Uluslararası İleri Doğa Bilimleri ve Mühendislik Araştırmaları Dergisi

Sayı 7, S. 7-9, 1, 2022

IJANSER

International Journal of Advanced Natural Sciences and Engineering Researches

Volume 7, pp. 7-9, 1, 2022

Araştırma Makalesi

https://as-proceeding.com/index.php/ijanser

Research Article

The Effect of Red Brick on the Physical and Mechanical Properties of Adobe

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(Received: 29 January 2023, Accepted: 15 February 2022)

ATIF/REFERENCE: Bezaou, F., Izemmouren O., & Guettala, S. (2023). The Effect of Red Brick on the Physical and Mechanical Properties of Adobe. *International Journal of Advanced Natural Sciences and Engineering Researches*, 7(1), 7-9.

Abstract **–** This study investigates the mechanical proprieties and hygroscopicity behavior of adobe incorporating waste red bricks as alternative to soil-sand mixture as well as sand. The main objective of this work is to study the effect of the use of waste red bricks on the mechanical strength of adobe. The study also focused on testing hygroscopicity behavior, through its total and capillary absorption. In this context, we used a content of quicklime (12%), three contents of waste red bricks and crushed sand (10, 20, and 30%) of the weight of the dry soil. The results indicate that there is a significant improvement in mechanical strengths (dry compression and dry traction) and durability (capillary and total absorption) with the addition of 30% waste red bricks and crushed sand. Adobe stabilized by waste red bricks gives considerably higher mechanical strengths and durability compared to bricks stabilized with crushed sand.

Keywords – Adobe, Mechanical Proprieties, Hygroscopicity Behavior, Waste Red Bricks, Durability

I. INTRODUCTION

The first prefabricated construction elements to be used by man were bricks molded in raw earth called 'Adobes', a technique used for millennia all over the world. Adobe is a building material made from a mixture of sand, clay and a quantity of chopped straw. Clayey in nature (up to 30% fine fraction); this mixture is then placed in a wooden mold, then left to dry in the sun [1].

Adobe brick is considered as an environmentally friendly choice due to its low carbon emission, low thermal conductivity characteristics [2, 3].

However, some of the disadvantages of adobe brick construction are the lack of strength and durability [4-5].

Hence, researchers have developed various additives and methods to enhance the performances (strength durability etc.) of adobe brick. Further experiments in the field of alternative additives to unfired earth materials have recently been focused mainly on natural wastes [6, 7].

II. Materials and Method

A. *Soil:*

B. The soil used in our research belongs to the region of Biskra. The criterion for choosing sound sampling locations: availability and abundance in the region.

C. *Sand and waste crushed brick:*

Crushed sand is the first variant in this search. This sand is generally used for the granular correction of the soil.

The used sand is crushed sand (0/3) from quarries in the Biskra region. (1996), the physical characteristics of the sand were determined.

The second variant is the waste red bricks, the grinding of brick made in the MDC laboratory of the university of Biskra.

Table 1. Physical properties of Soil natural sand and waste crushed brick.

Property		Soil	crushed sand	Crushed brick waste
Atterberg Limits	Liquid Limit Plastic Limit Plasticity Index	29.45% 16.22% 13.23%	- - -	20.4% 13.42% 6.98%
Apparent density.		1.29	1.60 (g/cm3)	1.24(g/cm3)
Absolute density.		2.610	2.61(g/cm3)	2.26(g/cm3)

III. Results

We are going to study the influence of crushed sand and waste red bricks on mechanical strength (dry compressive strength and dry tensile strength), the results of these tests are acceptable, so we move on to the tests of durability (Total and capillary absorption) of clay-based Adobe bricks from the Biskra region (EL Alia).

BOR: the reference block (Ordinary or controls).
BAD: Adobe brick made from waste red brick.
BAS: Adobe Brick made from Crushed Sand.
DBR: Waste red bricks. SC: Crushed Sand.

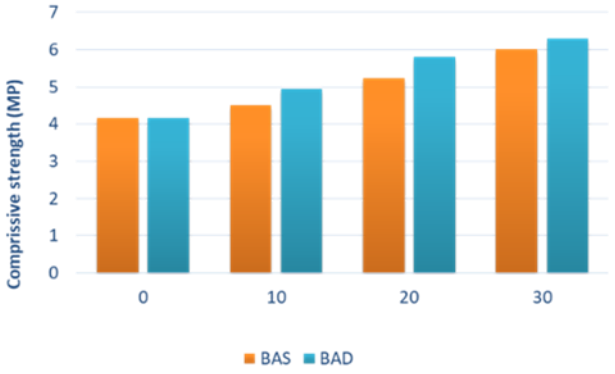

Fig 01: Effect of the crushed sand and brick waste dosage on compressive strength.

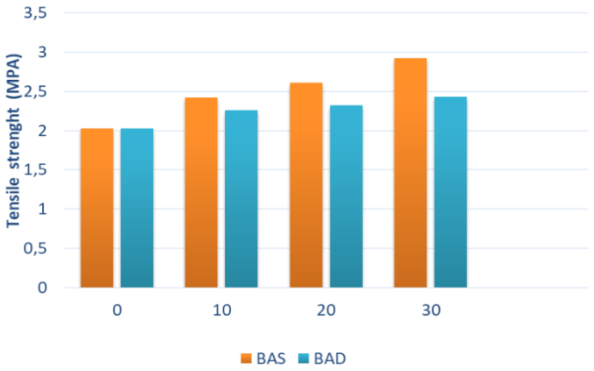

Fig 02: Effect of the crushed sand and brick waste dosage on tensile strength.

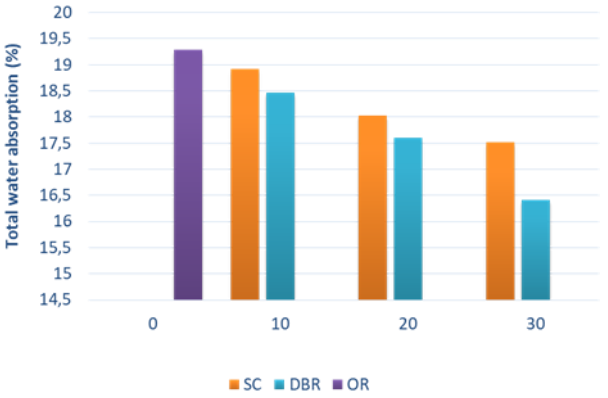

Fig 03: Effect of the crushed sand and brick waste dosage on total water absorption (%).

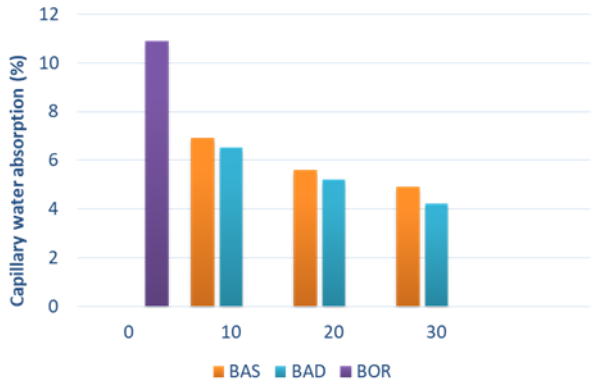

Fig 04: Effect of the crushed sand and brick waste dosage on Capillary water absorption (%).

IV. DISCUSSION AND CONCLUSION

From the experimental results, the following points can be drawn:

The mechanical strengths (traction by bending, compression in the dry state), increase according to the content of DBR and SC. The 30% content gives the best results for BAD and BAS.

Capillary and total absorption decreases with increasing DBR and SC up to 30%. This decrease is significant, reaching 61.15% and 54.91%, respectively.

In general best strength and durability results were achieved by adding DBR, followed by adding SC, then control blocks.

ACKNOWLEDGMENT

This study's results show that using mud brick in construction is simple and economical. And has many advantages which make it particularly interesting to obtain housing that respects the environment.

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