Composite of marble slurry with Lime and White cement

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Abstract - The waste generated from marble industry (cutting grinding and polishing) is responsible for many environmental issues for the reason that wastage is 70% and recovery of the main product is only 30%, which is everlasting. Dumping sites creates an ugly scene. Fertile soil is contaminated by this marble slurry, flowing with air blows, along with contaminating rivers and water bodies. Affecting irrigation and potable water sources. The loss to flora and fauna plants and trees. The favorable Solution of this pollutant marble slurry contamination is consumption in Bulk. The only construction industry has the potential to consume this pollutant at a large level. For making use in building construction different properties of this pollutant are found out in the lab. As Sp. gravity 2.61, Fineness modulus was found to be 0.91. In this study, marble slurry can be easily utilized in making composite of Marble slurry, Lime and White cement.

Key words: Fineness modulus, Marble slurry, Specific gravity, white cement, lime powder and composite.

I. INTRODUCTION

Marble Slurry is a mixture of dissimilar size particles produced during cutting, grinding and polishing procedures of Marble, dissolved and flowing with water. This mixture of marble particles in water, formed for the duration of the processing, because to cool down the cutting blades water is utilized as a cooling agent.

Marble waste an Environmental Hazard: If there is any biggest threat to the environment in Rajasthan state it is the threat of marble slurry pollution. There are thousands of cutting and grinding units creating 1.5-2.0million tons of marble waste i.e. marble slurry. Marble waste marble slurry is imperishable waste and hazardous to the human being, all animals (pet and wild) and the flora and fauna creating aesthetic issues. Hazardous effects of this hazardous pollutant on Environment may schedule as below: -

1. The waste cannot be destroyed.
2. The dumping grounds are limited and give an ugly and dirty scene of the topography.
3. Fertile soil cover is polluted and becomes infertile due to Marble slurry.
4. The marble slurry flows with rainwater into the gullies and rivers polluting all the water bodies.
5. Polluted water affecting irrigation and drinking water resources.
6. Pollution of air.

All of the above pollutions are shocking. These factors may award a thundershock to the marble industry. It is, therefore, a scientific and engineering responsibility of government and industry to solve the problem.

II. LITERATURE REVIEW

Researchers' working on the utilization of marble slurry in many products, but the amount consumed was very less. It's required to utilize marble slurry in a huge amount for the solution of the problem of marble slurry hazard.

Baboo Rai et.al (2011) have done their research on the "Influence of Marble powder/granules in Concrete mix". They found that if marble slurry powder is used as an ingredient in cement mortar or cement concrete up to some amount replacing amounts of cement and other fine particles fine aggregate, improves relative workability & compressive strength and also the flexural strengths. Fractional substitution of cement and other fine particles by a changeable percentage of marble slurry proves that more of marble slurry ratio results in better workability of mix and compressive strengths of the cement mortar and cement concrete.

Vaidevi C (2013) have done their research on "Study on the marble dust as partial replacement of cement in cement concrete". They established that the marble slurry from the marble industry is a waste which may be utilized in cement mortar and cement concrete. The use of this pollutant was supposed in many percentages as in additive to the cement mortar and cement concrete and also as a replacement of cement, to prepare cement mortar and cement concrete mixes. In this research, the utilization of marble slurry produced during the sawing process of marble blocks. This has been found in the cement mortar and cement concrete

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mixes as a cementitious material. The research is showing that marble slurry, which is in the form of dust, may be utilized as a cementitious material in cement mortar and cement concrete mixes where these materials are existing and cost for construction is less than plain concrete. The cement concrete is produced adding 5%, 10%, 15% and 20% marble slurry along with cement. The produced mixes were studied for their properties for both in the liquid and hardened state for strength. In compressive tests conducted after curing and tensile strength, with and without substitution of marble slurry in cement mortar and cement concrete after 14 and 28 days curing. Adding 10% gives the best strength and on every 10 bags of cement, on the addition of 10% of marble slurry makes a saving of 1bag of cement.

V. M. Sounthararajan et.al (2013) have done their research on "Effect of the Lime Content in Marble Powder for Producing High Strength Concrete". They found that the waste of marble industry marble slurry up to 10% by weight of cement was investigated for cured cement concrete strength properties. They find out splitting tensile strength, compressive strength, and flexural strength for the cement concrete mixes on various percentage substitution of marble slurry. The effect of the ratio of fine to coarse aggregate and ratio of cement to aggregate (coarse and fine) has a better effect for the step-up in strength. An exceptional enhance in compressive strength of 46.80 MPa at 7 days for 10% substitution of marble slurry in cement concrete was noticed.

Manju Pawar et.al (2014) have done their research on intermittent search, "The importance of fractional substitution of Cement With Waste Marble Powder". They found that the strength for the cement concrete mixes on various percentage addition of marble slurry in cement mortar or cement concrete was maximum at 12.5% addition of marble slurry. They find out splitting tensile strength, compressive strength, and flexural strength for the cement concrete mixes on various percentage substitutions of marble slurry. Fractional substitution of cement by a changeable percentage of marble slurry clarities that increment in waste marble powder (WMP) proportion will result in better strengths of the cement mortar and cement concrete. Exposure of the waste marble slurry to the environment may result in Sevier environmental hazard. The Compressive strength of Cubes tested was increased with the addition of waste marble Powder up to 12.5 % substituted by a similar quantity of cement. On further addition of waste Marble powder, the compressive strength decreased. Tensile strength of Cylindrical specimen was increased with the addition of waste marble powder up to 12.5 % substitute by weight of cement and further addition of waste marble powder Tensile strength decreased. They founded the optimum percentage for substitution of marble powder with cement is 12.5 % for both cubes and cylinders.

Cubes of size 150×150×150 mm were prepared for testing the compressive strength of both control and marble slurry replacement.

The mixes with varying percentage of stone dust and marble slurry as a Partial Replacement of sand and cement were prepared and cast the cubes. Compressive strength test results after curing of 7 and 28 days for control mix as well as for the customized mixes

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III. Materials and Methods

3.1 Materials

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Cement: Ordinary Portland cement was used because it is easily available in the market. The cement was used in measuring whole tests. The Specific gravity of cement was 3.13 and the fineness of cement was 4%

White cement: Special cement differs from conventional Portland cement in their chemical and phase composition as well as in their properties.

Lime: Lime is an oxide of calcium. While using the term lime it should ever be used another term, as lime in terms of a rock it is limestone and lime in the context of mortar is quicklime, lime in the reference of lime powder, Hydrated lime powder.

Marble dust powder: One of the major wastes produced in the marble industry during cutting, shaping, and polishing of marbles is the MDP. During this process, about 20-25% of the processed marble turns into the powder form. India is the third (about 10%) topmost exporter of marble in the world, every year million tons of marble waste form processing plants are released. Due to the availability of the large quantity of waste produced in the marble factory, this project has been planned and preceded. Snapshot of used

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MDP is figure no.3.1 The physical & chemical properties of MDP are given in table 3.4 & 3.5 respectively.

Method: For finding out the optimum quantity of marble slurry for making composites of Marble slurry, Lime powder and White cement mixed with water and casting rectangular tiles of 150mm x 150mm x 25mm for different mixes.

Curing of tiles for 28 days and then testing the tiles after 48 hrs of drying in sun.

Testing the tiles for:

Smoothness and glazing after rubbing the specimen. Crushing strength of Tile of composite and Marble.

Water absorption.

Apparatus: Moulds150mm x 150mm x 25mm, Vibrating machine, Trowel, Mixing platform, Curing tank, weighing machine and UTM.

IV. RESULTS AND DISCUSSION

Smoothness test

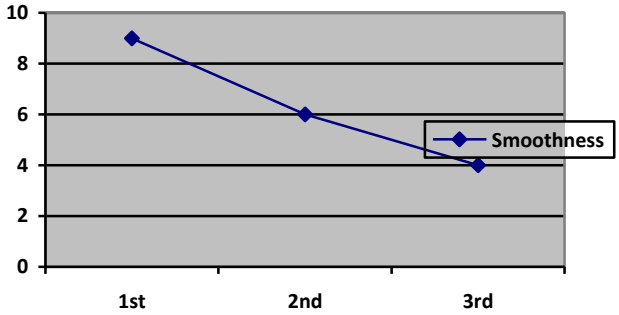
Tested for smoothness and mix or sample 3rd was found at level 4 out of 10 which is not so good but sample 2nd smoothness was found at number 6 which was average but the best smoothness was found of sample 1st and found at level 9. Which may be utilized for making the composite. For the experiment mixes 1st proportion was 1:0.5:1 for 2nd proportion was 1:1:2 and for 3rd proportion was 1:1.5:3.

Smoothness Values:

Mixes	Rubbing composite slabs(Minutes)	Smoothness level	Experiments days		
			1	2	3
1st	20	Best	10	9	8
2nd	15	Better	5	6	7
3rd	10	Good	4	3	5

Average Values:

Mix	Rubbing composite slabs(Minutes)	Smoothness level	Remarks
1st	20	Best	9
2nd	15	Better	6
3rd	10	Good	4



Smoothness of slab with proportion of mix 1:0.5:1 for 20 minute is best of all

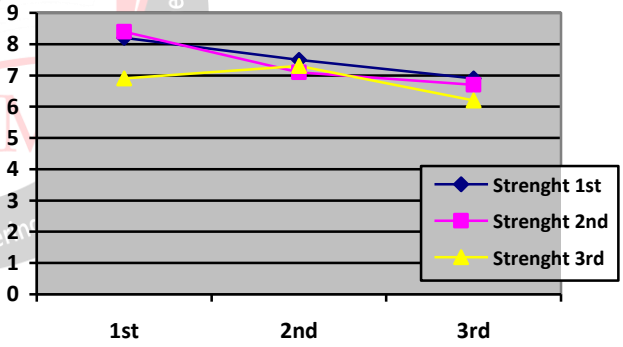
4.2 Crushing Strength:

After finding out crushing value of all three samples; findings are as below: Mix1- 1:0.5:1, Mix2- 1:1:2, Mix3- 1:1.5:3

The best strength were found in sample mix 1:0.5:1

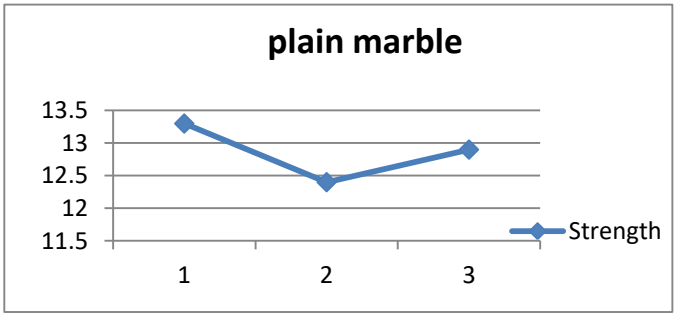
4.2.1 Crushing Strength of Marble Slurry composite Slab:

Mix	Composite Slab 1, MPa	Composite Slab 2, MPa	Composite Slab 3, MPa
1.	8.2	7.5	6.9
2.	8.4	7.1	6.7
3.	6.9	7.3	6.2



4.2.2 Crushing strength of Plain Marble:

Mix	Plain Marble MPa
1.	13.3
2.	12.4
3.	12.9



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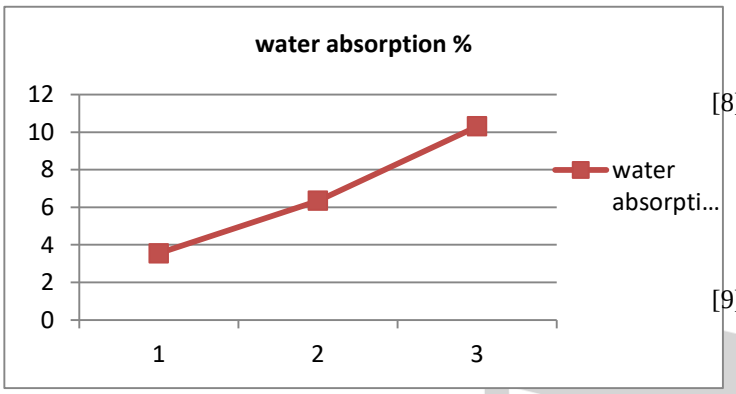
4.3 Water absorption test:

Mix	Dry weight gm	Wet weight gm	Water absorption %
1.	1099	1138	3.54
2.	1064	1132	6.340
3.	0997	1097	10.30

Water absorption is minimum for sample 1;
Mix ratio 1: 0.5:1; i.c; 3.54%



Overall, viewing all the result and discussion finally sample 1 is found suitable for any utilization in form of marble slurry composite.

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