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An Experimental Study on Stabilization of Clayey Soils by using Chrome Lignite

Paladagu Mohana sai[1], P. Hanuma[2]

[2]Assistant Professor, [1,2]Department of Civil Engineering,
[1,2]Sri Sunflower College of Engineering &Technology, Lankapalli, Andhra Pradesh, India

ABSTRACT

Use of natural Coal waste as soil reinforcement is gaining much attention by geotechnical engineers as it has inherent advantage with regard to its availability, cost and does not pose environmental hazard on the long run. Lignite when used as a soil reinforcement is found to increase peak compressive strength, shear strength, and ductility of the soil. In the present experimental study, un drained tri axial tests were conducted on black cotton soil (BC Soil) mixed with Lignite and the effect of treatment on peak deviator stress and shear parameters were studied. The results of the experimental investigation found that Lignite as reinforcement to BC soil causes significant increase in peak deviator stress. Increase in %of lignite increases cohesion and angle of internal friction. Black cotton soil and Lignite ash has prepared by varying of different proportions with respect to dry the density.

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INTRODUCTION

Expansive soils are a worldwide problem posing many challenges to civil engineers, construction firms and owners. Black cotton soils of India are well known for their expansive nature. In India, the black cotton soil covers 7 lakh square kilometres approximately 20-25 % land area and are found in the states of Maharashtra, Gujarat, Rajasthan, Madhya Pradesh, Uttar Pradesh, Karnataka, Andhra Pradesh and Tamil Nadu. These are derived from the weathering action of Basalts and traps of Deccan plateau. However, their occurrence on granite gneiss, shales, sandstones, slates and limestone is also recognized (Uppal, 1965; Mohan, 1973; Katti, 1979; Desai, 1985).

They are highly fertile for agricultural purposes but pose severe problems to the pavements, embankments and light to medium loaded residential buildings resting on them due to cyclic volumetric changes caused by moisture fluctuation. This volume change behaviour is the reason for cracking to the overlying structures. The reason for this behaviour is due to presence of clay mineral such as montmorillonite that has an expanding lattice structure. During monsoon's, soils containing this mineral will imbibe water, swell, become soft and their capacity to bear water is reduced, while in drier seasons, these soils shrinks and become harder due to evaporation of water. These types of soils are generally found in arid and semi-arid regions.

Here, in this project, our whole work revolves around the properties of soil and its stability. Basically, for any structure, the foundation has the priority importance not strong foundation means not safe structure and the foundation depends a loton the soil nearby. Soil with higher stability has more strong foundation and thus having very strong and durable structure. So, in short, we can say that the whole structure on any construction related things indirectly or directly depends on the soil stability. Thus, for any construction work we need to have proper knowledge about soil and its properties and the factor affecting the soil. After the commencement of Modern era in India after 1970's the shortage of land comes in front. We had to do construction over the weak soil, thus it became necessity to improve the strength of the soil at the construction site and then various method comes to improve the soil stability. Lots of further work is done after that in this field and addition of Calcium Carbide Residue and Fly Ash is the new way for this and it seems quite beneficial as these are the waste products of factories and can cause environmental pollution.

MATERIALS

Chrome Lignite is a specially formulated lignite-based drilling mud additive. It is an effective dispersant and fluid loss control agent in most water-based muds. Chrome Lignite is a uniquely planned and artificially altered lignite compound intended to be utilized as a Drilling Thinner, Fluid Stabilizer and Fluid Loss decreasing operator in all water based muds. It is a superb added substance for rheological adjustment at high temperatures. Chrome Lignite is selected lignite material which has been solubilized with caustic soda

and chromium salt. It is a fine dry free-flowing powder and readily disperses in the drilling mud. Chrome Lignite is highly soluble and is stable at high temperature. Chrome Lignite exhibits tolerance for soluble contaminants. Chrome Lignite was more temperature-stable than plain lignite in clay-based water muds. The recommended treatment of Chrome lignite as a deflocculate and as an emulsifier is 1.0 to 3.0 ppb and as a filtration control agent: 2.0 to 8.0 ppb.

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Chrome Lignite Supplier is utilized for diminishing and filtration control, reason in water-based muds at high temperature. It is likewise utilized as a thickness reducer and to increment rheological Stability and filtration control.

Fig-1 Chrome Lignite

Table-1 Chemical properties of CA

Mud sample	Types of materials used in the preparation of mud	Materials concentration g/l
Gypsum mud	Bentonite	60–65
	Caustic soda + C.L (chrome lignite)	1.5–4.5
	Gypsum	22
	CMC (L.V)	6
Lignite mud	Bentonite	60–65
	Caustic soda + C.L (chrome lignite)	1–3
	Barite	20
	CMC (L.V)	4–6

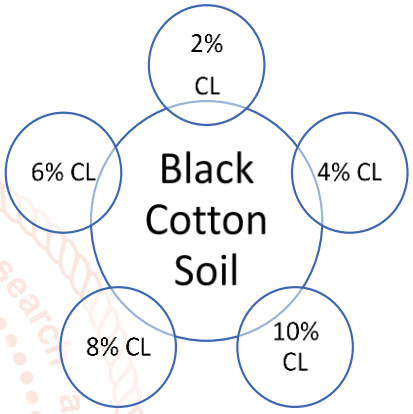


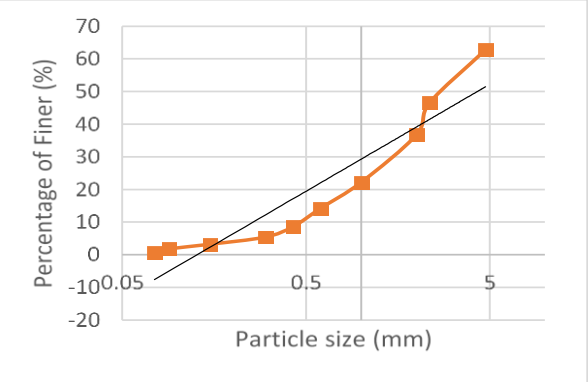
Fig-2Schematic Representation of Compaction Test Sample prepared with variation of CL%

Table-2 Type Compaction Test Samples with CL% variation

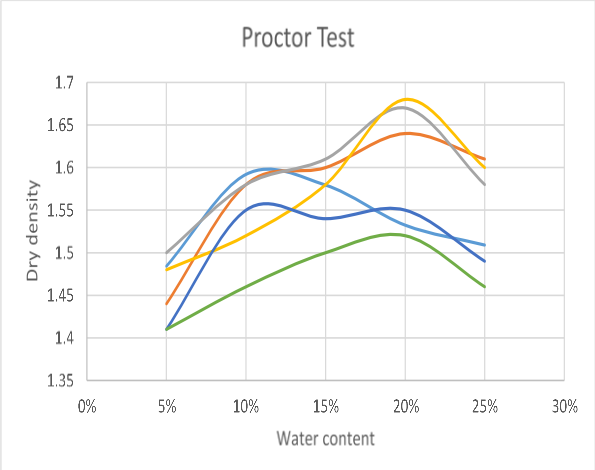
Samples Prepared for Compaction Test	
1	Black Cotton Soil
2	BC + 2% CL
3	BC + 4% CL
4	BC + 6% CL
5	BC+8% CL
6	BC +10% CL

Table -3 Sieve analysis:

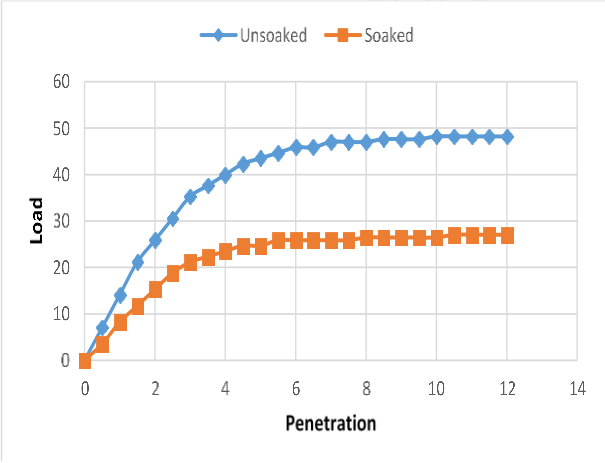
IS Sieve	Weight Retained (g)	Percentage Retained (%)	Cumulative Percentage (%)	Percentage of Finer (%)
4.75	372	37.2	37.2	62.8
2.36	162	16.2	53.4	46.6
2	98	9.8	63.2	36.8
1	146	14.6	77.8	22.2
0.6	80	8	85.8	14.2
0.425	56	5.6	91.4	8.6
0.3	32	3.2	94.6	5.4
0.15	22	2.2	96.8	3.2
0.09	14	1.4	98.2	1.8
0.075	10	1	99.2	0.8
PAN	4	0.4	99.6	0.4



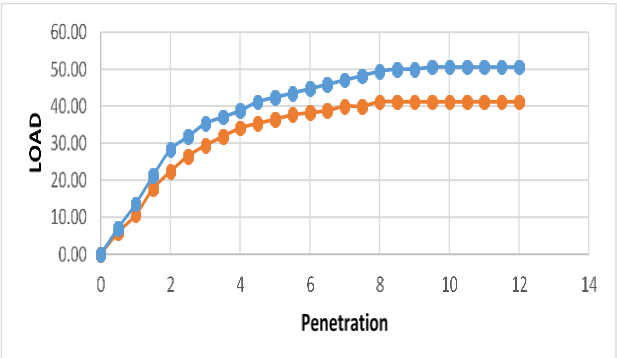
Graph 1Sieve Analysis Graph



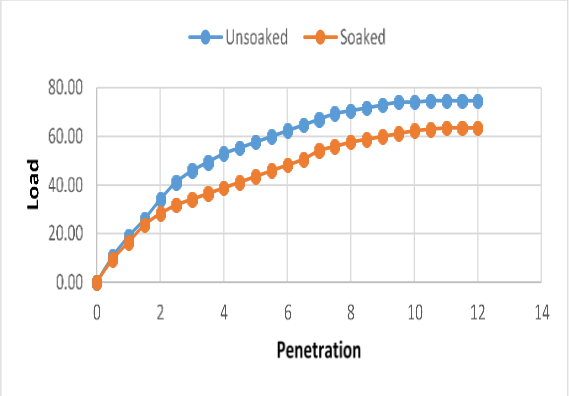
Graph -2Compaction curves for soil samples with 0%, 2%,4%,6%,8% and 10% of CL



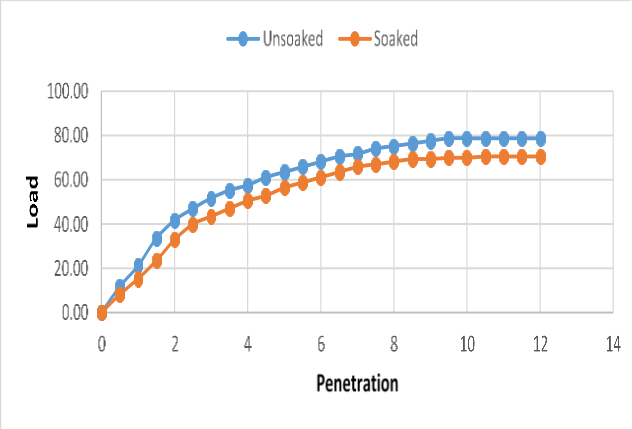
Graph-3Load Vs Penetration graph for Black Cotton Soil (Unsoaked & Soaked



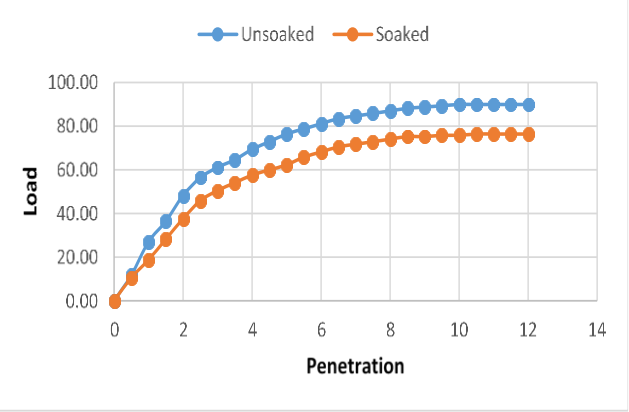
Graph-4Load Vs Penetration graph for Black Cotton Soil+2%CL (Unsoaked & Soaked)



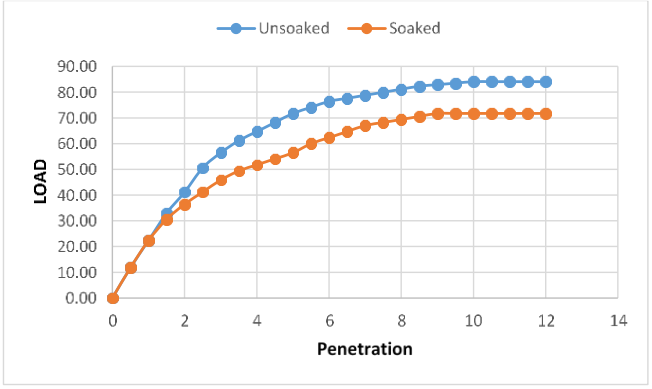
Graph-5Load Vs Penetration graph for Black Cotton Soil+4%CL (Unsoaked & Soaked)



Graph -6Load Vs Penetration graph for Black Cotton Soil +6% CL (Unsoaked & Soaked)



Graph -7 Load Vs Penetration graph for Black Cotton Soil +8%CL (Unsoaked & Soaked)



Graph -8 Load Vs Penetration graph for Black Cotton Soil+10% CL (Unsoaked & Soaked)

CONCLUSIONS

In this study, the major properties studied are OMC, MDD, CBR, UCS, and Consolidation. Based on the all investigations on all samples and when compared with normal soil, following conclusions were made

Compaction Test and CBR Test:

- In Standard Procter Test, the increase in CL percentage the dry density increases upto 20% and after the MDD value has been decreasing trend. Though, a decrease in OMC has been observed with increase in CL %
- Maximum dry density was increased with the addition CL
- When 2%,4%,6%,8% & 10% CL added, higher MDD observed for 6% of CL
- Both the Unsoaked and soaked condition of CBR were studied and Peak value was obtained at 6% CL in both conditions.

Unconfined compressive strength:

- In UCS, Due to increase in CL percentage the UCS value having increasing trend with respect to the parent soil.
- In UCS, Due to increase in CL percentage the UCS value has been observed increasing trend up to 20% after that having decreasing trend with increase in lime content.
- CL specimen fails by formation of Vertical cracks.
- The Curing period of mix is a governing parameter as the chemical reaction of stabilizers is depends on it.so it can be concluded that the strength will increase with increase in curing period.
- UCS of treated soils was higher than that of untreated soils.
- UCS value of sample is Increased from 1.29 to 7.2 kg/cm^2

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