

Effect of Sea shell powder on the Unconfined Compressive Strength of Black Cotton Soil

A. MohanChand¹, V.RameshBabu²

1. P.G Student, Department of Civil Engineering, KSRM College of Engineering, Kadapa, AP, India

2. Associate Professor, Department of Civil Engineering, KSRM College of Engineering, Kadapa, AP, India

ABSTRACT

Black Cotton Soil is a type of expansive soil which is basically susceptible to volumetric changes, with the changes in moisture. This is due to the presence of montmorillonite, which is an expansive lattice. There are various materials that may be used as firm up agent. This paper presents the result of an attempt that was made to find the unconfined compressive strength of black cotton soil by adding sea shell powder as admixture. The admixture sea shell powder is added with an increment. Thus sea shells powder can be used as a firm up agent. It was concluded that with the addition of admixtures, the unconfined compressive strength of the black cotton soil has been increased.

Keywords: Seashell powder, Black Cotton Soil, Unconfined compressive strength.

I. INTRODUCTION

Expansive soils cover large area in several countries of the world and in India these deposits are known by the name "black cotton soil" and it occupies 20% of its area. They are predominant in the states of Gujarat, Maharashtra, Madhya Pradesh, Andhra Pradesh, Karnataka and TamilNadu. These soils undergo volumetric changes with the increase in moisture content. This is due to the presence of the mineral montmorillonite. They are of great challenge to civil engineers for the construction of building structures and roads over it.

Number of researchers worked in improving the strength of black cotton soil. They used many admixtures which are naturally available with the soil and showed best results. LaxmikantYadu, Rajesh Kumar Tripathi and Dharamveer Singh (2011) have studied the effect of Fly Ash and Rice Husk in black cotton soil and showed that the soil attains its optimum strength at 12% and 9% of the admixtures. Oriola, Folagbade and Moses, George (2010) conducted experiments on black cotton soil by adding Ground Nut Shell Ash with them. Balasubramaniam et al., (1989), Locat et al., (1990) (1996), Narasimha Rao and Rajasekaran (1996) have found that the strength behaviour of soil greatly improved by adding Lime with it. In this current investigation sea shell powder is added with soil and its unconfined compressive strength characteristics were studied. Sea shells are naturally available materials on the sea shores. They are the hard exoskeleton of molluscs. They contain about 90% of calcium carbonate which is a major component in Lime.

II .AREA OF STUDY

Sample is collected in "Eguvapalle" village and near "KSRM College Of Engineering" surroundings in Kadapa. The soil sample is collected from a vast area of black cotton soil. The experiments are conducted in Geotechnical laboratory of KSRM College of Engineering, which is located near Krishnapuram village, Kadapa.

III . EXPERIMENTAL PROGRAM

3.1 MATERIALS

- **Black cotton soil:** Sample is collected near “KSRM College Of Engineering” surroundings in KADAPA. The soil sample is collected from a vast area of black cotton soil. The experiments are conducted in Geotechnical laboratory of KSRM College of Engineering, which is located near Krishnapuram village, KADAPA.

- **Sea shells powder:** The sea shells were finely grained and the sea shell powder retained on IS75 Micronsieve was used for this experiment.

Table 1: Properties of the soil

SL.NO	NAME OF THE PROPERTY	VALUE
1	Natural moisture content	2%
2	Liquid limit (W_L)	69.05%
3	Plastic limit (W_P)	23.2%
4	plasticity index (I_P)	45.85%
5	Optimum moisture content by Standard proctor test	24.21%
6	Maximum dry density	1.5gm/cc
7	Free swell index	88.89%
8	Sieve analysis	Coefficient of uniformity=2.5 Coefficient of curvature=1.02
9	Specific gravity	2.5
10	Unconfined compressive strength	256.1kN/m ²

3.2 Test specimen: Initially specimen of size 8.9cm length and 3.8cm diameter was made with soil alone. Then the admixture sea shell Powder were added in the proportions 12%, 14%, 16% and 18% to the soil and specimen of same length and diameter was made.

specimen are in complete contact with the apparatus. The dial gauge is adjusted to preferable value. Motor is then switched on.

The specimen is allowed to compress until a crack occurs in the specimen. When initial crack appears in the specimen the motor is switched off and the corresponding value on the dial gauge is noted.

3.3 Procedure of unconfined compression test:

The initial length and diameter of the specimen was measured. The specimen is then placed in the apparatus. Care should be taken such that both the edges of the



Fig 1 :Ucs test for soil



Figure 2: Unconfined Compressive Strength on soil with Sea Shell Powder

IV. RESULT AND DISCUSSIONS

After the detailed investigation on the unconfined compressive strength of black cotton soil has been done, the following results have been achieved. At different percentages of Sea shell powder added with soil mass, UCS test were performed and results are shown in table.

Table 2 : UCS test for soil adding sea shell powder

Sea shells powder (%)	UCC Strength KN/m ²
12	88.2
14	172
16	314.6
18	251

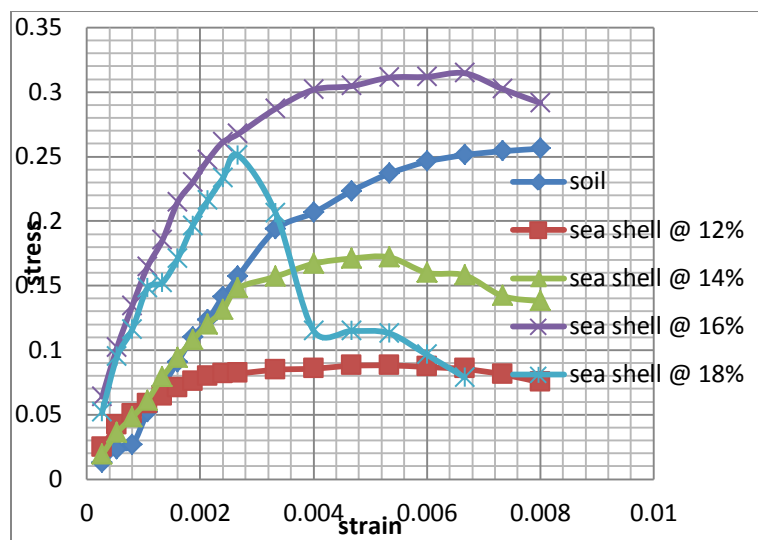


Figure 3: UCS results for soil with sea shell powder

V.CONCLUSION

The following conclusions have been made based on the results obtained from experimental investigations:

The unconfined compressive strength of the black cotton soil increases by adding the soil with sea shells powder. It is one of admixture out of remaining admixture like stone dust, fly ash, rice husk, polymers, Portland cement, lime and ionic stabilizers.

The unconfined strength of black cotton soil is 256KN/M^2 and increased at 16% by addition of sea shell powder, that is 314KG/M^2 . So there is an 58% of increase in strength of soil at 16% addition of sea shell powder.

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AUTHORS

A.MohanChandis a post graduate student in Geotechnical Engineering in KSRM College Of Engineering,KADAPA.His research interests include Soil Stabilization and ground improvement techniques.

MR.V.RameshBabu has received his M.TECH.,(Ph.D.)and specialization in Structures.His area of interests include Strength of Materials and Engineering Mechanics.