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"USE OF MARBLE AND GRANITE STUDY IN MANUFACTURING OF BRICKS"

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Abstract: Bricks have been a major construction and building material for long time. The use of dried-clay bricks for the first time dates back to 8000 BC and the fired-clay bricks were used for the first time as early as 4500 BC. The worldwide estimated annual production of bricks is currently about 130 billion units and the demand for bricks is continuously rising exponentially. Conventional bricks are produced from clay by burning at high temperature either in clamps or kilns . For obtaining clay to mold bricks quarrying operations are required to be done which are energy intensive, generates high level of wastes and affects the landscape adversely. The high temperature required in the kilns for firing bricks not only consumes significant amount of energy but also releases huge quantity of greenhouse gasses and particulate matter. Clay bricks, on average, have an embodied energy of approximately 2.0 kWh and release about 0.41 kg of carbon dioxide (CO) per brick . It should also be noted that due to lack of resources there is a shortage of clay and bricks in many parts of the world. Due to continuous excavation for clay some countries such as China has started to limit the production of bricks made from clay to protect the clay resource and the environment. The production of OPC concrete bricks are done by using OPC and aggregates. It is also well known that huge amount of energy is required in the production of OPC and significant amount of greenhouse gasses are released in this process. Production of 1 kg of OPC consumes approximately 1.5 kWh of energy and releases about 1 kg of CO in the atmosphere. Worldwide, production ofOPC is responsible for about 7% of all CO generated So the production of OPC concrete bricks also consumes large amount of energy and releases substantial quantity of CO. In addition, the aggregates are produced from quarrying and thus have the same problems as described above for clay. For environmental protection and sustainable development it is necessary to find a new construction material

1 Introduction

Brick is a very important material for construction industry. The traditional method of manufacturing bricks has left this important material far behind in advancement. The infrastructure such as buildings, housing, industries, and waste water plants for handling water and sewage will require large amount of construction material. Since the large demand has been placed on building material industry especially in the last decade owing to the increasing population, there is a mismatch between demand-supply management of these materials. Therefore to meet this continuously rising demand for the construction materials, engineers are attempting to design and develop sustainable alternative solutions to fulfill this increasing demand. With the rise in the popularity of using environment friendly, less expensive and lightweight construction materials in construction industry this has brought about the need to investigate how this can be obtained by beneficiating the environment as well as maintaining the standards as required for the materials. Brick is one of the most widely used building material everywhere due to its properties and availability. Researchers have been attempting to incorporate waste materials in the production of bricks, for example the use of rice husk ash, cigarette butts, polystyrene foam, polystyrene fabric, paper processing residues, plastic fiber straw, fly ash, textile effluent treatment plant (ETP) sludge, cotton waste, dried sludge collected from an industrial waste water treatment plant, granulated powder mixtures compressed in a hydraulic press, and the green bodies dried before firing at 1100°C.

2 Materials:

Brick is a very important material for construction industry. The traditional method of manufacturing bricks has left this important material far behind in advancement. The infrastructure such as buildings, housing, industries, and waste water plants for handling water and sewage will require large amount of construction material. Since the large demand has been placed on building material industry especially in the last decade owing to the increasing population, there is a mismatch between demand-supply management of these materials. Therefore to meet this continuously rising demand for the construction materials, engineers are attempting to design and develop sustainable alternative solutions to fulfill this increasing demand. With the rise in the popularity of using environment friendly, less expensive and lightweight construction materials in construction industry this has brought about the need to investigate how this can be obtained by beneficiating the environment as well as maintaining the standards as required for the materials. Brick is one of the most widely used building material everywhere due to its properties and availability. Researchers have been attempting to incorporate waste materials in the production of bricks, for example the use of rice husk ash, cigarette butts, polystyrene foam, polystyrene fabric, paper processing residues, plastic fiber straw, fly ash, textile effluent treatment plant (ETP) sludge, cotton waste, dried sludge collected from an industrial waste water treatment plant, granulated powder mixtures compressed in a hydraulic press, and the green bodies dried before firing at 1100°C.

Clay Winning

The choice of method of clay winning will depend on the depth, thickness, hardness and physical geology of the clay beds. The usual method for winning clay (extracting from the quarry) is once or twice a year by heavy plant machinery, whether it be excavators, back actors etc, to stockpile large amounts. The advantages of bulk winning are that it can take place during good weather, a large reserve close to the factory means that breakdown of quarry plant is not critical to the production schedule. The layering of the stockpile from large reserves helps to eliminate localized variations in the clay strata. Laboratory testing of the clays from different parts of the quarry determine the likely characteristics of the layers and clay is mixed according to the required properties of the finished item. Particular attention is given to environmental factors both during the clay win and when restoring the landscape after excavations are complete.

Clay Preparation

Clay preparation methods may have to accommodate the physical characteristics of the raw material and special provision may have to be made to deal with certain impurities. Preparation consists of transforming the clay rock into plastic moldable material by a process of grinding and mixing with water. A typical factory might have a Primary crusher, these are used to break down large lumps of rock to manageable size, which can then be fed to a Secondary crusher, for example Pan mill, wherethe clay is reduced in size further. Water can be added here or if it is a dry pan the clay is reduced todust and water added later. Further crushing takes place through conveyor rollers reducing the clay particles to about 1-2mm.

3 Results

Specific Gravity Test for Clay, Granite slurry and Marble Slurry Powder

Specific gravity of aggregates and marble slurry powder was tested using pycnometer test and Le-Chatelier'stest was performed for specific gravity of cement. The formula used to calculate the specific gravity is –

$$sp.\,gr. = \frac{(W_2 - W_1)}{(W - W) - (W - W)\rho}$$

2 1 3 4

Where, W_1 = Weight of Pycnometer in gm

W_2 = Weight of Pycnometer + aggregate in gm

W_3 = Weight of Pycnometer + aggregate + water in gm

W_4 = Weight of Pycnometer + water in gm.

ρ = density of medium

After adding water, pycnometer was rotated so that all the voids get filled with water and all the air bubbles come on the surface. Again water was poured to fill the pycnometer completely. The test results for coarse and fine aggregates, cement and marble slurry are as follows –

Chemical composition of Clay, Granite slurry and Marble Slurry Powder

Compound	Marble	**Granite**	**Clay**
SiO_2	10.41	73.19	65.04
CaO	31.33	20.14	4.12
MgO	20.91	Nil	1.96
Loss of Ignition (LOI)	37.20	0.53	5.66
Fe_2O_3	Nil	5.93	5.06
Al_2O_3	Nil	Nil	12.95

Compressive Strength –

Table: Marble Replacement in Clay Bricks

Sample	Marble Replacement(%)	Compressive Strength (N/mm^2)
M0	0	12.23
M5	5	12.71
M10	10	13.29
M15	15	13.95
M20	20	12.01
M25	25	10.73

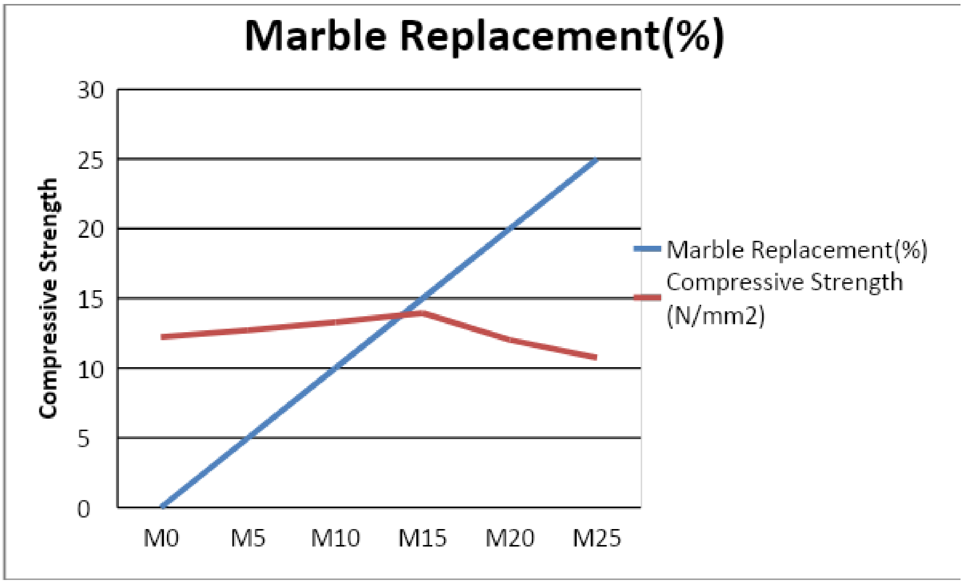
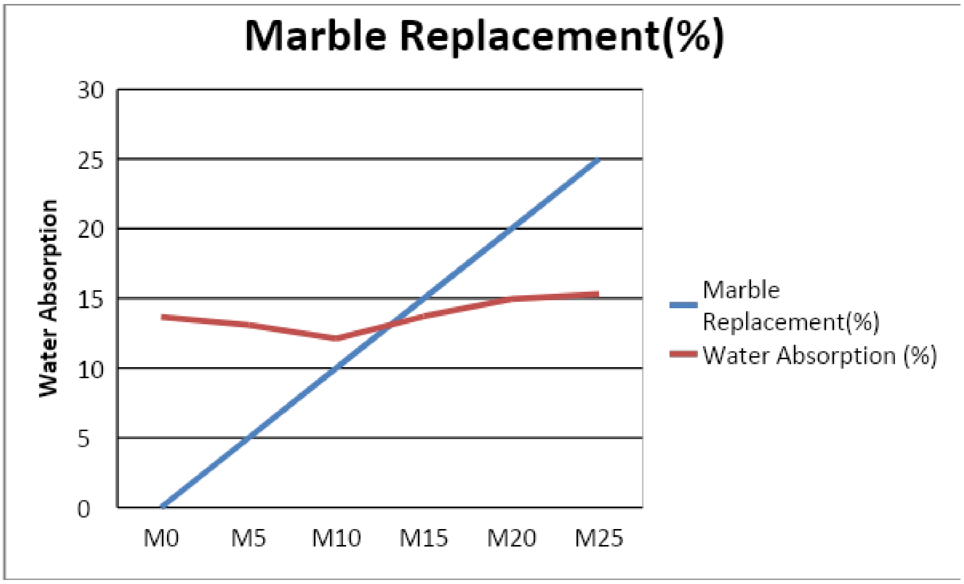


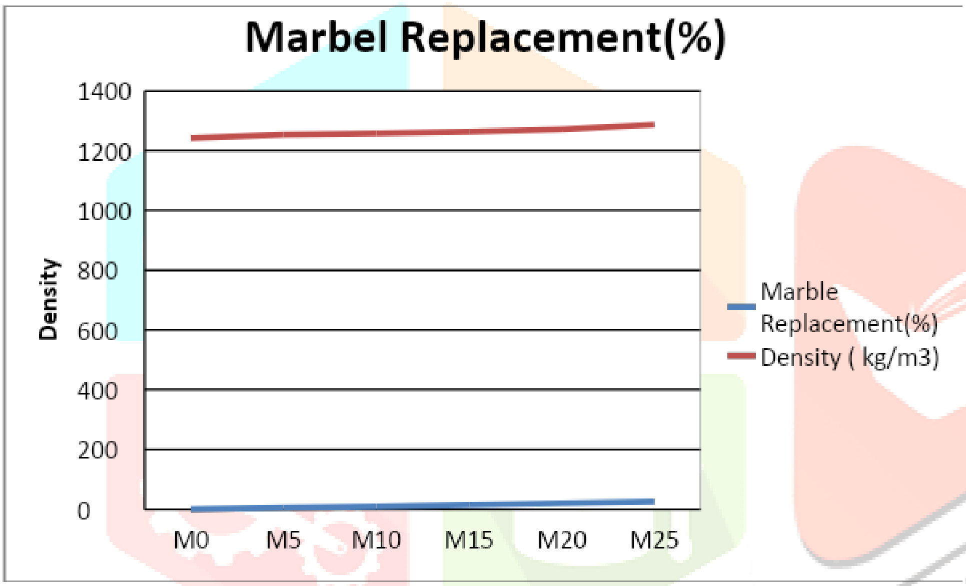
Table: Granite Replacement in Clay Bricks

Sample	Granite Replacement(%)	Compressive Strength (N/mm^2)
G0	0	12.23
G5	5	12.94
G10	10	13.71
G15	15	12.01
G20	20	11.18
G25	25	9.07

Water Absorption

Sample	Marble Replacement(%)	Water Absorption (%)
M0	0	13.67
M5	5	13.10
M10	10	12.11
M15	15	13.71
M20	20	14.95
M25	25	15.30





Density-

Table: Marble Replacement in clay bricks

Sample	Marble Replacement(%)	Density (kg/m^3)
M0	0	1241
M5	5	1253
M10	10	1257
M15	15	1263
M20	20	1271
M25	25	1287

4 Conclusion

- After collecting and analyzing all the results, we can conclude that, at 10 % replacement of clay with granite slurry and marble slurry gives maximum compressive strength. After 15%, the compressive strength starts decreasing in both granite and sand replacement.
- Water absorption observed for both replacement granite and marble decreases up to 10 % after that increases.
- Density of brick after replacement of granite continuously decreases and after replacement marble continuously increases.

So we can analysed that 10 % replacement of marble and granite slurry is optimum

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