Experimental Study of Laterite Soil using Coconut Shell Ash

Sowmyashree T[1] Renuka R[2] Shabeena S[3] Shivanagouda M Patil[4] Sabeeha Banu[5]
[1,2]Assistant Professor [3,4,5]UG Student
[1,2,3,4,5]Department of Civil Engineering
[1,2,3,4,5]Jain Institute of Technology, Davangere, Karnataka, India

Abstract— Some soil exhibit generally undesirable Engineering properties. They tend to have low shear strengths and to lose shear strength further upon wetting or other physical disturbances. They can be plastic and compressible and they expand when wetted and shrink when dried. Some types expand and shrink greatly upon wetting and drying a very undesirable feature. This study is carried out with an intention to evaluate the effects of coconut shell ash on the geotechnical properties of the laterite soil. Tests which are to be carried out on the sample of soil dealt with consistency limits, specific gravity, compaction, California bearing ratio, unconfined compressive strength and Compaction Test. These tests are to be conducted at both non-stabilized and stabilized states by adding 2%, 4%, 6% and 8% of coconut shell ash. The results show the effect of coconut shell ash on geotechnical properties of the soil samples strength.
Key words: Laterite soil, Coconut Shells, MDD

I. Introduction

Soils are generally stabilized to increase their strength and durability or to prevent erosion and dust formation in soils. The main aim is the creation of a soil material or system that will hold under the design use conditions and for the designed life of the Engineering project. The properties of soil vary a great deal at different places or in certain cases even at one place the success of soil stabilization depends on soil testing. Various methods are employed to stabilize soil and the method should be verified in the lab with the soil material before applying it on the field.

II. Soil Stabilization

"Soil stabilization means the improvement of stability or bearing power of the soil by the addition of suitable admixture or stabilizers".

Soil stabilization is the alteration of soil properties to improve the engineering performance of soils.

III. Objectives of the Project

The major objectives of the project are:

- The possibility of using To explore the coconut shell ash in soil stabilization.
- To study the effect of coconut shell ash on properties of the soil.
- To study the changes in CBR of soil by the addition of coconut shell ash.

IV. Applications of Soil Stabilization

- Soil stabilization is used in many sectors of construction industry roads, parking lots, airport runways, building sites, landfills and soil remediation all use some form of soil stabilization.
- The use of soil stabilization for slope protection, levee and dam cores, impervious liners and maintenance accessibility are feasible based on both economical and service life considerations.
- Other applications include water way management, mining and agriculture Pavements, especially in flexible pavements.

V. Materials & Methodology

A. Materials

Soil, coconut shell ash are the main requirements for the project.

1) Soil:

Laterite soil which is expansive in nature was collected from 1.5m depth, Near kundwad pond, Davanagere District, Karnataka.

1) They are the most common naturally-occurring materials.
2) In the tropics weathering is intense, and hence there is lack of good quality crush aggregate.

Fig. 3.1: Laterite soil

2) Coconut Shells

The coconut shells ash were obtained from a market waste dump. They were subsequently spread on matting and allowed to properly dry to facilitate proper combustion during burning. The coconut shells were burnt separately in a metal drum.

The ashes formed were allowed to cool down before sieving through 4.75mm BS sieve. The ashes were therefore stored in airtight containers to prevent moisture loss and any form of contamination. The portable water available in the laboratory was used for the study.

Fig. 3.2: Coconut shells

B. Methodology

- Collection of materials.
- Burning of shells.
- Test on natural soil.
- Mixing of admixture.
- Test on admixtured soil.

VI. SAMPLING OF SOIL

The laboratory studies were carried out on the samples of Soil, Soil + Coconut shells Ash, for different percentage of CSA, as shown in the below proportion by weight of the soil.

Sl. No	Soil Sample	Composition of soil
01	Sample 1	100%Soil
02	Sample 2	98% soil +2% CSA
03	Sample 3	96% soil +4% CSA
04	Sample 4	94% soil +6% CSA
05	Sample 5	92% soil +8% CSA

Table 1: Soil Composition

VII. TESTS ON SOIL

1) Sieve Analysis test
2) Specific Gravity Test by Density Bottle Method – [IS 2720 Part-3, 1980]
3) Atterberg's limit test
4) Modified Proctor Test – [IS 2720 Part-8, 1983]
5) California Bearing Ratio Test – [IS 2720 Part-16, 1987]
6) Unconfined Compression Test – [IS 2720 Part-10, 1991]

VIII. RESULTS AND DISCUSSION

The results of the conducted experiments are presented in the below Table

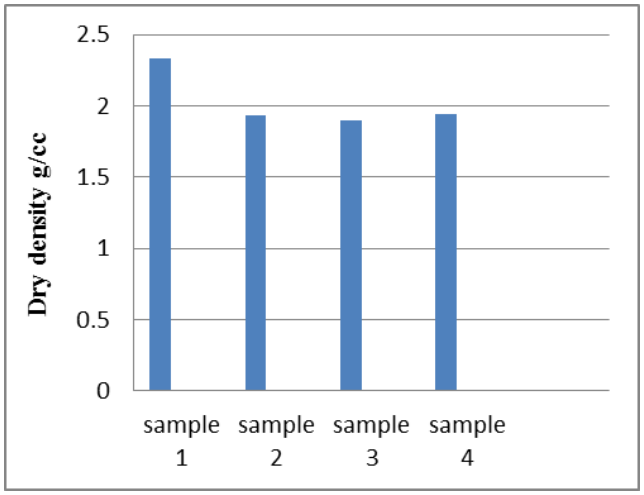
Description	Soil sample 1	Soil sample 2	Soil sample 3	Soil sample 4
Maximum dry density (g/cc)	2.33	1.93	1.90	1.94
Optimum moisture content (%)	12	10	14	16
CBR (%)	9.71	15.42	15.42	20
Unconfined Compressive Strength (kg/cm^2)	12.99	9.87	14.15	5.93

Table 5.1: Variation of Soil Properties

IX. GRAPH SHOWING VARIATIONS OF PROPERTIES OF SOIL

A. Maximum Dry Density Variation

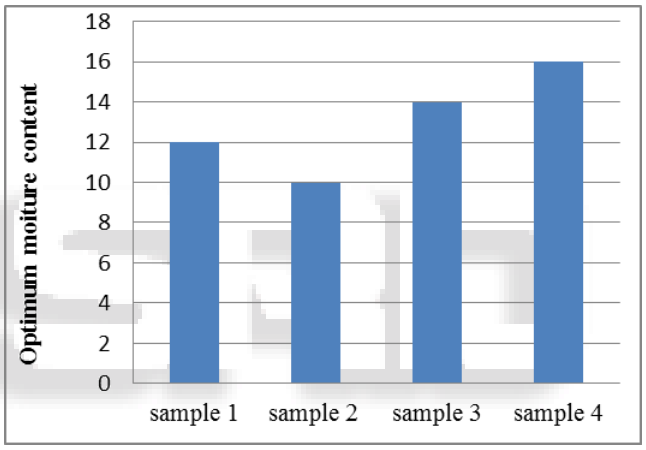
The maximum dry density increased from 1.94 g/cc to 2.33 g/cc when coconut shell ash was added 2% and further decreased from 1.93 to 1.9 for the addition 20% to 30% of the coconut shell ash.



a) Graph showing variations of MDD

B. Optimum Moisture Content Variation

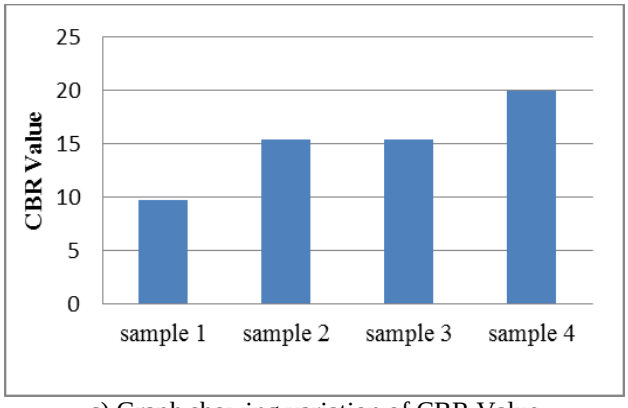
The optimum moisture content increased from 12 to 16% when coconut shell ash raised from 2 to 8% and further decreased to 10% for addition of coconut shell ash.



b) Graph showing variations of OMC

C. CBR Value Variation

The CBR value increased from 9.71 to 20% whe coconut shell ash was raised from 2% to 8%.

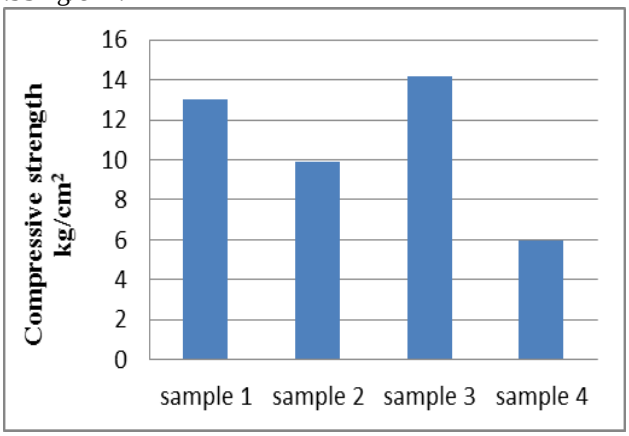


c) Graph showing variation of CBR Value

D. Compressive Strength Variation

The unconfined compressive strength decreased from 12.99 kg/cm^2 to 9.87 kg/cm^2 when coconut shell ash was raised from 2 to 4% further increased to 14.15 kg/cm^2 for the

addition of 6% of coconut shell ash and further decreased to 5.93 kg/cm^2.



d) Graph showing variation of UCC

X. CONCLUSION

1) Optimum moisture content of soil has improved on addition of 8% coconut shell ash
2) Maximum dry density of the soil has improved on addition of 2% coconut shell ash.
3) CBR value of the soil has improved on addition of 8% coconut shell ash.
4) Unconfined compressive strength has varied with addition of coconut shell ash and was found maximum with addition of 6% of coconut shell ash.

REFERENCES

[1] Olakanmi I. Shitan, Olugbenga O. Amu, Opeyemi S. Owokade, "Potentials of Coconut Shell and Husk Ash on the Geotechnical Properties of Lateritic Soil for Road Works". International Journal of Engineering and Technology, Volume: 3, Issue: 2, 2011.
[2] Shabana Salih K, Anshi C., Shamseera Parambath, Shyamili T. M., Sruthi V., Suhaira P., "Study On CBR Values Of Soil With Crushed Coconut Shells. International Journal of Advanced Engineering Technology.
[3] Arathy V B, Christina Jery, Jumy Raj, Lekshmi V S &AnniammaChack "Effect Of Coconut Shell Powder On The Strength Of Soil".International journal Of Management, InformatioTechnology and Engineering (BEST: IJMITE)
[4] EmekaSegunNnochiri, Olumide Moses Ogundipe, "– "Effects of Coconut Shell Ash on Lateritic Soil for Road Construction".

IS Codes

[5] Grain size analysis – IS 2720 Part 4, 1985.
[6] Specific gravity - IS 2720 Part-3, 1980.
[7] Atterberg limit - IS 2720 Part-5, 1985.
[8] Proctor Compaction – IS 2720 Part-8, 1983.
[9] CBR test – IS 2720 Part-16, 1987.
[10] Unconfined compression – IS 2720 Part-10, 1991.

