

Experimental Investigation on Brick by Using Various Natural Materials

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Abstract--- Majority of the people prefer burnt bricks for the construction purpose which emits nearly 1ton of carbon dioxide. Conventional fine aggregate used in bricks are depleting at an increasing rate. Thus to curb the problem of environmental threat and depleting natural resources, egg shell powder, granite dust and micro silica are used. This paper presents the strength of the bricks by using different recyclable materials like granite dust, egg shell powder and micro silica.

Keywords--- Brick, Egg shell powder, granite dust, Micro silica.

I. INTRODUCTION

Since the large demand has been placed on building material industry especially in the last decade owing to the increasing population which causes a chronic shortage of building materials, the civil engineers have been challenged to convert the natural wastes to useful building and construction materials. In our present day life, Hybrid material are widely used as an alternatives for traditional construction materials. Hybrid material are material from two or more constituent material with significantly different physical or chemical properties, that when combined. This produce a material with characteristics different from the individual component. In this investigation we used Natural materials like Micro silica, Quarry sand and Egg shell powder to achieve compressive strength higher than normal conventional brick. Granite dust powder which is a by-product of granite processing factory was studied by many researchers for its use in brick. Micro silica, which can end up in rivers, lakes and coastal waters. The disposal of this waste is a very important problem, which can cause risk to public health, contamination of water resources and polluting the environment. The use of eggshell powder in concrete production reduced the cost of raw material and contributes to the construction industry. Thus, eggshells can be applicable to reduced cost of construction material and produced a new raw material for development in the construction industry.

Materials

A. Egg Shell Powder

Eggshell consists of several mutually growing layers of CaCO_3 , the innermost layer-maxillary 3 layer grows on the outermost egg membrane and creates the base on which palisade layer constitutes the thickest part of the eggshell. The top layer is a vertical layer covered by the organic cuticle. The eggshell primarily contains calcium, magnesium carbonate (lime) and protein. In many other countries, it is the accepted practice foreggshell to be dried and use as a source of calcium in animal feeds. The quality of lime in eggshell waste is influenced greatly by the extent of exposure to sunlight, raw water and harsh weather conditions. It is the fine grained powder with suitable proportion which is sieved to the required size before use with brick.



Fig.1 Eggshell powder

B. Micro Silica

Micro silica, or silica fume, is an amorphous type of silica dust mostly collected in bag house filters as by-product of the silicon and ferro-silicon production. Micro silica contains trace amounts of heavy metal oxides and organic deposits, which originate from natural raw materials. Since the concentration of these impurities is very low. The effect of silica fume can be explained by two mechanism i.e. pozzolanic reaction and micro filler effect. The first product is calcium silicate-hydrate (C-SH) gel, that is cementitious and binds the aggregate together in concrete and $\text{Ca}(\text{OH})_2$ The C-S-H formed by the reaction between micro-silica and the product $\text{Ca}(\text{OH})_2$ which comprises 25% of volume of hydration product.

Table1. Physical properties of Micro silica

Microsilica Physical Properties	
Specific Gravity	2.20 g/cm ³
Physical form	Powder
+325 Mesh (45µm) Residue	<1.0%
Particle Size	<45µm
Bulk Density (loose-filled)	1.25 g/cm ³

Table2. Chemical properties of Micro silica

Microsilica Chemical Composition	Wt %
SiO ₂ + Al ₂ O ₃ + Fe ₂ O ₃	>95.0
Sulphur Trioxide (SO ₃)	<0.10
Alkalies (as Na ₂ O, K ₂ O)	<1.00
Loss on Ignition	<2.50
Moisture Content	<1.50
pH	5.5 - 7.5



Sl. No	Specifications	Values
1	Specific Gravity g/cc	2.77 - 2.82
2	Chemistry	Felsic
3	Density (lbs/ft ³)	166.5
4	Melting Point (°F)	Approx. 3,000
5	Solubility In Water	Insoluble
6	Boiling Point (°F)	Approx. 4,000
7	Thermal Conductivity (K)	~ 2.2
8	Particle Shape	Irregular
9	Mohr's Hardness	7.0
10	Odor and Appearance	Black and white No odor
11	Vapor Pressure	None
12	Color	Pink, light gray, dark gray

Fig.2 Micro Silica

C. Granite dust powder

Granite is a material used indoor flooring. The industry's disposal of the granite powder material, consisting of very fine powder, today constitutes one of the environmental problems around the world. Major waste generating industries is the granite quarry and

production industry by which around 70% of this precious mineral resource is wasted in the mining, processing, and polishing procedures. Granite is a mixture of angular particles; color can range from white to red to black and colors in between, ranging in size from pebbles to boulders. It is odorless and not flammable. Respirable dust particles containing silicon dioxide may be generated by handling granite. Its property is shown in table 3.

Table3. Physical properties of Granite Dust Powder



Fig.2 Granite Dust

D. Brick Details

Weight of burnt brick = 3.5kg
 Size of the brick = 23X11X11cm
 Area of the brick = 253cm²

The percentage of waste added is 0, 5, 10, 15 and 20.



Fig.4 Various proportion of Ingredients



E. Mix proportion

Table4.Mix proportion of brick

ITEM	Total Amount of Reusable material		Eggshell Powder		Quarry Dust		Micro Silica	
	%	gms	%	gms	%	gms	%	gms
SAMPLE 1	0	0	0	0	0	0	0	0
SAMPLE 2	5	175	1	35	2	70	2	70
SAMPLE 3	10	350	2	70	4	140	4	140
SAMPLE 4	15	525	3	105	6	210	6	210
SAMPLE 5	20	700	4	140	8	280	8	280

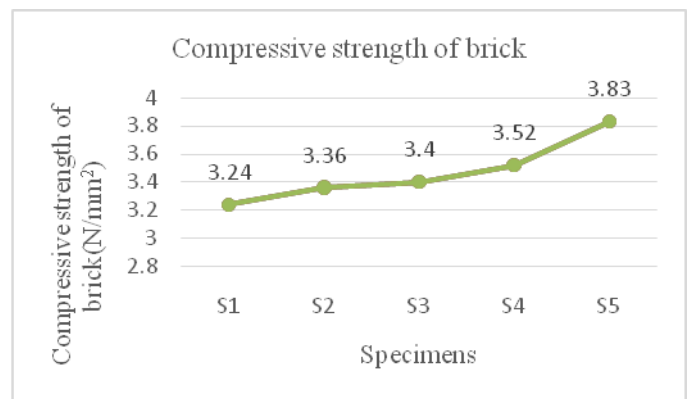
F. Result And Discussion

1. Compressive strength

The compressive strength of a brick is done by preparing the specimen adding suitable recycling waste of granite waste, eggshell powder and micro silica in various proportion such as 0%, 5%, 10%, 15% and 20%.

Table5.Compressive strength of brick

S.NO	Specimen	Load (kN)	Compressive Strength (N/mm ²)
1	S1	82	3.24
2	S2	85	3.36
3	S3	86	3.40
4	S4	89	3.52
5	S5	97	3.83

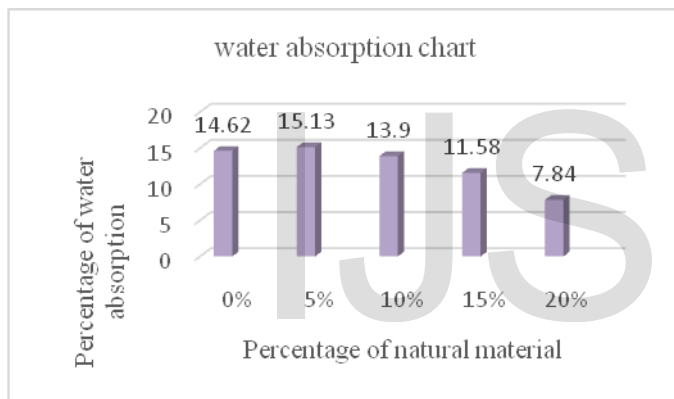


2. Water Absorption test on bricks

As per standard, for a good quality brick the amount of water absorption should not exceed 20% of weight of dry brick. The less water absorbed by brick the greater its quality.

The test was carried out by immersing the bricks in cold water for 24 hours after that its change in weight is calculated for water absorption test.

S.No	Weight before absorption of water(W1)G	Weight after absorption of water(W2)G	% of absorption of water
Normal Brick	2.757	3.160	14.62
5% Brick	2.789	3.211	15.13
10% Brick	2.805	3.195	13.90
15% Brick	2.858	3.189	11.58
20% Brick	2.985	3.219	7.84



G. CONCLUSION

Based on the present study which is conducted on production of bricks from natural waste materials, the following conclusions can be drawn:

- The possibility to use the granite wastes and eggshell as an alternative raw material in the production of clay-based products leads to relief on waste disposal concerns.
- The bricks are sufficiently hard in 10%, 15% and 20% replacement of granite waste and the percentage of granite waste increases with increase in the hardness of the brick.
- It is observed that as the temperature increases the compressive strength of bricks is also increases and as the percentage of the soil reduces the strength of the brick decreases. It is noted that as the clay content is reduces the bricks become lighter in weight.
- The water absorption property of all the bricks manufactured with natural waste materials is in accordance with IS code standards.