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An experimental investigation on brick by partial replacement of red soil with copper slag and sculpture waste

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***Abstract*—Since the large demand has been placed on building material industry especially in the last decade owing to the increasing population, increase in infrastructure and also increase in new infrastructural projects. which causes a chronic shortage of building material; the civil engineering has been challenged to convert waste to use full building and construction material like brick.Recycling of such waste as raw material alternative may contribute In the exhaustion of the natural resources which will help to create awareness toward clean environment.In the review of utilization of those waste, this paper reviewed recycling various waste like copper slag and sculpture waste with Red Soil in Brick. All mixtures are subjected to oven curing until the testing age. However the brick specimen size is 220mm x 100mmx 100mm. Compression strength, Soundness, hardness test, water absorption test were conducted at 7, 14 and 28 days.**

***Key words*: Brick, Copper slag, Compression strength, Environment, Population, Red soil, Recycle.**

I. INTRODUCTION

Bricks are one of the oldest types of building blocks. They are an ideal building material because they are relatively cheap to make, very durable, and require little maintenance. A brick is a block of ceramic material used in masonry construction, usually laid using various kinds of mortar. Bricks dated 10,000 years old were found in the Middle East. Examples of the civilizations that used mud brick are the ancient Egyptians and the Indus Valley Civilization, where it was used exclusively.The first sun-dried bricks were made in Iraq, in the ancient city of Ur in about 4000 BC.

The copper slag production in industrial is large and increases with time. In each country the copper slag composition is different, since it is affected by socioeconomic characteristics, consumption patterns and waste management programs, but generally the level of copper slag in waste composition is high. The largest component of the copper slag smelting As we know that Copper slag is by-product obtained during the copper smelting and refining process. it is a product which contains 30-35 percentage of copper, 12 per. of silica and 5 percentage of calcium.

Gypsum is a soft mineral composed of calcium with the calcium formula of caso4 2H2O. Gypsum is widely mined andis used as a fertilizer, and as the main constituent in many forms of plaster, blackboard chalk and wallboard. A massive fine-grained white or lightly tinted variety of gypsum, called alabaster, has been used for sculpture by many cultures including Ancient Egypt, Mesopotamia, Ancient Rome, the Byzantine Empire and the Nottingham alabasters of Medieval England

Our life rivers pond obscure and clean water to drink. Some particular community to fulfill their religious customs and worship god. They deposits lots of wastethings to make this water resources unfit. Worship system causes water pollution and they are likely short-lived.

Advantages of Bricks

- Brick will not burn, buckle or melt.
- Brick will not rot and allow Termites to invade.
- Brick will not rust and corrode.
- Brick will not dent.
- Brick will not fade from the Sun's UV Rays.

II. OBJECTIVE

Objective of the research work is to study the effect of the copper slag and sculpture waste bricks on the performance and the properties of bricks with the view to study the comparison between clay brick, copper slag and sculpture waste. Because both are enriched by silica, are the main constituents for conventional building material

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III. SCOPE

- The building structures are getting heavier with time, the use of this combination of bricks would be more efficient as well as environment friendly.
- The research will be helpful for the aquatic animal.
- To minimize the water pollution.
- Construction industries will build a new thrust by this research work.

IV. LITERATURE STUDY

Various books and journals were collected for reference and were studied before starting the project work for having an idea about how the project should be done. The collected journals are:

K. MahendranApril 2017- Experimental study on low cost bricks using copper slag and rise husk ash-From this literature we get the information that we can partial replace red soil with copper slag and other materials. And also increase in the ratio reduces the compression strength of brick.

R.Sumathi Dec 2016 - Study and analysis in making of bricks using debris - From this literature we get the information that how much degree of heat is required to burn the bricks.

A.Sumanthi 2014 - Comparison strength of brick with addition of lime and gypsum - From this literature A. Sumnthi reviews that by adding of gypsum to the brick it will increase the fire resistance property. And with addition of lime it will boost the strength to the brick.

AmitVishvakarma Dec 2016 - Experiment study of brick by using e-waste and sculpture waste

From this literature we get the information that sculpture waste gives better finishing look as compared to other materials

V. MATERIAL

a) Red soil
b) Clay
c) Sculpture waste
d) Copper slag
e) Lime
f) Water.

5.1 RED SOIL : Red soil is a type of soil that develops in a warm, temperature, moist climate under deciduous or mixed forest, having thin organic and organic-mineral layers overlying a yellowish-brown leached layer resting on an alluvial red layer. Red soils are generally derived from crystalline rock. They are usually poor growing soils, low in nutrients and humus and difficult to cultivate because of its low water holding capacity. Red soils denote the third largest soil group of India covering an area of about 3.5 lakhs sq. km (10.6% of India's area) over the Peninsula from Tamil Nadu in the south to Bundelkhand in the north and Rajmahal hills in the east to Katchch in the west. They surround the red soils on their south, east and north.

5.2 CLAY:Clay is one of the most abundant natural mineral materials on earth. For brick manufacturing, clay must possess some specific properties and characteristics.Clay is a finely-grained natural rock or soil material that combines one or more clay minerals with possible traces of quartz, metal oxides and organic matter. Geologic clay deposits are mostly composed of phyllosilicate minerals containing variable amounts of water trapped in the mineral structure. Clays are plastic due to particle size and geometry as well as water content and become hard, brittle and non–plastic upon drying or firing. Depending on the soil's content in which it is found, clay can appear in various colors from white to dull grey or brown to deep orange-red.

5.3 SCULPTURE WASTE: Gypsum is a soft mineral composed of calcium with the calcium formula of caso4 2H2O. Gypsum is widely mined and is used as a fertilizer, and as the main constituent in many forms of plaster, blackboard chalk and wallboard.

Table No. : 5.1 Physical Properties of Gypsum

Chemical Classification	Sulfate
Color	Clear, colorless, white, gray, yellow, red, brown
Streak	White
Luster	Vitreous, silky, sugary
Diaphaneity	Transparent to translucent
Cleavage	Perfect
Specific Gravity	2.3
Chemical Composition	Hydrous calcium sulfate, $CaSO_4 \cdot 2H_2O$
Crystal System	Monoclinic
Uses	Used to manufacture dry wall, plaster, and joint compound. An agricultural soil treatment.

5.3 COPPER SLAG: Copper slag used for this work is taken from Suyog suppliers (zone-II), a dealer in Pune which is used for sand blasting and the supplier brought the slag from Baruch, thoothukudi.

5.4 LIME: Lime is a calcium-containing inorganic mineral in which carbonates, oxides, and hydroxides predominate. In the strict sense of the term, lime is calcium oxide or calcium hydroxide. It is also the name of the natural mineral (native lime) CaO which occurs as a product of coal seam fires and in altered limestonexenoliths in volcanic ejecta.

5.5 WATER:The water used for mixing of bricks and should be potable drinking water having PH 6 TO 8.

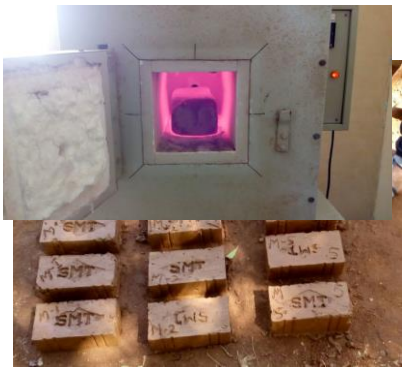
VI BRICK MIX DESIGN

MIX-1	MIX-2	MIX-3	MIX-4	MIX-5	MIX-6
Red Soil 80%	Red Soil 75%	Red Soil 75%	Red Soil 75%	Red Soil 75%	Red Soil 75%
Clay 10%	Copper Slag 5%	Sculpture Waste 5%	Copper Slag 3%	Copper Slag 2%	Copper Slag 2.5%
Lime 10%	Clay 10%	Clay 10%	Sculpt--ure Waste 2%	Sculpture Waste 3%	Sculptur-e Waste 2.5%
	Lime 10%	Lime 10%	Clay 10%	Clay 10%	Clay 10%
			Lime 10%	Lime 10%	Lime 10%

VI. TOTAL QUANTITY OF BRICK RAW MATERIAL

RAW MATERIAL	QUANTITY
Red soil	290 kg
Copper slag	8 kg
Sculpture waste	8 kg
Clay	38 kg
Lime	38 kg

VII. CASTING AND OVEN CURING OF BRICK



VIII. TEST RESULTS

8.1 STRUCTURE TEST:

8.2 WATER ABSORPTION TEST

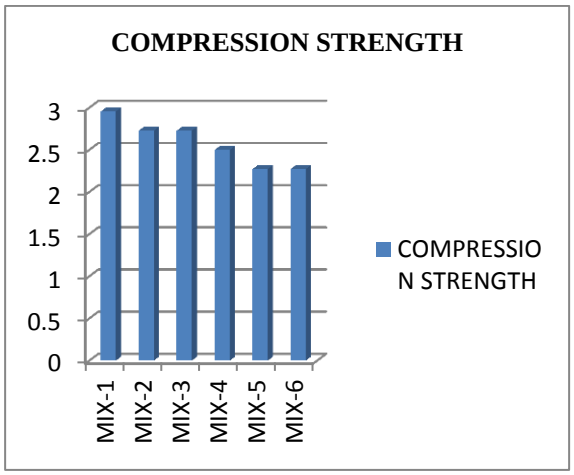
The test was done by immersing the brick in water for 24 hours.

Wt. of bricks	M-1	M-2	M-3	M-4	M-5	M-6
Initial	2.990	2.890	2.986	2.890	2.990	2.890
Final	3.220	3.110	3.230	3.220	3.340	3.310
w/a result	7.6%	7.6%	8.17%	11.4%	11.7%	14.53%

8.3 COMPRESSIVE STRENGTH TEST

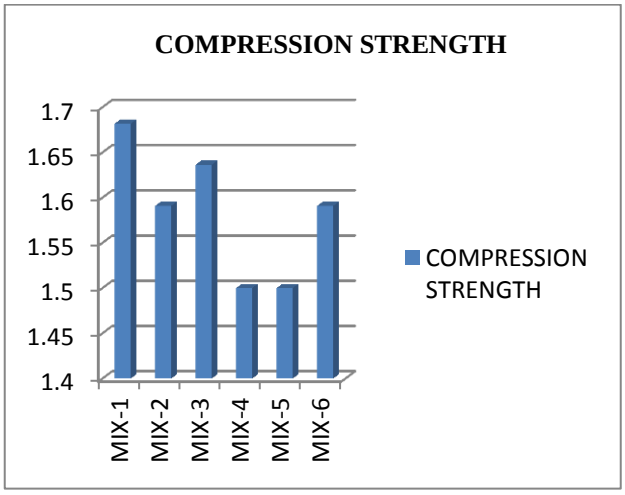
7 DAYS COMPRESSION TEST

Trial No	Sample ID	Size in mm	Bearing area in mm^2	LOAD		Compressive stress in N/mm^2
				Kg	In N	
1	M-1	220X100	22000	37	37000	1.68
2	M-2	220X100	22000	35	35000	1.59
3	M-3	220X100	22000	36	36000	1.63
4	M-4	220X100	22000	33	33000	1.5
5	M-5	220X100	22000	33	33000	1.5
6	M-6	220X100	22000	35	35000	1.59



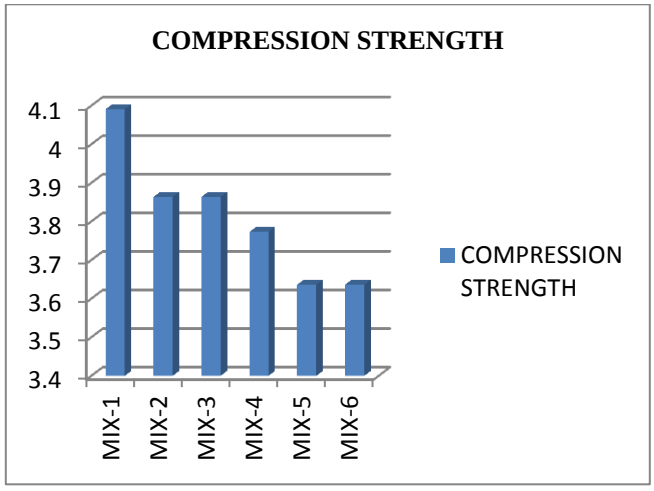
28 DAYS COMPRESSION TEST

Trial No	Sample ID	Size in mm	Bearing area in mm^2	LOAD		Compressive stress in N/mm^2
				Kg	In N	
1	M-1	220X100	22000	90	90000	4.09
2	M-2	220X100	22000	85	85000	3.86
3	M-3	220X100	22000	85	85000	3.86
4	M-4	220X100	22000	83	83000	3.77
5	M-5	220X100	22000	80	80000	3.63
6	M-6	220X100	22000	80	80000	3.63



14 DAYS COMPRESSION TEST

Trial No	Sample ID	Size in mm	Bearing area in mm^2	LOAD		Compressive stress in N/mm^2
				Kg	In N	
1	M-1	220X100	22000	65	65000	2.95
2	M-2	220X100	22000	60	60000	2.75
3	M-3	220X100	22000	60	60000	2.72
4	M-4	220X100	22000	55	55000	2.5
5	M-5	220X100	22000	50	50000	2.27
6	M-6	220X100	22000	50	50000	2.27



8.4 EFFLORESCENCE TEST

The test was done by soaking the bricks in water in for 24 hours. After that deposit of efflorescence was recorded.

BRICKS	EFFECT OF EFFLORESCENCE
MIX-1	NIL
MIX-2	NIL
MIX-3	NIL
MIX-4	SLIGHT
MIX-5	SLIGHT
MIX-6	MODERATE

IX CONCLUSION

As per the result of compression strength. If the number of proportion increases in brick ratio then the strength of the brick is also reduces. The brick with less mix ratio have better compression result as compared to other bricks. And by the way the strength of bricks is not too minimum, so we can use this bricks for low strength structures and that will be environment friendly.

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