International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

LATERITIC SOIL WITH VARYING PERCENTAGE AND PROPERTIES OF NIGERIAN LIME USED AS A BRICK ADMIXTURE

Bamitale Dorcas Oluyemi-Ayibiowu [1]; Igibah Christopher Ehizemhen[2]; Lucia Omolayo Agashua[1],

1Civil Engineering Department, Federal University of Technology Akure, Ondo State, Nigeria.
2Civil Engineering Department, Federal University Oye-Ekiti, Ekiti State, Nigeria.
**Corresponding author: agashualight@gmail.com, lightjesuniyi@yahoo.com.*

ABSTRACT

This paper was aimed at producing cost-effective brick admixture materials for construction works using locally made materials. Lime from several localities in Abuja, F.C.T, Nigeria was mixed with lateritic soil to create brick admixture. The results indicated that the 60%–40% ratio of Kwali laterite to hydrated lime was the most effective and optimal mix. This was in terms of Plasticity index (PI) of 6.08% and California bearing ratio at 45.0%, with flow speed of 1.87 L/hour.

Keywords*: Hydrated, lime, Lateritic, soil, Atterberg Limit.*

1. INTRODUCTION

Soils admixture based on lime have been used in various parts of the earth as a system of stabilizing and brick admixture for construction works use. The introduction of lime isn't uniquely new and trendy approach, but it cheap and the use of locally available chemical in soil admixture. The use of lateritic soil and lime from North-center Nigeria is worth researching upon for use as brick admixture materials. Nigerian lateritic soils and lime had been used in past researches for several stabilizing purpose [1–3].

Methods

Lateritic soils sampled from many localities (Kwali, Sheda, Yangoji, Gadabiu and Abaji) in Abuja, Nigeria were pulverized and sieved through the 0.425 mm sieve size. Natural hydraulic lime powdered form was purchase from store in Deidei Market, Abuja. The sieved samples of lateritic soils and hydrated lime were mixed in different ratios with water to form stiff consistency and moudable paste. The moulded brick firing process was performed in a traditional (locally made) kiln after an air drying phase had been concluded. The air drying was to avert brick admixture from cracking as a result of quick heating during the firing process. These were also cured after firing to prevent loss of moisture and physical changes in the material over time for 28 days. Atterberg limit and California bearing ratio tests [4] were carried out on the lateritic samples with and without lime additive. The brick admixture was also tested for flow speed.

Results and conclusions

The Physical characteristics of lime admixture bricks and colour of the Abuja samples are itemized in Table 1. The Consistency (Atterberg limits) and California bearing ratio values are presented in Table 2. The flow speeds were determined based on the decrease in the water column level over time (Table 3). From the results, Kwali laterite and hydrated lime in 60%:40% ratio had the maximum performance level regarding PI, CBR and flow speed.

Table 1

Physical characteristics of bricks admixture and colour of the Abuja samples.

Soil samples	Colour	Soil type	Crack pattern	
Hydration				
Kwali	Reddish brown	A-2-7 (Silty-clayey soil)	No cracks	Very slow
Sheda	Reddish brown	A-2-4 (clayed soil)	Tiny cracks	Slow
Yangoji	Reddish brown	A-2-7 (Silty-clayey soil)	No cracks	Very slow
Gadabiu	Reddish brown	A-2-4 (Silty-clayey soil)	Tiny cracks	Slow

Abaji	Reddish brown	A-2-7 (Silty-clayey soil)	No cracks	Very slow

Table 2

Consistency and California bearing ratio tests

% soil to % lime mix ratio	Plasticity index (PI) and California Bearing ration (CBR) (%)									
	Kwali soil		Sheda soil		Yangoji soil		Gadabiu soil		Abaji soil	
	P I	CBR	P I	CBR	P I	CBR	P I	CBR	P I	CBR
100:0	5.15	9.87	5.10	8.67	5.04	7.12	5.11	7.35	5.13	9.56
90:10	5.49	15.5	5.28	14.9	5.30	13.8	5.34	14.8	5.34	15.2
80:20	5.62	25.7	5.58	24.9	5.54	23.8	5.50	23.9	5.60	25.4
70:30	5.84	34.8	5.76	32.6	5.73	33.8	5.78	34.0	5.81	34.5
60:40	6.08	45.0	5.57	44.8	5.53	43.8	5.45	44.5	6.05	44.9
50:50	4.02	39.2	3.97	37.4	3.82	39.6	3.67	38.4	4.01	38.9
40:60	3.14	32.6	3.02	30.4	3.05	31.8	3.01	30.8	3.10	31.9
30:70	2.29	25.6	2.15	21.8	2.05	22.8	2.18	20.9	2.23	25.2
20:80	1.09	11.6	1.03	10.8	1.02	10.4	0.5	10.7	1.07	11.4
10:90	0.56	5.45	0.48	5.21	0.36	4.67	0.28	3.89	0.52	5.37
0:100	0.07	0.12	0.04	0.09	0.03	0.10	0.02	0.10	0.06	0.11

Table 3

Flow speed data of several lateritic soils to lime mix ratios (soil admixture)

%soil to % lime mix ratio	Flow speed (litres/hour)				
	Kwali soil	Sheda soil	Yangoji soil	Gadabiu soil	Abaji soil
100:0	0.00	0.00	0.00	0.00	0.00
90:10	0.03	0.04	0.03	0.03	0.04
80:20	0.09	0.07	0.06	0.07	0.08
70:30	1.34	1.31	1.28	1.14	1.32
60:40	1.87	1.86	1.84	1.85	1.87
50:50	1.58	1.52	1.50	1.51	1.56
40:60	1.46	1.40	1.39	1.40	1.44
30:70	1.04	1.00	1.02	1.00	1.04
20:80	0.04	0.03	0.02	0.02	0.04
10:90	NR	NR	NR	NR	NR
0:100	NR	NR	NR	NR	NR

Note: NR means “No result” (because materials were disintegrated during sintering).

REFERENCES

[1] O. O. Amu, F. B. Oluwole, A. K. Iyiola. The Suitability and Lime Stabilization Requirement of some lateritic soil samples as pavement. International Journal of Pure and Applied Sciences Technology, 1 (2011), 29 - 46.

[2] J. Ige, O. Ajamu, Effects of moisture on lime-stabilized lateritic soil. International Journal of Research in Engineering & Technology, 3 (2015), 37-44.

[3] A. Raheem, O. A. Bello, O. A. Makinde, A comparative study of cement and lime stabilized lateritic interlocking blocks. Pacific Journal of Science and Technology 11 (2010), 27–34.

[4] ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils, American Society for Testing and Materials, ASTM International, West Conshohocken, PA., 2017.