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Soil Stabilization Using Coconut Coir Fibre

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Abstract— Use of Coconut coir Fibre for improving soil property is advantageous because they are cheap, locally available and eco-friendly. In this study, the stabilizing effect of Coconut coir Fibre (Natural Fibre) on soil properties has been Experimental studied. Keeping this in view an experimental study is conducted on locally available i.e. expensive soil mixed with varying percentage of Coconut coir fibre. Soil samples for California bearing ratio (CBR) tests are prepared at its maximum dry density (MDD) corresponding to its optimum moisture content (OMC) in the CBR mould without and with Coconut coir fibre. The percentage of Coconut coir fibre by dry weight of soil is taken as 0.25%, 0.50%, 0.75% and 1% and corresponding to each Coconut coir fibre content un-soaked and soaked CBR tests are conducted in the laboratory. Tests result indicates that both un-soaked and soaked CBR value of soil increases with the increase in Coconut coir fibre content. Soaked CBR value increases from 3.9 % to 8.6 % and un-soaked CBR value increases from 8.1 % to 13.2 % of soil mixed with 1% Coconut coir fibre. Adding of coconut coir fibre results in less thickness of pavement due to increase in CBR of mix and reduce the cost of construction and hence economy of the construction of highway will be achieved. This is because of composite effect of Coconut coir fibre (Natural Fibre) changes the brittle behaviour of the soil to ductile behaviour.
Keywords— Coconut coir Fibre, OMC, MDD, Un-Soaked CBR, Soaked CBR, Expansive soil

I. INTRODUCTION

Expansive soils because more damage to structures, particularly light buildings and pavements, than any other natural hazard, including earthquakes and floods. Engineers are continually faced with maintaining and developing pavement infrastructure with limited financial resources. Traditional pavement design and construction practices require high-quality material for fulfilment of construction standards. In many areas of the world, quality material is unavailable or in short supply. Due to these constraints, engineers are often forced to seek alternative design using substandard materials, commercial construction aids, and innovation design practices. Concrete or asphalt pavement cannot be constructed on weak soil, because in this case the pavement will be easily cracked. As sub grade pavement to the layer beneath, it should have a sufficient load carrying capacity.

The entire pavement section would have to be removed and replaced to correct embankment soil performance problems created by lack of strength or uniformity. It is imperative that the embankment be built as strong, durable, uniform and economical as possible. The most economical embankment is one that will perform well for many decades, present methods to help achieve adequate stiffness, strength, and uniformity for a given embankment soil. The procedure starts with a good soil survey at the location so that proper design and construction procedures can be included for the project. Efforts are therefore made to strengthen the sub grade soil by mechanical stabilization or soil-cement, lime, fly ash or geo-synthetics to improve its performance. One of the latest techniques is the soil reinforcement. Soil reinforcement is an effective and reliable technique for improving strength and stability of the soil.

Coir or coconut Fibre belongs to the group of hard structural fibres. It is an important commercial product obtained from the husk of coconut. The coir Fibre is elastic enough to twist without breaking and it holds a curl as though permanently waved. Shorter mattress fibres are separated from the long bristle fibres which are in turn a waste in the coir Fibre industry. So this coir Fibre waste can be used in stabilization of soil and thus it can be effectively disposed off. The inclusion of fibres had a significant influence on the engineering behaviour of soil-coir mixtures. The addition of randomly distributed polypropylene fibres resulted in substantially reducing the consolidation settlement of the clay soil. Length of fibres has an insignificant effect on this soil characteristic, whereas Fibre contents proved more influential and effective. Addition of Fibre resulted in decrease in plasticity and increase in hydraulic conductivity

II. MATERIALS

The materials used in the experiments are soil and Coconut coir Fibre

A. Expansive Soil

The expansive soil used in the experimental work was brought from **LNCT College campus, Bhopal, (M.P.), India**. The geo-technical properties of the expansive soil are:

Table-1: Physical characteristics of Expensive soil

Sr. No.	PROPERTIES	Test Values
1.	Specific gravity	2.86
2.	Liquid Limit LL (%)	28
3.	Plastic Limit PL (%)	23
4.	Plasticity Index PL (%)	5
5.	Uniformity coefficient, Cu	5.14
6.	Coefficient of curvature, Cc	0.97
7.	Compaction characteristics	
I	Optimum Moisture Content (%)	13.65
II	Maximum Dry Density (g/cc)	1.85
8.	California Bearing Ratio CBR (%)	
	Un-soaked CBR	8.1
	Soaked CBR	3.9

B. Coconut Coir Fibre

Coconut coir Fibre is obtained from the husk of coconut and belongs to the group of hard structural fibres. The fibrous husks are soaked in pits or in nets in a slow moving body of water to swell and soften the fibres. The long bristle fibres are separated from shorter mattress fibres underneath the skin of nut, a process known as wet milling. The coir Fibre is elastic enough to twist without breaking and it holds a curl as though permanently waved. It is an important commercial product used in mattress. Shorter mattress fibres are separated from the long bristle fibres which are in turn a waste in the coir Fibre industry.

The coir is purchased from market. It is the fibrous portion of the coconut extracted mainly from the green nut. Coir extracted consists of rotting the husk in water and removing the organic material binding the fibre. Diameter is 0.5mm. The coir is cut into pieces of 3cm to 5cm, as those percentage remains 0.25, 0.50, 0.75, 1%.

III. TESTING PROCEDURE

For studying, the effect of Coconut coir Fibre on expansive soil, the Coconut coir Fibre was added from 0.25 to 1 % at an increment of 0.25 %.The following tests were conducted on Expansive soil and Coconut coir Fibre mixes as per relevant IS code practice.

The experiments conducted are:

Compaction characteristics

Un-Soaked California bearing Ratio (CBR)

Soaked California bearing Ratio (CBR)

IV. TEST RESULTS

The various tests were conducted on Expansive soil mixed with Coconut coir Fibre in different proportions as per relevant IS Code of practice. The test results obtained from various laboratory investigations are summarized in table

Table 2 – Results of variation of properties

S. No.	Properties	Test Results				
		CM_0	$CM_{0.25}$	$CM_{0.50}$	$CM_{0.75}$	CM_1
1	OMC (%)	13.65	13.45	13.10	12.80	12.60
2	MDD (g/cc)	1.85	1.87	1.885	1.89	1.90
3	Un-Soaked CBR (%)	8.1	9.7	10.8	11.9	13.2
4	Soaked CBR (%)	3.9	5.0	6.2	7.1	8.6

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Where: CM_0 = Expansive soil + 0 % Coconut coir Fibre
$CM_{0.25}$ = Expansive soil + 0.25 % Coconut coir Fibre
$CM_{0.50}$ = Expansive soil + 0.50 % Coconut coir Fibre
$CM_{0.75}$ = Expansive soil + 0.75 % Coconut coir Fibre
CM_1 = Expansive soil + 1 % Coconut coir Fibre

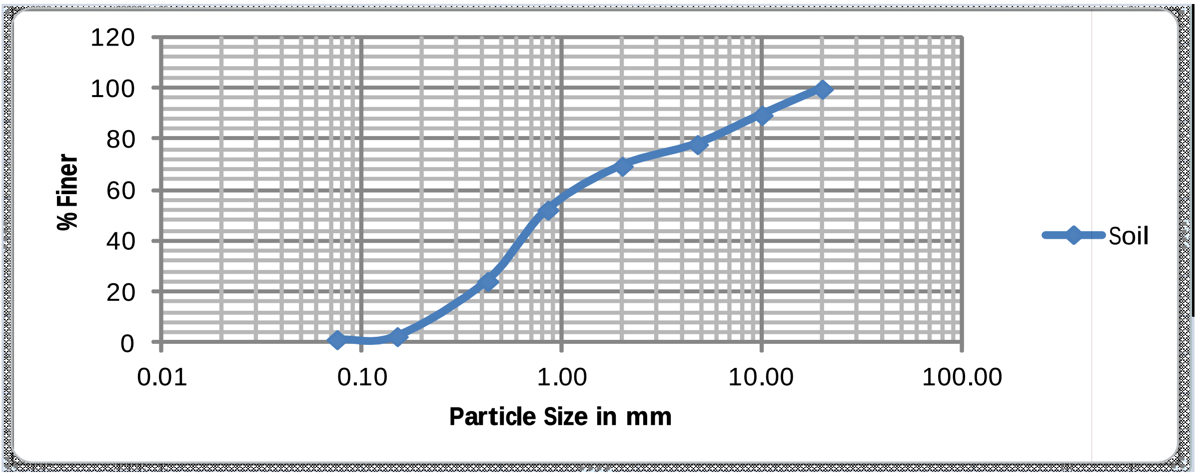


Fig 1 – Grain Size Analysis of soil

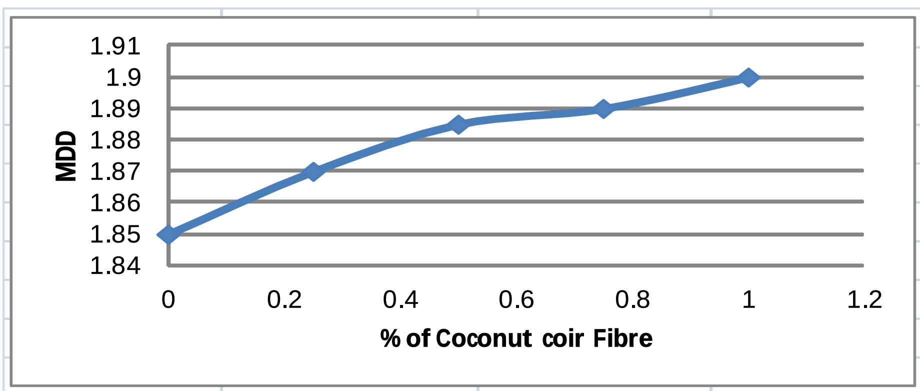


Fig 2 – Maximum dry density (MDD) of Soil with Coconut coir Fibre

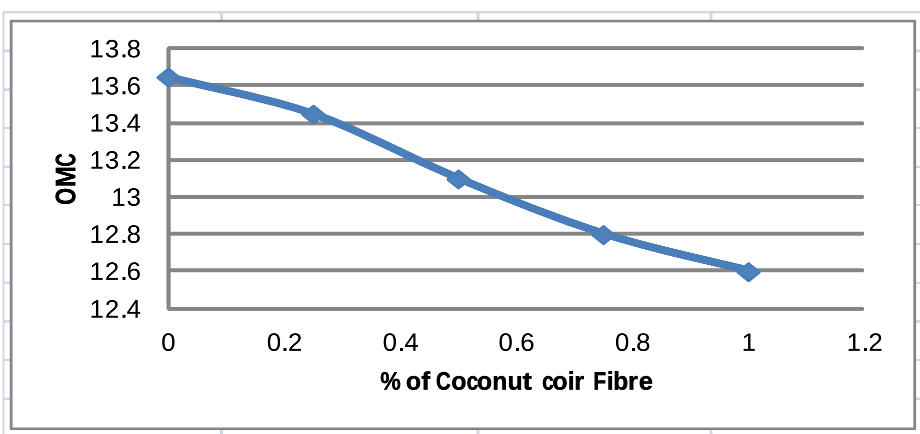


Fig 3 – Optimum moisture content (OMC) of soil with Coconut coir Fibre

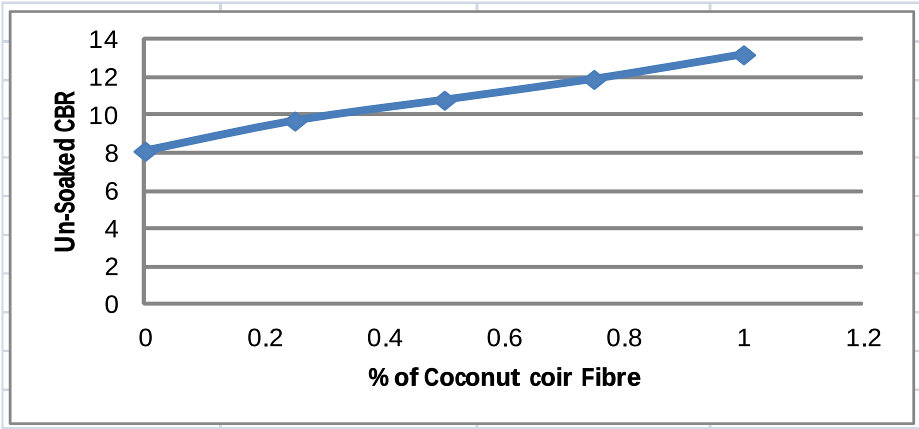


Fig 4 – Un-Soaked California berating ratio (CBR) of soil with Coconut coir Fibre

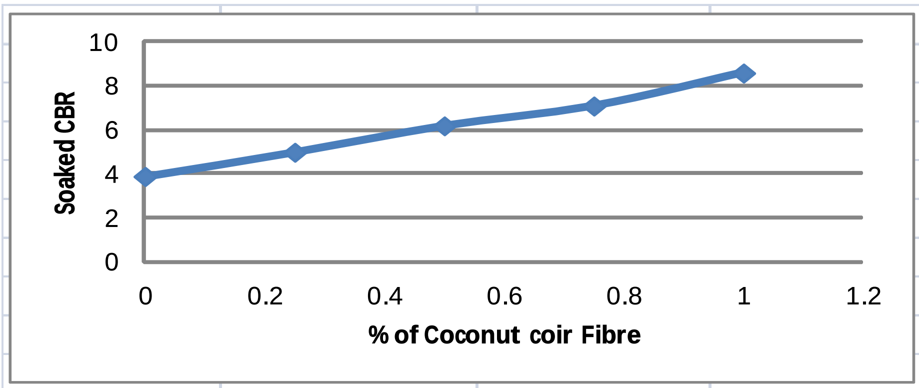


Fig 5 – Soaked California berating ratio (CBR) of soil with Coconut coir Fibre

V. RESULTS AND DISCUSSION

Based on the results obtained from various tests conducted on Expensive soil, Coconut coir Fibre mixes. The variations in various engineering characteristics of the soil are discussed below. The compaction test results showed a decrease in OMC from 13.65% to 12.60 % and increase in MDD values from 1.85 g/cc to 1.90 g/cc with the addition of Coconut coir Fibre content from 0% to 25%. The variation in OMC and MDD are presented in figure-3 and figure-2 .The soaked CBR test results indicates that the values increase from 3.9 % to 9.6 % as the Coconut coir Fibre content increase from 0% to 1%. The load penetration curves and the variation of CBR with Coconut coir Fibre are presented in figure 5.

VI. CONCLUTIONS

Based on above laboratory investigations conducted on Expensive soil-Coconut coir Fibre mixes the following conclusions can be drawn:

The addition of Coconut coir Fibre into the Expensive soil has changed the compaction parameters. The OMC of the Expensive soil has decreased and the maximum dry density (MDD) increased with the addition of Coconut coir Fibre.

The soaked CBR values have also increased significantly with the addition of Coconut coir Fibre content. The addition of 1% Coconut coir Fibre into the Expensive soil, increase the CBR values from 3.9 % to 8.6 %

From the above laboratory investigation it can be concluded that the industrial waste like Coconut coir Fibre has a potential to modify the engineering behaviour of Expensive soil and to make it suitable in many geotechnical application

REFERENCES

[1] Choudhary A. K., Gill K. S. and Jha K.N. (2011); "Improvement in CBR values of expansive soil sub grade using geo-synthetics". Proc. Indian Geotechnical Conference,Kochi, pp.569-572.

[2] Gourley C. S., Newill D. and Shreiner H. D., (1993); "Expansive soils", TRL's research strategy. Proc. 1st Int. Symp. on Engineering Characteristics of Arid Soils, City University, London.

[3] Negi Chhaya (2013); "Effect of silica fume on engineering characteristics of BC soil", ME Thesis,JEC Jabalpur (MP).

[4] Palaniappan K. A. and Stalin V. K. (2009); "Utility effect of solid wastes in problematic soils" International Journal of Engineering Research and Industrial Applications. 2(1), pp. 313-321.

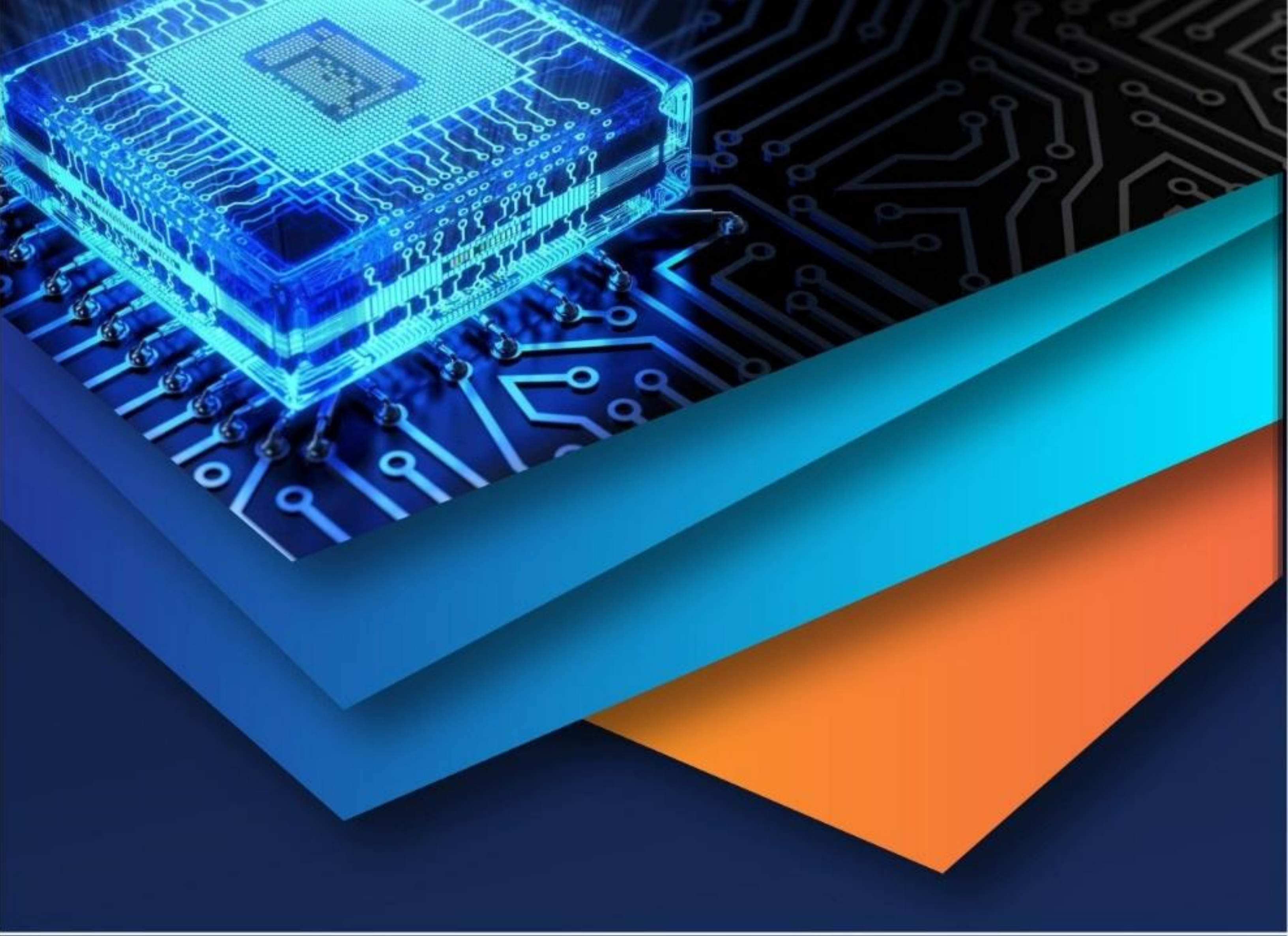
[5] Ranjan Gopal and Rao A. S. R.(2003); "Basic and Applied soil mechanics". Second Edition, New Age International Publication, New Delhi.

[6] Saranjeet Rajesh Soni,(2011); "Disposal of solid waste forblack cotton soil stabilization". International Journal of Advanced Engineering Sciences and Technologies, Vol No. 8, Issue No. 1, pp.113 –120.

[7] Amit tiwari, H.K.Mahiyar. "Experimental study on stabilization of black cotton soil by fly ash, coconut coir fiber & crushed glass" International journal of engineering technology and advanced engineering., Vol 4,Issue 11, 2014.

[8] R.R.Singh, Er.Shelly mittal, importance of loacal subgrade soil for road construction by the use of coconut coir fiber, International journal of research in engineering and technolog., Vol 3, Issue5, 2014.

[9] V Rama Susheel Kumar1 , J Vikranth2 "Application of Coconut Coir and Fly ash in Sub grade strengthening" The International Journal Of Engineering And Science (IJES) || Volume || 3 || Issue || 12 || December - 2014 || Pages || 48-54|| ISSN (e): 2319 – 1813 ISSN (p): 2319 – 1805



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