Study of Durability and Economy of Cement Concrete Tiles and Bricks Using Marble Slurry as One of the Ingredients

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***Abstract*—**Marble slurry is a processing and polishing waste of marble mining industry. Its huge quantity of the order of 20% out of mined resources is dumped on any empty land, agricultural fields, pasture lands, river beds and road sides. The present dumping practices have been creating a number of nuisances and problems including environmental and human health. Scientific disposal systems but with more emphasis on engineering utilization have to be developed simultaneously and as fast as possible. Construction industries can be the main user of marble slurry whether in bulk or minor quantities. The utilization of marble slurry in mortar either by substitution or addition ,in damp proof course(DPC)replacing sand by 50% marble slurry as leak proof material, formwork removing agent, curing and white washing mixture were investigated by field experiments and observations. Formwork removal was easily obtained with smooth surfaces. Using slurry in curing proved to be more efficient, cheap and more beneficial to the concreting process having hardening and gaining strength more than normal. White washing with 50-50 slurry and lime was proved to be the best option.

***Keywords*—**Utilization, Marble slurry, Marble dust, Technical use.

I. Introduction

TODAY, use of concrete and brick are the backbone for any civil construction. Concrete is a composite material composed of water, coarse granular material (the fine and coarse aggregate or filler) embedded in a hard matrix of material (the cement or binder) that fills the space among the aggregate particles and glues them together. Coarse granular meterial is genrally Silica. Production of marble waste slurry is in very huge amount. There are several possible applications of marble dust in construction industry. However, probably due to lack of systematic studies, enough data are still not available for its wide spread use in construction. The research on the use of marble dust in concrete needs to be supplemented with durability studies such as permeation properties of near surface.

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Three Scales Of Utilization

(i) Small – e.g. in mortar, concrete (ii) piecemeal/medium – e.g. white washing on walls & (iii) bulk or large quantity – e.g. (a) Road construction/bridge (b) cement production (mixed/ground with clinker as raw material) (c) filler in SCC (self compacting concrete) (d) soil stabilization. Marble slurry can be used as admixture (addition) and substitution (replacement partially or wholly). In bulk, bagged storage like cereals / wheat in the godowns of Food Corporation would be much better than silo type construction. Since, it is still a waste; the consideration of bag storage would gain only after its utility is confirmed by research and experiments.

Environmental Protection

Rajasthan State pollution control board (3) had officially ordered:

1. Utilization of marble slurry as premix for manufacture of cement, it is directed that while issuing consent to establish and consent to operate under Air & water acts to the major cement manufacturing units, a consent condition will be imposed making it compulsory to replace at least 1% of the raw material (lime stone) with marble slurry.
2. Mable slurry will be made available by the Marble processing unit to the production unit of concrete free of cost. Suitable consent condition should be imposed while granting consent to all such units.
3. The cement manufacturing units, major or minor, to replace 1% lime stone by marble slurry at the manufacturing stage.

Mortar

By substitution or by addition (or both) marble slurry has been very effectively used in Mortar. Technically mortar is a mixture of binding agent, for example, cement/lime, fine aggregate and water. The classification of mortar, particularly with reference to slurry research is : cement mortar, lime mortar, lime cement mortar (also called composite mortar or gauged mortar) and special mortars.

In Damp proof course 1:1:6 (cement+lime+sand) is a very good material and sand replacement by 50% marble slurry had added to the property of damp proofing while saving 50% sand which is a natural resource.

Tests on mortars including marble slurry were done for

crushing strength. Testing done on cubes of 3'' side, was found to increase with 50% marble slurry replacing sand. The increase, however, depended on different w/c ratio ranging from 0.3 to 0.5.Adhesiveness was not found to increase neither it decreased as compared to control, setting tested with Vicat's apparatus was around 30 minutes (initial) and 9 hours (final). Marble slurry (80%) in mortar gave thermal insulating properties reducing temperature up to 6 to 70 C. The thickness of plaster was kept around 2 mm. on plastered wall surface. Marble slurry had increased the hardness of plaster coating of thickness 2 mm again by around 10%. The final hardness after due curing was obtained between 4 and 5 MhO.

II. Result

TABLE I
EFFECT OF MARBLE SLURRY ON DURABILITY

% marble slurry mixture	Durability in months	Remarks
0 % slurry + 100% lime	12	No fading but quite white
20 % slurry + 80% lime	6	Slight fading + less white
30 % slurry + 70% lime	$7\frac{1}{2}$	Fading + white
40 % slurry + 60% lime	10	Not much fading + white
50 % slurry + 50% lime	12	No fading + quite white
100 % slurry + 0% lime	halfmonth	Completely removed & original surface recovered

III. Conclusion

1. Marble slurry is wholly insoluble in water. It takes time to settle i.e24 hrs
2. Engineering utilization rather than dumping is the best policy to deal with marble
3. For DPC (damp proof course) 1:1:6 (cement +lime+sand) where 50 %sand is replaced by marble slurry gives the best constructions material.
4. Using marble slurry in removal of form work for beams, column and slab is easy and efficient and renders smooth surfaces.
5. Marble slurry is a good curing aid because it avoids quick evaporation of water and hydration of cement continues for a required period.
6. For white washing, 50-50 slurry and lime have proved the desired quality with durability.

References

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[5] Inspection of slurry dumping grounds.
[6] Consultation with marble processing gangsaw units in Rajasthan.