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Use of Stone Dust in Manufacturing of Tiles

Sandeep Sukhwal[1], Aman Sharma[2], Manoj Kumar[3] and Musharraf Ali[4],

Department of Civil Engineering, Poornima Institute of Engineering & Technology, Sitapura Jaipur, Rajasthan, India
E-mail: [1]sandeep.sukhwal@poornima.org, [2]2014pietcivaditya@poornima.org, [3]2014pietcivarpit@poornima.org, [4]2014pietcivafreen@poornima.org, [5]2014pietcivarsh@poornima.org

Abstract—*The pollution is basically caused by dumping the solid waste directly in environment. For example Marble and sand stone industries generate both solid as well as stone slurry. Solid waste result from the mine site and stone slurry from sawing and polishing process. Tiles are most widely used construction material in civil engineering industry. The tile industry is constantly looking for an alternative i.e supplementary material with the objective of reducing the solid waste .These solid wastes generated from Marble and sand stone industries can be used to develop new products and may be used as admixture so that natural resources are used more efficiently. The main objective of this research paper is to take use of marble dust, sand stone dust, fly ash in manufacturing of tiles.*

Keywords*: Marble powder, Sand stone powder, Fly ash.*

1. INTRODUCTION

Dumping the waste material directly into the environment can cause various environmental problems. Hence the use of waste material has been emphasized.[1] Waste from stone industries can be used to produce new product or can be used as admixture so that natural products are used more efficiently and the environment is protected from waste deposits which are imposing health threat to surrounding ecosystem. Some industries present on annual output 68 million tones of processed product, therefore scientific and industrial community must look towards more sustainable practice.[2]There are various recycling options for this environment by product both at an experimental phase and in practical application or use.[3] This paper decides the feasibility of using marble stone sludge dust and sand stone dust in tile production on as partially replacement of clay.

2. OBJECTIVE OF PAPER

To know about the behavior of tiles with partial replacement of clay by marble stone slurry, sand stone dust and fly ash at different proportion of replacement.[4] Another concern is to utilize crushed stone dust and fly ash waste as useful building material to reduce greenhouse gases which can help to achieve environment friendly materials.

3. PROPERTIES OF RAW MATERIALS

3.1. Marble Slurry

Marble is the most preferred stone India among all dimension stone because of it's pleasant and transparent colour, uniform texture, smooth and shiny polished surface. Around 90% of the world production come from India and approximately 85% of industrial production is received from Rajasthan(1100 million tons)[1]. The marble processing units over the Rajasthan are generating around 5 to 6 million metric tons of marble slurry every year.

Table 1: Physical Properties of Marble Slurry

Property	Result
Bulk Density (gm/cc)	1.3-1.5
Specific Gravity	2.83-2.87
Bulking of marble slurry	42% at 5% moisture
Fineness modulus	0.93

Table 2: Chemical Composition of Marble Slurry

Composition	%Amount
Lime	49.07
Alumina	1.04
Iron Oxide	0.21
Magnesia	4.47
Silica	1.69

3.2 Sand stone

Sandstone contains distinct physical and chemical properties that include a hard, compact and dense composition along with texture consisting of fine granules, while chemical properties include a composition primarily of silica, along with trace amounts of other minerals. Sandstone contains particular physical and compound properties that incorporate a hard, smaller and thick creation alongside surface comprising of fine granules, while concoction properties incorporate a structure essentially of silica, alongside follow measures of different minerals.

Table 3: Chemical Composition of Sand Stone

Ingradient	%Amount
SiO_2	93%-94%
Al_2O_3	1.4%-1.5%
Fe_2O_3	1.5%-1.6%
CaO	0.8%-0.9%
Na_2O	1%-1.2%
MgO	6.2%-0.25%

Table 4:Physical Properties of Sand Stone

Property	Result
Water absorption	<1%
Hardness	6 to 7 on moh's scale

3.3 Clay

Table 5: Chemical Composition of Clay

Composition	Result
Silica (SiO_2)	56..00%,
Alumina(Al_2O_3)	21.64%
Iron oxide (Fe_2O_3)	0.12%

Table 6: Physical Properties of Clay

Properties	Result
Shrinkage	2.40%,
Porosity value	4.21%.

Table 7: Physical Properties of Fly Ash

Properties	Result
Specific gravity	2.36
Fineness	224 m2/kg
Consistency	45%

Table 8: Chemical Properties of Fly Ash

Composition	Percentage
SiO_2	56%
Al_2O_3	23%
CaO	8%
TiO	0.98%
Fe_2O_3	5.10%
MgO	4.31%
SO_3	1.8%

4. MANUFACTURING PROCESS

Once the raw materials are processed, following steps were taken to obtain the finished product-Batching (Weight batching) Mixing and Grinding Forming Drying (3 days in shade) Burning (12 hrs in muffle furnace at 1200 deg. Celsius) On the basis of weight batching following proportions were made- Marble Slurry-50%, Sand Stone Slurry-20%, Clay-20% Flyash-10%. These materials are properly grinded in machines. After proper sieving these are mixed with water which is 35% of total weight of raw materials taken. After that, tile is made by dry pressing. during this technique, the free flowing powder containing organic binder or an occasional share of moisture—flows from a hopper into the forming die.[5] the fabric is compressed during a steel cavity by steel plungers and is then ejected by rock bottom plunger. The tiles fashioned square measure dried (at high relative humidity), during a shaddy space. Drying, which might take many days, removes the water at a slow enough rate to stop shrinkage cracks. once 3 days i.e seventy two hours drying, tiles square measure placed in muffle chamber for twelve hours so as to realize their actual strength.[6]

5. EXPERIMENTAL RESULTS

5.1 Water Absorption Test

Water absorption should not more than 10% of the total raw materials taken .In our test the water absorption in 7% of the total weight of raw materials taken.

5.2 Texture and Color

The texture and color of tiles should be specified by the purchaser and mutually agreed upon between purchase and supplier with reference to a sample of the type specified representing the possible range of shades and textures.

5.3 Dimensional & Tolerances Test

The total variation in dimensions of tiles, when measured in accordance with test method C 67, shall not be more than ± 5% from the nominal dimensions specified by the supplier.

5.4 Weight

The total variation in weight of tiles, when measured in accordance with test method C 67, shall not be more than ± 10% from the nominal weight specified by the supplier.

6. CONCLUSION

This paper finally gives an idea of manufacturing of roof tiles for rural areas by using stone dust and fly-ash as raw materials. The tiles are economical because the raw materials used are considered as waste by the industries. so it is easily available as a waste material.

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