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USE OF COIR PITH IN STABILIZED MUD BRICKS

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Abstract: ***Bricks are a widely used construction and building material around the world. Conventional bricks are produced from clay with high temperature kiln firing. Thus contain high embodied energy and have large carbon footprint. In many areas of the world, there is already a shortage of natural sources for production of the conventional bricks. For environmental protection and sustainable development, extensive research has been conducted on production of bricks from waste materials. The present research work is on manufacturing of stabilized mud bricks with locally available soil, using cement as stabilizer and a agro industrial by-product coir pith as soil replacement. By considering both economic and use of eco-friendly materials, 7.5% of cement and 2.5% of coir pith yielded optimum compressive strength and durability properties.***

Keywords: Embodied energy, Environmental protection, Sustainable development, Stabilized brick & Eco-friendly.

1. INTRODUCTION

In all parts of the world there is an enormous increase in construction activity which has coupled in years and has made construction a great deal in today's world. The various construction materials are stone masonry, bricks, concrete blocks etc., among these the most basic building material used for construction is usually burnt bricks.

In the growing concern of awareness regarding sustainable building materials and environmental issue, stabilized mud brick gives the view of energy efficient, cost reduction and environmental friendly building materials, overall contribution on the sustainable development.

Coconut coir pith is an agro waste from coir industry. It is assessed that around 7.5 million tons of coir pith is being produced annually in India. Thus there is huge disposal problem of it. Presently coir pith is dumped into ocean but it does not degrade. In this research work, cast the unburnt clay bricks as per IS specifications by using cement as stabilizer and agro industrial by product coir pith as a replacement to soil.

2. LITERATURE REVIEW

From the civilizations of Mesopotamia dated 6000 years back the use of earth as a building material is very evident [1]. Earth, being available abundantly has invariably been the main construction material in providing housing systems. It offers a number of environmental benefits, including lower embodied energy levels; high thermal mass and maximizing the use of locally sourced materials [2]. Considerable research has been undertaken in the modern times to make earth as a sustainable construction material. This has led to development of technology using earth in the form of rammed earth and unfired bricks popularly known as Compressed Stabilized Earth Blocks (CSEBs). The main advantage of manufacturing unfired bricks is that it requires lesser energy than fired bricks, and hence the release of carbon dioxide into the atmosphere is 80% less than fired bricks [3]. For six decades, extensive attempts have been made to make unfired stabilized bricks to be a reliable walling unit against the more expensive fired bricks and concrete blocks [4]. CSEBs prepared using lime as a replacement to cement in certain proportions has clearly brought out the effectiveness of lime with cement in improving the long-term build-up of strength better than using cement alone [5]. 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 [6].

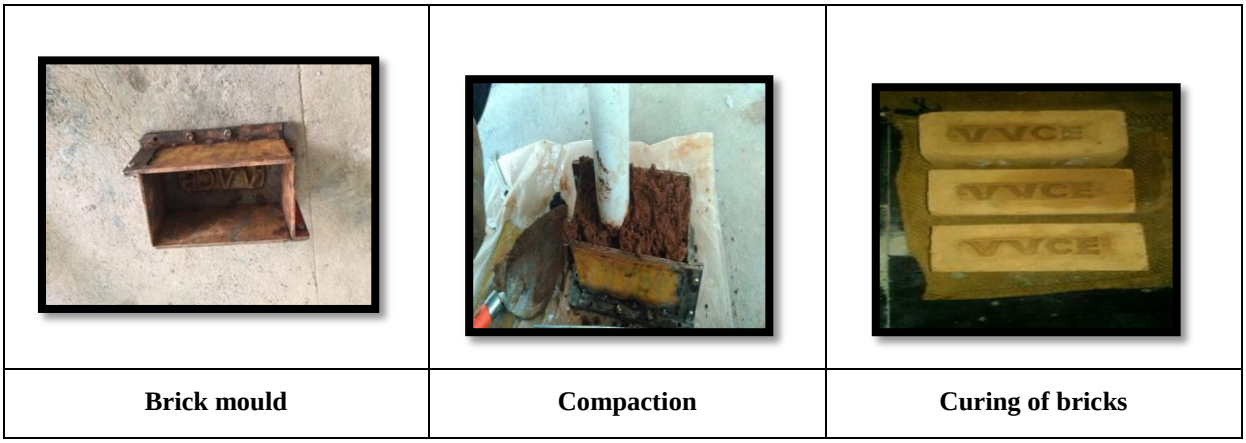
3. OBJECTIVE

The main objective of this research work is to use the locally available soil and agro industrial by-product coir pith for casting stabilized mud bricks.

4. EXPERIMENTAL INVESTIGATION

The experimental program included, firstly the preliminary investigation on the materials used for the study, i.e., Soil, Cement and Coir Pith. Soil used in compressed soil blocks should not be surface soil and it must be free from organic components. In present study soil was procured from Udbur, Mysore, Karnataka and some physical properties were determined as per IS standards and the results are tabulated in Table 1. Ordinary Portland cement of 43 grade was used and it confirms IS: 8112-2013. Coir pith collected from Nandi agro-based industry in Bilikere. Mysore, Karnataka. The soil and coir pith passing the 4.75 mm sieve and retained on 150µm sieve used for this study. The soil is replaced by stabilizing agent cement by weight up to 10% at an interval of 2.5%. The coir pith added at an interval of 2.5% upto 10% for fixed 7.5% cement proportion. The prepared mould, compaction of soil and curing of bricks are shown in Figure 1. The Variation of compressive strength and with increase in cement and coir pith are Tabulated in Table 2 and shown in Figure 2.

The Variation of water absorption and with increase in cement and coir pith are Tabulated in Table 3 and shown in Figure 3.



Brick mould	Compaction	Curing of bricks

Fig.1: Preparation and Curing of Bricks

Table 1: Physical characteristics of soil

Sl. No.	Parameters	Values Obtained
1.	Specific gravity	2.66
2.	Liquid limit	28%
3.	Shrinkage limit	21.66%
4.	Standard compaction	OMC = 15.33%
		MDD = 18.54kN/m^3
5.	Co-efficient of curvature	1.20
6.	Co-efficient of uniformity	5.65

Table 2: Variation of compressive strength and with increase in cement and coir pith

Sl. No.	Proportion	Compressive strength (MPa)		
		7 days	14 days	28 days
1.	Control cubes	2.61	2.80	3.57
2.	Soil + 2.5% cement	2.87	2.96	3.71
3.	Soil + 5% cement	3.10	3.47	3.92
4.	Soil + 7.5% cement	3.52	3.69	4.25
5.	Soil + 10% cement	3.79	4.21	4.70
6.	Soil + 7.5% cement + 2.5% coir pith	3.10	3.49	3.70
7.	Soil + 7.5% cement + 5% coir pith	2.60	2.75	2.83
8.	Soil + 7.5% cement + 7.5% coir pith	1.80	1.97	2.57
9.	Soil + 7.5% cement + 10% coir pith	1.54	1.84	2.40
10.	Burnt clay brick	-	-	7.53

Table 3: Variation of water absorption at 28 day with increase in cement and coir pith

Sl. No.	Proportion	Water absorption (%)
1.	Control cubes	Failure
2.	Soil + 2.5% cement	24.50
3.	Soil + 5% cement	12.00
4.	Soil + 7.5% cement	10.85
5.	Soil + 10% cement	9.25
6.	Soil + 7.5% cement + 2.5% coir pith	15.30
7.	Soil + 7.5% cement + 5% coir pith	17.45
8.	Soil + 7.5% cement + 7.5% coir pith	18.0
9.	Soil + 7.5% cement + 10% coir pith	20.20
10.	Burnt clay brick	13.10

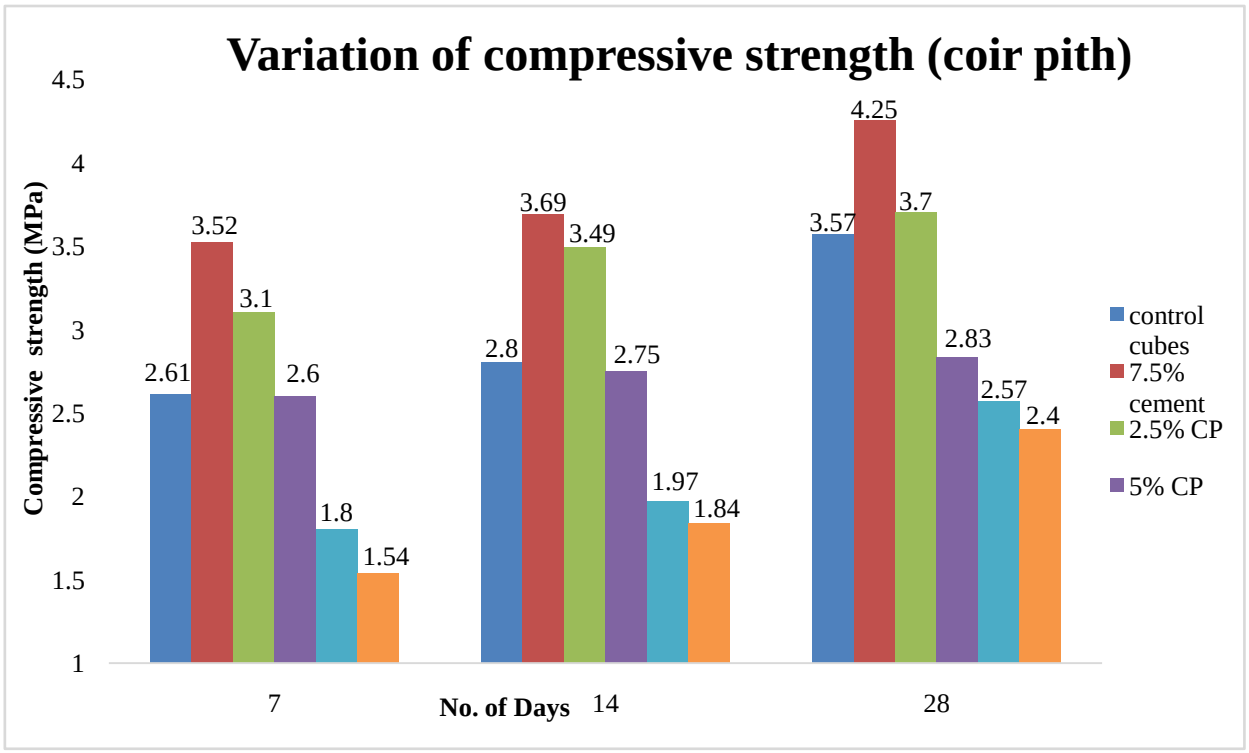


Fig.2: Variation of compressive strength with % increase in coir pith

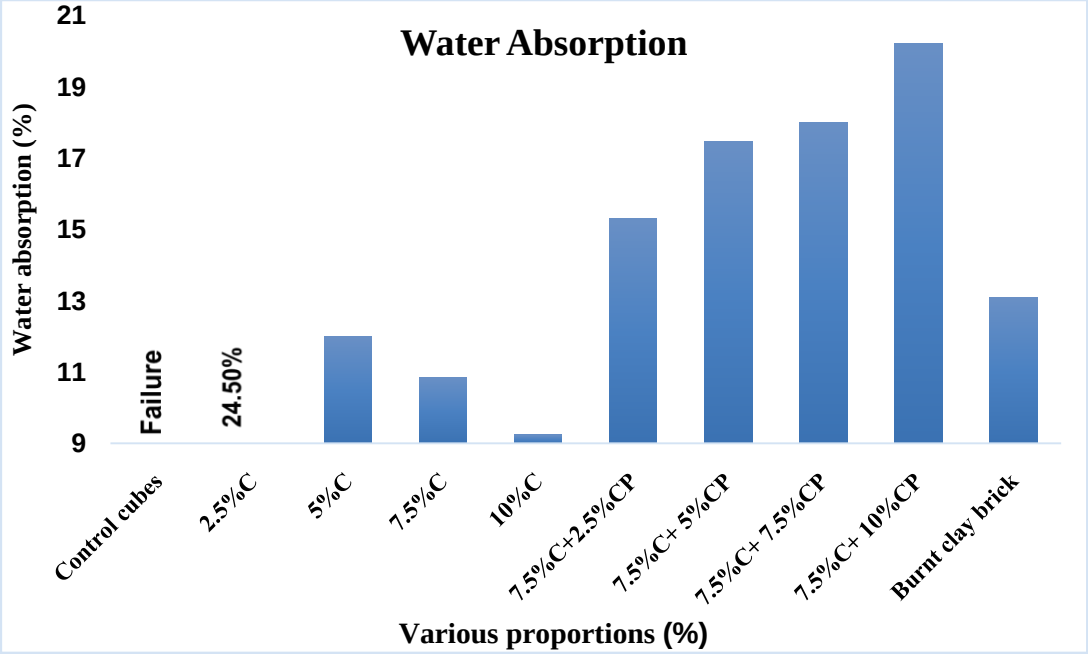


Fig. 3: Water absorption of various proportions

5. CONCLUSIONS

The following conclusions were drawn based on the result interpretation of the present study,

- Control cubes gave minimum strength requirement as per IS 1077 : 1992 for the construction but it fails in water absorption test
- Thereby the % of stabilizer i.e cement is incremented in 2.5% , this shows the increase in compressive strength with increase in cement
- For further study 7.5% cement bricks were selected since they gave higher compressive strength with optimum % of cement which was found to be economical
- Bricks were assigned the class designation of 3.5 as per IS 1077 : 1992 and water absorption values were within standards i.e. <20%
- Industrial by-product coir pith was varied in 2.5% and it was found that compressive strength decreased with increase in coir pith
- All the proportions gave minimum strength requirements as per IS standards but maximum compressive strength and minimum water content is achieved at 2.5% coir pith
- Weight of coir pith bricks was found to be less than regular burnt clay bricks
- Thus these bricks can be used in construction as economical, eco-friendly and light weight bricks

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