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A STUDY ON BLACK COTTON SOIL STABILIZED WITH COCONUT COIR AND FLY ASH- COMPARISION

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Abstract— Abstract: India is a country which is mostly covered with black cotton soil and most of the regions in Andhra Pradesh are rich in black cotton soil resources, but black cotton soils are highly expansive and are not suitable for the construction of multi storied buildings in order to construct these heavier structures we need to stabilize the soil using admixtures, the admixtures which are in use at present are costlier, that is why to reduce the cost of stabilization for foundation soil, coconut coir is used, which is locally available raw material and a comparison in the strength properties are carried out by using coconut coir and fly ash.

In the present study an attempt is made to find out the improvement of strength in black cotton soil mixed with varying percentage of coconut coir and fly ash, by conducting a series of Unconfined compression strength (U.C.S) and California bearing ratio (C.B.R) tests, Differential free swell. The tests are conducting by adding varying percentages of 4%,5%,8%,10% respectively for coconut coir and fly asfh.

Key words: Coconut Coir, Fly ash, Subsoil, California Bearing Ratio, Unconfined Compression Test, soil stabilization.

I. INTRODUCTION

The study is carried on the soil of Chelluru (a village near Ramachandrapuram, East Godavari District, Andhrapradesh). During the course :a study is carried by collecting soil samples from many places and finally we selected the soil of Chelluru village, because the black cotton soil at that place has shown inherently adverse readings in differential free swell index conducted at our lab. It shows above 100%of free swell.

Coconut coir is abundant, economical and highly consistent material available in all the parts of India. In this study coconut coir is collected from Gangavaram village which is famous for coconut products and coir production. Fly ash is collected from electricity generating plant in Chelluru.

II. LITERATURE REVIEW

In telugu black cotton soils are called as "reguda bhoomulu".these are formed due to the solidification of molten magma during the volcanic erruption. The crops grown on these soils are cotton, paddy, maize and millets.

Black soils absorb water very quickly and become muddy. These soils in summer season become dry on the top surfaces but if we break the blocks of soil it will contain water content. During the time of formation these soils are rich in nutrients later, they start losing their nutrients which are stored in them due to growth of crops on these soils.

Distribution of Black Soil in India

In India, black soils are spread over an area of nearly 6 lakh sq.km. these soils spread over the major parts of Maharastra, Madhya Pradesh, Gujarat, Andhra Pradesh, Tamil Nadu, and Karnataka. These are highly formed in the regions of high temperature and low rainfall.

Disadvantages of Black Soils

There major disadvantages of black soils are as follows :

- Black soils are highly expansive and highly water absorbant soil.
- These soils show severe cracking on during drying and show swell by absorbing water.
- These soils are of poor drainage property.
- These soils have low bearing capacity and are not suitable for the construction of heavier structures.

Improvement of Black Soils:

In order to improve the soil characteristics stabilization is to be done to soils. Stabilization is of two types, and are chemical stabilization and mechanical stabilization. Mechanical stabilization is done by using compaction technique or

by densification. in chemical stabilization soil is stabilized by using an external material. In the present course of study Soil stabilization is done by using coconut coir and fly ash.

III. METHODOLOGY

In the present study soil samples are collected from Chelluru a village near Ramachandrapuram. Soil samples are collected from agricultural field in chellure at a depth of 1m from ground levelThis soil is tested for various properties. i.e. Grain size distribution, specific gravity, consistency limits, compaction characteristics, strength characteristics (UCS), CBR values. These properties are shown in table.

Table

S.NO	Description of the Property	Values
1	Gravel content (%)	0
2	Sand content (%)	27
3	Fines (%)	73
4	Liquid Limit (%)	82.8
5	Plastic Limit (%)	44.44
6	Specific gravity	2. 96
7	OMC (IS heavy Compaction) Optimum moisture content (%) Maximum dry density (g/cc)	 16.7 1.525
8	California bearing ratio a) 2.5mm penetration b) 5mm penetration	 3.138 2.384
9	Unconfined compressive strength test (KPa)	52.5

Introduction to coconut coir:

Coconut coir is abundant, economical and highly consistent material available in all the parts of India. In this study coconut coir is collected from Gangavaram village which is famous for coconut products and coir production

Physical properties of coir fibre:

Length in inches	6-8
Density (g/cc)	1.40
Tenacity(g/Tex)	10.0
Breaking Elongation %	30%
Diameter in mm	0.1 to 0.5
Rigidity of Modulus	1.8924dyne/cm^2

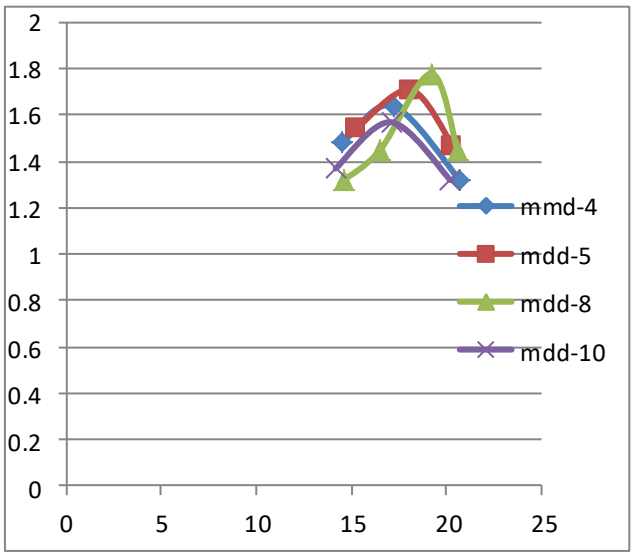
Introduction to fly ash:

In the present course of study Fly ash is collected from an electricity generating plant in chellure village named sri sarwaraya sugars limited. Fly ash is s finely divided material which is obtained as a residue after combustion of coal in electric generating plants. Fly ash is an inorganic material and incombustible material. Fly ash is classified in to two types namely Class-C and Class-F these are divided based on the presence of the percentage of cementing properties in it. The major constituents of fly ash are slica, aluminium oxide and iron oxide.and it also consists of heavy metals like nickel, vanadium, cadmium barium etc.

II. RESULTS AND DISCUSSIONS

Characteristics for different percentages of compaction –fly ash:

Sn.O	*Percentage of fly- ash*	*OMC (%)*	*MDD*
1	4	17.2	1.64
2	5	18.1	1.71
3	8	19.4	1.78
4	10	17.1	1.57



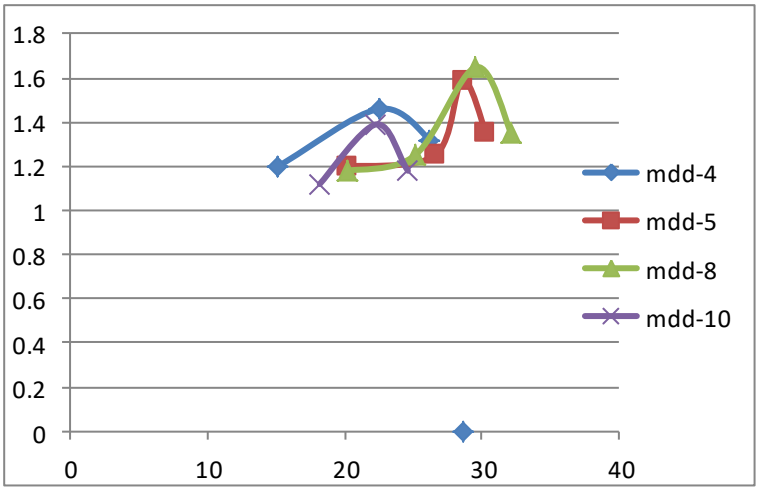
OMC

Unconfined Compression Strength-FLY ASH:

Sn.O	*Percentage (%)*	*0 Days (KPa)*	*3 Days (KPa)*	*7 Days (KPa)*	*14 Days (KPa)*	*28 Days (KPa)*
1	4	67.5	124.5	139.6	179.5	249.6
2	5	74.6	134.5	149.6	191.7	264
3	8	124.3	152.8	179.5	225.2	303
4	10	60.8	87.3	122.4	141.9	197.7

Characteristics for different percentages of Compaction –Coconut Coir:

Sn.O	*Percentage of Coconut coir (%)*	*OMC (%)*	*MDD*
1	4	22.5	1.46
2	5	28.6	1.59
3	8	29.6	1.65
4	10	22.3	1.39



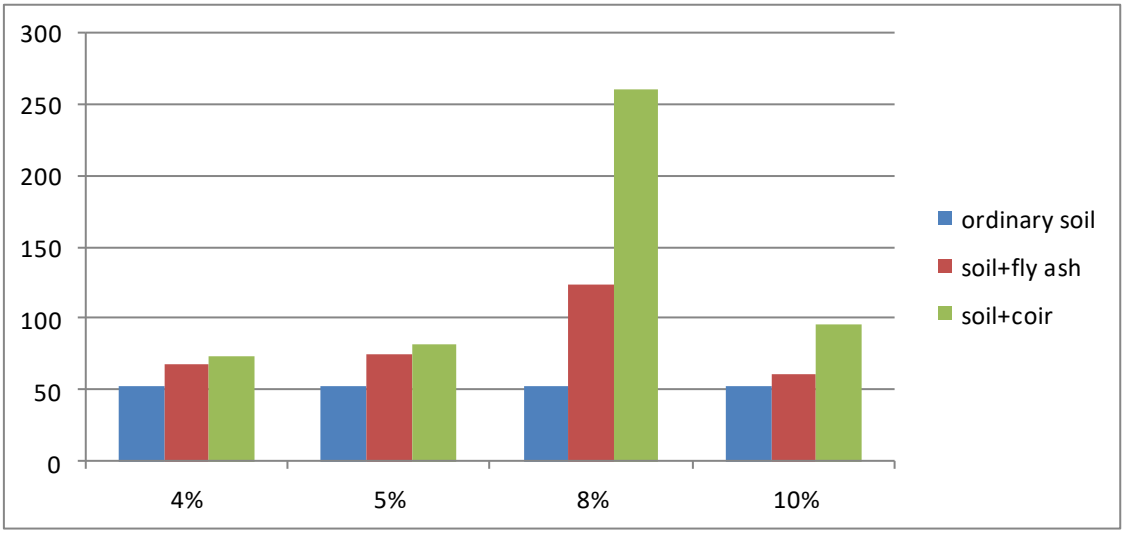
OMC

UCS-COCONUT COIR

Sn.O	*Percentage*	*0 Days (KPa)*	*3 Days (KPa)*	*7 Days (KPa)*	*14 Days (KPa)*	*28 Days (KPa)*
1	4	73.0	138	179	216.8	370.4
2	6	81.4	149.3	260.1	334.2	392
3	8	260.1	295.6	320.5	398.3	452.4
4	10	95.7	188.7	268.5	319.9	367.4

0 DAYS

SNO.	*4%*	*5%*	*8%*	*10%*
Soil (KPa)	*52.5*	*52.5*	*52.5*	*52.5*
Soil+ fly ash (KPa)	*67.5*	*74.6*	*124.3*	*60.8*
Soil+ coconut coir (KPa)	*73*	*81.4*	*260.1*	*95.7*

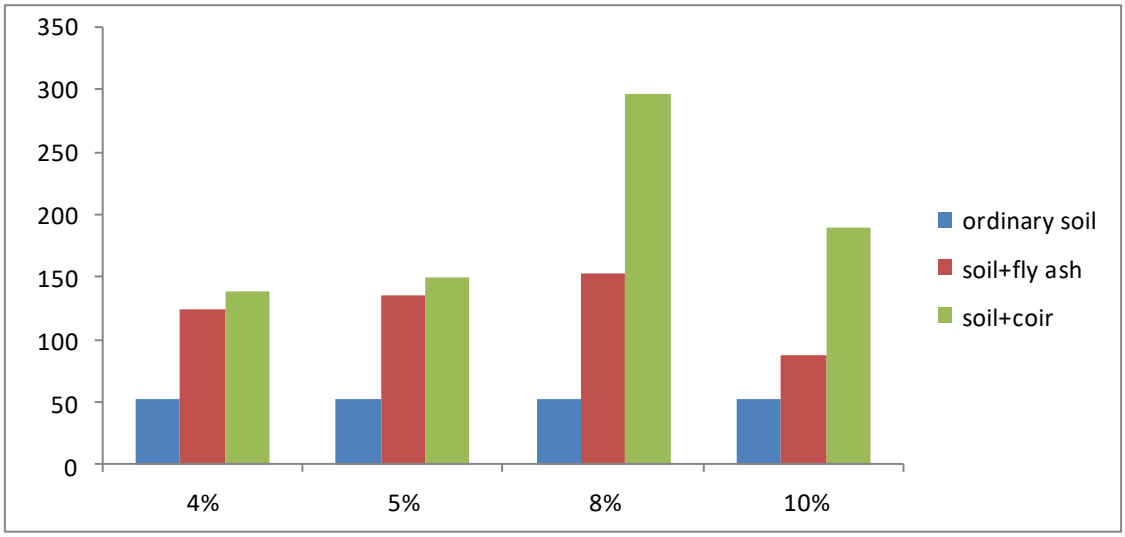


Conclusion: The ultimate compressive strength of soil+fly ash is increased than ordinary soil. And the ultimate compressive strength of soil+coconut coir is increased than soil+fly ash.

The ultimate compressive strength has increased from 4to 8% of coconut coir and fly ash. And when compared with 10% of additive 8% have high compressive strength.

THREE DAYS

SNO.	4%	5%	8%	10%
Soil (KPa)	52.5	52.5	52.5	52.5
Soil+ fly ash (KPa)	124.5	134.5	152.8	87.3
Soil+ coconut coir (KPa)	138	149.3	295.6	188.7



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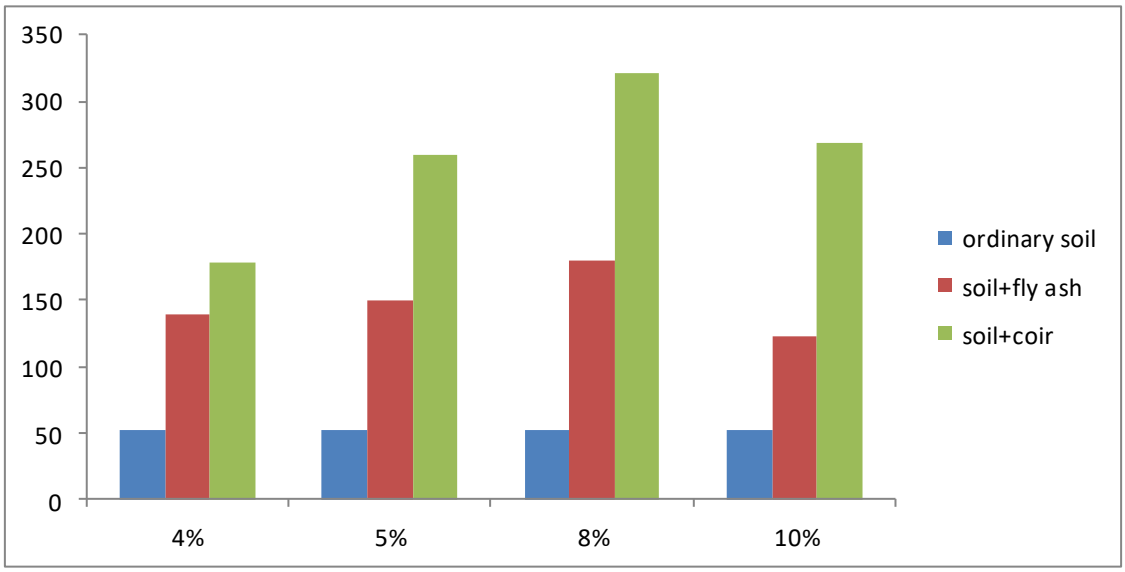
SEVEN DAYS

SNO.	4%	5%	8%	10%
Soil (KPa)	52.5	52.5	52.5	52.5
Soil+ fly ash (KPa)	139.6	149.6	179.6	122.4
Soil+ coconut coir (KPa)	179	260.1	320.5	268.5



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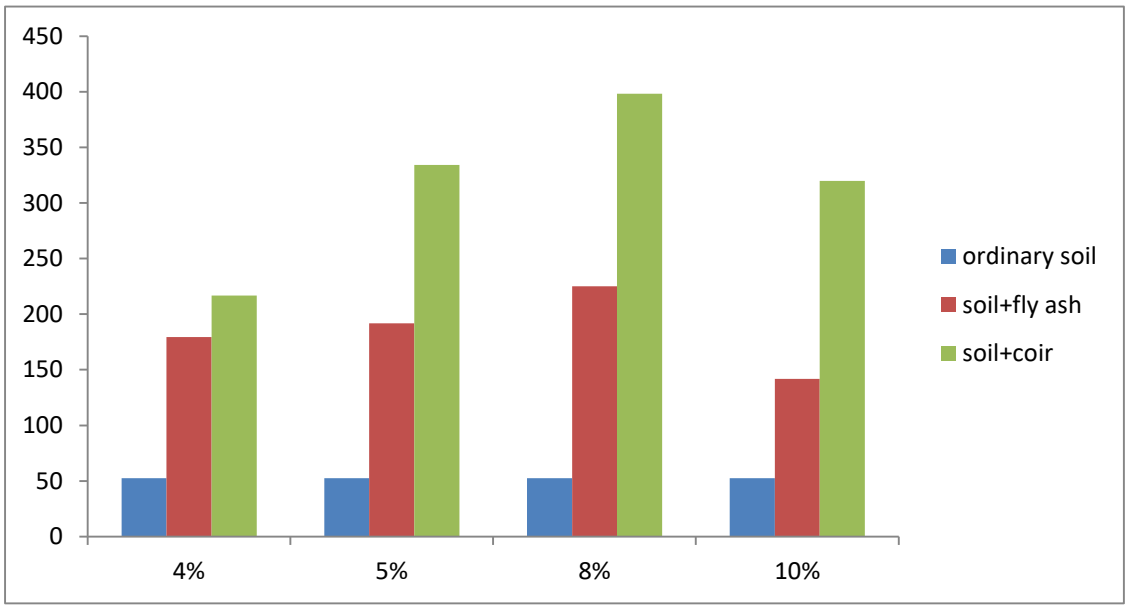
The ultimate compressive strength has increased from 4to 8% of coconut coir and fly ash. And when compared with 10% of additive 8% have high compressive strength.

FOURTEEN DAYS

SNO.	4%	5%	8%	10%
Soil (KPa)	52.5	52.5	52.5	52.5
Soil+ fly ash(KPa)	179.5	191.7	225.2	141.9
Soil+ coconut coir (KPa)	216.8	334.2	398.3	319.9



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The ultimate compressive strength has increased from 4to 8% of coconut coir and fly ash. And when compared with 10% of additive 8% have high compressive strength.

TWENTY EIGHT DAYS

SNO.	4%	5%	8%	10%
Soil (KPa)	52.5	52.5	52.5	52.5
Soil+ fly ash (KPa)	249.6	264	303	197.7
Soil+ coconut coir (KPa)	370.4	392	452.4	367.4

The *Conclusion:* ultimate compressive strength of soil+fly ash is increased than ordinary soil. And the ultimate compressive strength of soil+coconut coir is increased than soil+fly ash.

The ultimate compressive strength has increased from 4to 8% of coconut coir and fly ash. And when compared with 10% of additive 8% have high compressive strength.

V. **CONCLUSION**

- The strength of soil goes on increasing up to 8% by weight of coconut coir and fly ash respectively.
- The maximum dry density is maximum for 8% of coir than that of the fly ash.
- The unconfined compressive strength of soil also shows it's peak value at 8 % only.
- Both fly ash and coir shows a decrease in strength, maximum dry density at 10% of the addition of additive.

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