EXPERIMENTAL STUDY ON MANUFACTURING BRICKS BY USING MARBLE SLUDGE POWDER FOR ACID RESISTANCE TEST

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Abstract

Brick is one of the most common masonry units as a building material due to its properties. The rapid growth in today's construction industry has obliged the civil engineers in searching for more efficient and durable alternatives far beyond the limitations of the conventional brick production. Many attempts have been made to incorporate wastes into the production of bricks and recycling such wastes by incorporating them into building materials is a practical solution for pollution problem. So the proposed system is to the invention of waste marble sludge powder and bottom ash as the replacement of clay bricks regarding the strength and durability studies. In our project, totally 100 number of bricks are to be casted with partial replacement of marble sludge powder. The percentage of replacement is carried out in this work as 0%, 5%, 10%, 15% and 20% by total volume. The strength and durability test of bricks is to be calculated.

Keywords: Thermal resistant, Marble Sludge powder, compressive strength, Minimum percentage

I. INTRODUCTION

Brick is one of the oldest manufactured building materials in the world. As early as 14,000 BC, hand-moulded and sun-dried clay bricks were found in the lower layers of Nile deposits in the Egypt. Clay was also ancient Mesopotamia's most important raw material and most buildings during that time were made of clay bricks. The earliest use of bricks recorded was the ancient city of Ur (modern Iraq) that was built with mud bricks around 4,000 BC and the early walls of Jericho around 8,000 BC. Starting from 5,000 BC, the knowledge of preserving clay bricks by firing has been documented. The fired bricks were further developed as archaeological traces discovered in early civilizations, such as the Euphrates, the Tigris and the Indus that used both fired and unfired bricks. The Romans used the fired bricks and were responsible for their introduction and use in England. However, the brick making craft declined following the departure of the Romans from Britain in 412 AD and was only revived later by Flemish brick makers. The development of different types of bricks continued in most countries in the world and bricks were part of the cargo of the First Fleet to Australia, along with brick moulds and a skilled brick maker. Bricks have continuously been used by most cultures throughout the ages for buildings due to their outstanding physical and engineering properties. Brick is one of the most demanding masonry units. It has the widest range of products, with its unlimited assortment of patterns, textures and colours.IN1996, the industry produced 300 million bricks in Victoria, which were about 55% of the potential production of the facilities available. The export markets included Japan, New Zealand, the Middle East and other Asian countries. This is equivalent to an annual turnover of 130 million dollars. Brick is durable and has developed with time. It remains highly competitive, technically and economically, with other systems of structure and field. The main raw material for bricks is clay besides clayey soils, soft slate and shale, which are usually obtained from open pits with the attendance of disruption of drainage, vegetation and wildlife habitat. Clays used for brick making vary broadly in their composition and are dependent on the locality from which the soil originates. Different proportions of clays are composed mainly of silica, alumina, lime, iron, manganese, sulphur and phosphates.

II.LITERATURE VIEW

1. Dr.C.Anbalagan et al., 2016 Majority of the people prefer burnt bricks for the construction purpose which emits nearly about 1 ton of CO2. The usage of environmental friendly, structurally sound and in expensive materials was used in the ancient centuries. The stabilized bricks are the one which have a low embodied energy of 0.42 MJ/kg and low carbon foot print. This paper presents the strength of the

bricks by using different recyclable materials like coconut fiber, granite waste and egg shell powder.

2. L.M. Federico, S.E. Chidiac, R.G. Drysdale et al., 2005
Fired clay bricks are produced when clay particles bond to one another at high temperatures,
Forming a glassy material, which, upon cooling, displays high strength and durability properties. High temperatures required to melt SiO2 mean high energy cost associated with brick
In addition to cost, challenges facing the modern brick industry include shortages of raw material and environmental impacts of production. The feasibility of using waste material as a brick body was investigated, where several possible waste additives, including slag, biological waste, and waste container glass, were considered. A literature review was conducted in order to assimilate past work and experimental results. The results of several testing programs were compared and the feasibility of further work in the addition of waste additives to bricks was
Its soda content, amorphous glassy structure, and availability, waste glass was determined to be a feasible option for addition. The specimens with glass additions exhibited an increase in compressive and flexural strength, a decrease in the initial rate of absorption, and an increase in firing shrinkage. The determination of feasibility of adding slag or biological waste to bricks was hindered by a lack of comparable data; however, the limited comparison available suggested the necessity for additional, directly comparable testing programs. As a result, an experimental program was developed to investigate potential benefits in terms of strength, absorption, and durability of bricks associated with the addition of waste glass, as well as economic and environmental gains as a result of the process.

3. A. Venkatesan et al., 2015 Based on experimental investigations concerning compressive strength and water absorption of the Brick, the following results were obtained, Compressive strength decreases on increase in percentage of wood ash as compare to charcoal brick. The different percentage of wood ash and charcoal (5%, 10% & 15%) are added with cement and sand. The compressive strength for both bricks are decreased. In that charcoal brick has maximum compressive strength ie.,(11.07 N/mm2 for 15 % of charcoal) than wood ash brick (7.9 N/mm2 for 15% of wood ash).The water absorption for both the bricks are increases with percentage of (5%,10%,15%).In that the
charcoal brick has less amount of water absorption ie.,(4.45% for 15% of charcoal) than wood ash brick(15.80% for 15% of wood ash).Thus from above study, this project concluded that, with the addition of charcoal in the cement and sand, the compressive strength of bricks increases and water absorption decreases than wood ash bricks.

4. Rania Hamza, Salah El-Haggar, Safwan Khedr et al., 2011 Marble and granite slurry cement bricks yield similar mechanical, in terms of compressive strength, and physical, in terms of density and absorption, properties. There is a positive effect of granite slurry on cement brick samples that reach its optimum at 10% slurry incorporation. Absorption is the major drawback of slurry incorporation in cement bricks according to the ASTM C55 where water absorption requirement is full filled only at Zero, 10 %, and 20% slurry samples for grade S. The accelerated hydration, endued by heating, compensated the detrimental effect of volumetric changes associated with temperature variation. Most cement brick samples, including the control, are of normal weight according to both the Egyptian specifications and ASTM C55.All cement brick samples tested in this study comply with the Egyptian code requirement for structural bricks. This is not true when compared to ASTM C55. Instead, 10% and 20%

5. Virendra Kumara at al., 2015 Granite sludge powder generates in processing activities of granite stone, such as cutting, polishing and finishing process. This contributes of about 30% wastage in these processes. As granite sludge powder is non- biodegradable waste, it has to be effectively disposed without creating environmental hazards. In our present study the objectives are to prepare Granite Sludge blocks of size230×110×70(mm) for varying mix proportions such as 20%, 30%, 40%, 50%,60%, and 70% for granite sludge powder and sand, by keeping lime 8% and gypsum 2% as constant. To find Mechanical properties such as Compressive Strength, Flexural strength and Water absorption, where maximum compressive Strength value for 7 days of 5.54 MPa, maximum flexural strength of 2.17 MPa And maximum breaking load 4.33kN was obtained for A3 block type. Water Absorption of granite sludge blocks increases with increase in addition of granite Sludge powder in mix proportions, yet it is in limit as per IS code specifications. Utilizing granite sludge powder for manufacturing of granite sludge masonry Blocks is one of efficient manner to minimize the disposal problems of granite
Sludge powder.

6. R.Nithiya ct al., 2016 Majority of the people prefer burnt bricks for the construction purpose which emits nearly about 1 ton of CO2.The usage of environmental friendly, structurally sound and in expensive materials was used in the ancient centuries. The stabilized bricks are the one which have a low embodied energy of 0.42 MJ/kg and low carbon foot print. This paper presents the strength of the bricks by using. Thus from above study, this project concluded that, with the addition of charcoal in the cement and sand, the compressive strength of bricks increases and water absorption decreases than wood ash bricks. Utilizing granite sludge powder for manufacturing of granite sludge masonry Blocks is one of efficient manner to minimize the disposal problems of granite
Sludge powder.

III.METHODOLOGY

Data was collected from the study area, review of literature and secondary source of information. The main aim is to identify materials and check the parameter of materials using study. Material parameters are mainly used for design the mix as per code practices. Mix design can be calculated from the procedure for prepare the specimen. Brick will be
Casted and burned. Finally specimen will be tested to get results.

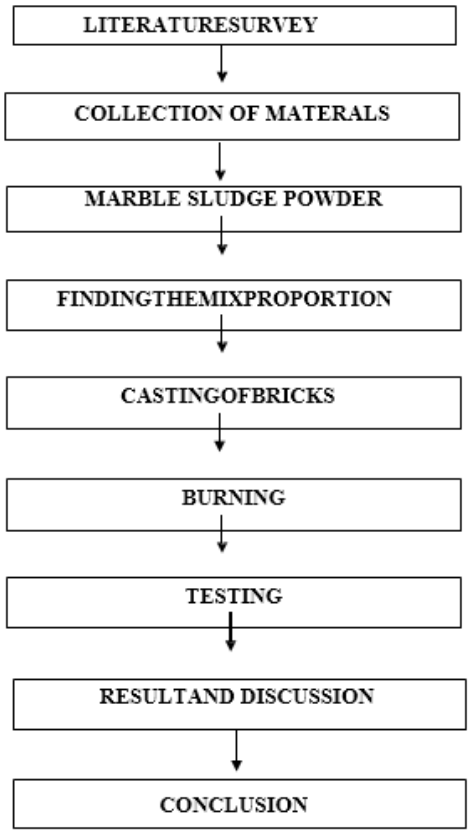

Fig 1 Methodology

IV.TESTING PROGRAM

1. MATERIALS

i) Marble sludge powder:

Marble is a metamorphic rock resulting from the transformation of pure lime stone. Marble sludge powder is an industrial waste containing heavy metals as constitutes. Chemically, marbles are crystalline rocks composed predominantly of calcite, dolomite or serpentine materials. The other mineral constituents vary from origin to origin.

ii) RED SOIL:

Red soil is a type of soil that develops in a warm, temperate, moist climate under deciduous or mixed forests and that have thin organic and organic-mineral layers overlying a yellowish-brown leached layer resting on an alluvial (see illuviation) red layer. Red soils generally derived from crystalline rock

iii) CLAY:

Clay is a fine-grained natural rock or **soil** material that combines one or more **clay** minerals with traces of metal oxides and organic matter. Geologic **clay** deposits are mostly composed of phyllosilicate minerals containing variable amounts of water trapped in the mineral structure.

iv) WATER:

Ordinary potable water

2. MIX DESIGN

Mix design for control specimen of bricks
(As per code IS3495-P(1)-1992) Methods of tests of burnt clay building bricks compressive strength of Clay brick can be determined.

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Adjustment is made according to IS code.

Sample	Sand (Kg)	Clay (Kg)	Marble sludge powder (Kg)	Water in % in weight
CS	2.7	0.3	-	10
S1	2.56	0.3	0.135	10
S2	2.43	0.3	0.27	10
S3	2.3	0.3	0.405	10
S4	2.16	0.3	0.54	10

Table 2: Mix design

3. MIX PROPTION

SAMPLE	MARBLE SLUDGE (%in vol.)
CS	0
S1	5
S2	10
S3	15
S4	20

Table 3: Mix Proportion

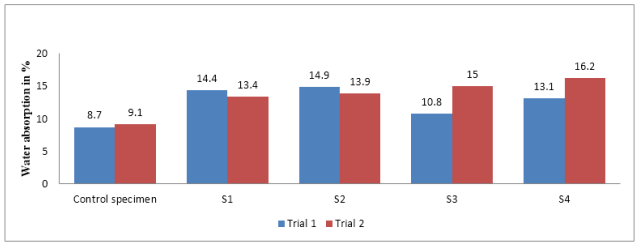
In order to know the best proportion of Marble sludge powder. To make 100 different test bricks of dimension 19x9x9cm. The different four proportions are as following

V.RESULTS AND DISCUSSIONS

1. Water Absorption Test

S. NO	sample	time (hrs)	Dry weight (kg)		Wet weight (kg)		LOSS IN WEIGHT IN (%)
			Trial 1	Trail 2	Trial 1	Trial 2	
1	CS	24	3.20	3.04	2.98	2.86	6.41
2	S1	24	2.88	2.85	2.67	2.63	7.6
3	S2	24	2.76	2.76	2.61	2.58	5.8
4	S3	24	2.95	2.86	2.70	2.67	6.4
5	S4	24	2.84	2.83	2.64	2.57	8.3

Table 1: Water Absorption Test



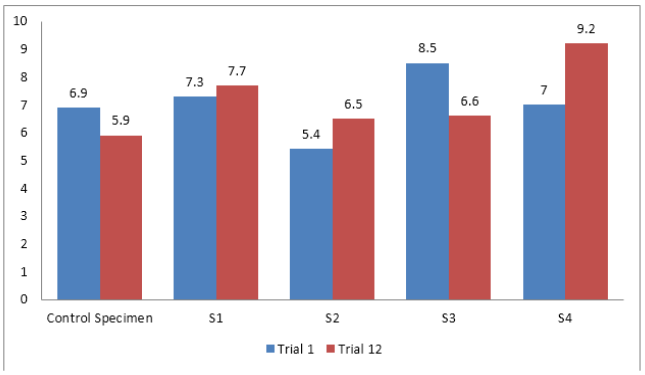
Water Absorption Test

Fig: 1 Water Absorption Test

2. Acid Resistance Test

S. NO	sample	time (hrs)	Dry weight (kg)		Wet weight (kg)		LOSS IN WEIGHT IN (%)
			Trial 1	Trail 2	Trial 1	Trial 2	
1	CS	24	3.20	3.04	2.98	2.86	6.41
2	S1	24	2.88	2.85	2.67	2.63	7.6
3	S2	24	2.76	2.76	2.61	2.58	5.8
4	S3	24	2.95	2.86	2.70	2.67	6.4
5	S4	24	2.84	2.83	2.64	2.57	8.3

Table 2: Acid Resistance Test



Acid Resistance Test

Fig: 2 Acid Resistance Test

VI.CONCLUSION

The following conclusions could be drawn from the present investigation.

- Marble sludge powder waste content up to 5%, 10%, 15%&20% by vol can be replaced in Sand mixture, without degrading their mechanical properties.
- The presence of marble sludge powder allow one to obtain a clay brick with better properties as the conventional clay brick at low temperatures as
- The normally used for brick products in the brick industry, resulting in energy saving and waste reduction.
- The incorporation of marble sludge powder in brick production anticipates safe for the health an environmentally friendly recycling products.
- Therefore, utilization of solid wastes has been encouraged as one of the most cost-effective alternative materials.
- That could be used in fired clay brick manufacturing.
- Recycling industrial and urban waste in fired clay brick is useful if the correct percentages were incorporated.
- Brick manufacturer will reduce the cost of raw materials, the usage of energy during firing and the improvement of the properties.

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