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An Experimental Study on Lime-Quarry Dust Bricks by Partially Replacing with Agro-Waste

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Abstract **– Building construction is one of the fastest growing industries in India and it puts a huge burden on its limited natural resources. Fired clay bricks are one of the major constituent materials for the construction industry and it produces a huge amount of greenhouse gases. This research tries to highlight the use of alternative materials and how they can be modulated to suit the Indian construction industry. However, there's hope for a more sustainable solution – Lime–Quarry dust bricks made from agricultural waste i.e such as dry hay, sugarcane, bagasse, cotton plant waste, etc. These Lime –Quarry dust bricks can be a cost-effective and eco-friendly alternative for the Indian construction industry. In this experimental investigation, agro-waste is partially replaced in Lime –Quarry dust bricks with the percentages of 0, 5, 10 and 15.**

KeyWords: **Lime, Quarry dust and Agro-waste**.

1. INTRODUCTION

Construction is the second largest industry in India, only second to agriculture. With rapid urbanization and exponential growth of population, there is a huge demand for housing and other ancillary related to housing creating a shortage of conventional building materials. The main aim of the research presented in this paper is to find a constructive method to turn solid, agricultural wastes into viable building materials, thereby addressing both pressing issues at the same time. The present paper explores the potential application of 'agro-waste', like hey or straw stubbles, leftover wood, et cetera, as the ingredient for alternative sustainable construction materials in the form of bricks.

2. LITERATURE REVIEW

Following were the research works conducted on bricks with different materials as replacements to constituent materials.

Dwivedi (2023)-The results of straw brick study using normal material, consistently showing low compressive strength, have been used to improve the quality of stroke brick with viscocrete additions. The aim of this study is to examine the mechanical properties of the brick, compressive
strength and water absorption strength.

Naik et al,. (2023)-Samples CB-BFA, MB-BFA, and GB-BFA had maximal compressive strengths of 35.79 N/mm^2, 36.98 N/mm^2, and 37.67 N/mm^2, respectively. The observed results of various BFA samples were significantly good, indicating that it has a high potential for use as a construction material in a variety of applications such as paver blocks, bricks, concrete, and so on.

Kocygit (2023)- The compressive strength decreased due to the micropores forming as a result of the addition of these materials in the brick, it was greater than 7MP, as stated in the literature. The findings of this study indicated that the fired clay bricks produced are potential materials for construction applications that require an appropriate thermal insulation and mechanical strength, as well as internal structural applications.

Singh et al,. (2023)- This paper provides up-to-date comprehensive studies of the innovative brick made by using different kind of waste in terms of different properties such as physical, mechanical, durability, microstructural attributes and thermal properties.

Korapayev et al,. (2023)- The results show that depending on the percentage of SWW introduced into the raw clay materials, the bulk density of fired bricks may be lowered by up to 13%. The pore-forming function of SWW had a promising impact on thermal insulation of up to 20.75% decrease following the addition of 10% at 1050 °C.

Murugesan et al,. (2023)- Results concluded that the eco-friendly cement bricks have good strength, shape and texture and 16% water absorption. Cement bricks are the most ecologically friendly and found as a sustainable product since they are available at the lowest embodied energy of 1.49 MJ/kg and emit the lowest embodied greenhouse gas of 0.162 kg of CO_2 when compared to conventional bricks.

Ejaz et al,.(2022)- The results showed that density and shore C hardness reduced with increasing the amount of agricultural waste while the water absorption remained similar up to a dosage of 7.5%. Except for the 10% wheat straw dosage, flexural and compressive strength of developed composites showed a decrease with the

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increase of wheat straw and rice husk dosages but remained above the acceptable values of 1 MPa and 2 MPa, respectively, as per BS EN 14246.

Ngayakamo (2021)- The results showed that adding 15 wt.% of eggshell powder as a bio-filler and flux yielded a compressive strength of 4.8 MPa, the bulk density of 2.1 g/cm^3, and a lower water absorption value of 11.1% at the firing temperature of 1000 °C.

Islam (2023)- As a result, sawdust, tobacco residues, and grass can be utilized in an environmentally safe way as organic pore-forming agents in brick-clay.

Khoudja et al,. (2021)- The results obtained revealed an improvement in the thermal insulation, with a thermal conductivity that went from 0.677 W/m.K, for test pieces with no date palm waste (DPW), to 0.342 W/m.K for those containing 10% of DPW.

Isah (2014)-The results show that the addition of CSA improves the strength properties of fired clay bricks. The optimum amount of CSA to be added for the production of fired clay bricks was found to be 2%.

Demir (2008)- The insulation capacity of brick increases with the increasing porosity of the clay body. Combustible, organic types of pore-forming additives are most frequently used for this purpose. For this reason, increasing amounts of organic residuesc(0%, 2.5%, 5% and 10% in wt.) were mixed with raw brick-clay.

3. MATERIALS USED

The constituent materials used in this project were gathered from different sources. Necessary tests were conducted on these materials to choose the kind and type of material.

LIME: It is a colorless crystal or white powder and is produced when quicklime is mixed or slaked with water. It has many names including hydrated lime, caustic lime, builders' lime, slack lime and pickling lime.

Table -1 Physical properties of lime

S.NO	PROPERTIES	OBTAINED VALUES
1	Determination Of Insoluble Residue By Hydrochlori Acid	Class -B
2	Fineness test	2 %
3	Normal consistency	60 %
4.	Initial setting time	120 min
5	Final setting time	540 min

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QUARRY DUST: Quarry dust is a byproduct of the crushing process which is a concentrated material to use as aggregates for concreting purpose, especially as fine aggregates.

Table -2 Physical properties of Quarry dust

S.NO	PROPERTIES	OBTAINED VALUES
1	Specific gravity	2.67
2	Fineness modulus	2.55

AGRO- WASTE: Agricultural Waste is unwanted or unsalable materials produced wholly from agricultural operations directly related to the growing of crop. The agro-waste comprised dry sugarcane bagasse, wheat straw, and paddy straw. The agro-waste should being less than or equal to 15mm.
It involves in three stages.

- Soaking: The agro-waste is soaked in water upto 24 hours.
- Drying: After soaking, the agro-waste is soaked in water upto 24 hours.
- Chopping: Dry agro-waste is chopped with less than or equal to 15mm of size.

4. RESULTS AND DISCUSSIONS

4.1 Compressive strength

The strength in compression has a definite relationship with all other properties of bricks. The nominal brick size is 190mm x 90mm x 90mm. The test results are tabulated below.

Figure 1: Brick under compression testing machine

Table – 3 Compressive strength values

SI. No	Percentage replacement Agro - Waste (%)	Compressive Strength of (MPa)
1	0	2
2	5	2.48
3	10	3
4	15	2.6

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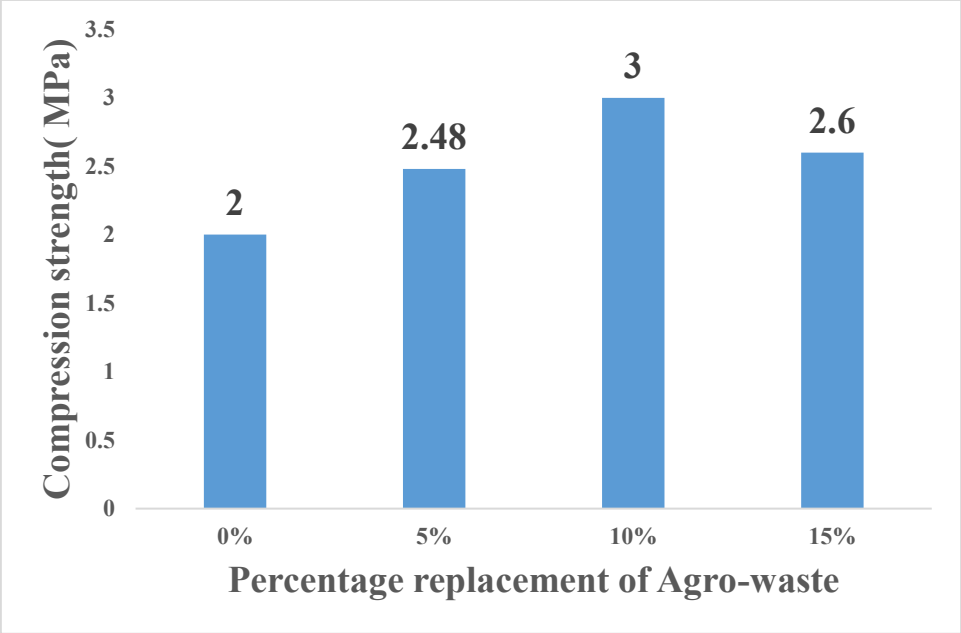

4.2 WATER ABSORPTION TEST ON BRICKS

Water absorption test on bricks are conducted to determine durability property of bricks such as degree of burning, quality and behavior of bricks in weathering to all the mixes designed for various repacement given below.

Figure 2: Brick under Water absorption Test

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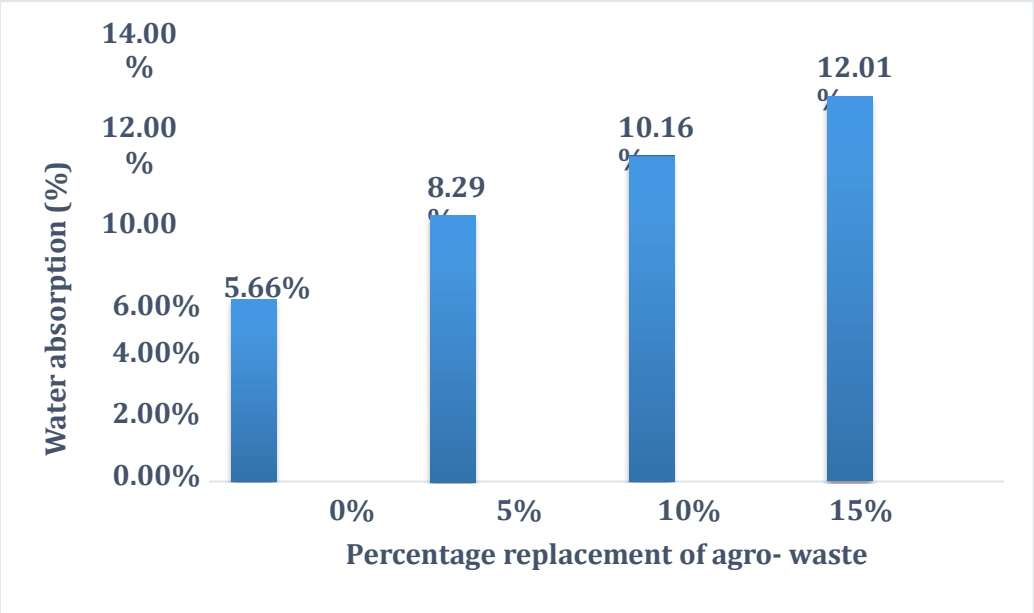
Table -4 Water absorption Test values

SI.NO	Percentage replacement of agro – waste	Water absorption (%)
1	0	5.66
2	5	8.29
3	10	10.16
4	15	12.01



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CONCLUSIONS

- The optimum compressive strength occurs at 10% replacement of agro – waste.
- Water absorption rate increases up to 15% replacement of agro waste.

REFRENCES

[1] Dwivedi, V. K., Parashar, A. K., Yadav, R., & Islam, A. (2023). Analysis of compressive strength and water absorption of bricks made up of agro-waste (rice straw) material. In AIP Conference Proceedings (Vol. 2721, No. 1). AIP Publishing.

[2] Naik, S. S., Pandey, S., Pawar, S. N., Shinde, B. H., & Prakash, C. (2023). Innovative and interactive methodology for development of geopolymer mortar using fly ash of agricultural waste briquettes. International Journal on Interactive Design and Manufacturing (IJIDeM), 1-9.

[3] Koçyiğit, Ş. (2023). The Effects of Waste Materials on the Thermo-mechanical Properties of Eco-Friendly Bricks. International Journal of Thermophysics, 44(10), 152.

[4] Singh, D., Kumar, R., Nighot, N. S., Rajput, A., Prajapati, A., Singh, B. K., ... & Lakhani, R. (2023). A comprehensive review on valorisation of octal by-product as supplementary admixtures in the production of fired and unfired bricks. Construction and Building Materials, 408, 133641.

[5] Korpayev, S., Bayramov, M., Durdyev, S., Hamrayev, H., Baymyradova, D., & Nurmuhammedov, A. (2023). Effect of stone wool waste from greenhouse agriculture in brick production. Journal of Building Engineering, 63, 105340.

[6] Murugesan, P., Partheeban, P., Manimuthu, S., Jegadeesan, V., & Christopher, C. G. (2023). Multi-criteria decision analysis for optimum selection of different construction bricks. Journal of Building Engineering, 71, 106440.

[7] Ejaz, M. F., Riaz, M. R., Azam, R., Hameed, R., Fatima, A., Deifalla, A. F., & Mohamed, A. M. (2022). Physico-mechanical characterization of gypsum-agricultural waste composites for developing eco-friendly false ceiling tiles. Sustainability, 14(16), 9797.

[8] Ngayakamo, B., Aboubakar, A. M., Komadja, C. G., Bello, A., & Onwualu, A. P. (2021). Eco-friendly use of eggshell powder as a bio-filler and flux material to enhance technological properties of fired clay bricks. Metallurgical and Materials Engineering, 27(3), 371-383.

[9] Khoudja, D., Taallah, B., Izemmouren, O., Aggoun, S., Herihiri, O., & Guettala, A. (2021). Mechanical and thermophysical properties of raw earth bricks incorporating date palm waste. Construction and Building Materials, 270, 121824.

[10] Isah, B. W. (2014). Effect of coconut shell ash on properties of fired clay brick. Journal of Civil Engineering and Environmental Technology, 1(6), 7-11.

[11] Demir, I. (2008). Effect of organic residues addition on the technological properties of clay bricks. Waste management, 28(3), 622-627.