SPCB/PCC from time to time.
- SPCBs/PCCs in association with Marble and Granite Slurry Association may facilitate slurry-generating units and end-user industries (e.g., cement, brick kilns, geo-polymeric concrete and road works, precast paving blocks, curb stone, divider stone etc.) for utilization of Marble/Granite slurry.
- Associations or individual units may also approach expert institutions such as CSIR-CBRI, CSIR-AMPRI, CSIR-CRRI, NCB, or any other expert institutes for technical guidance and technology solutions for utilization of marble and granite slurry to promote circular economy.

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