Simultaneous Use of Coconut Fibre in Soil Reinforcement

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Abstract— Coconut fiber or coir fiber and is obtained from the coconut shell. Coconut fiber is very cheap, economical and easily available in the market .It can be used to impart the various engineering properties such as shear strength, tensile strength, bearing capacity and many other properties by using various proportions and size of the coir fiber The fiber has a high degree of water retention and is rich in micronutrients. By introducing the coconut coir fibers in the soil the developmentof the frictional forces increases between the soil particles and the reinforcement fibers. In this paper the author has worked on using various proportions of coconut fiber to the clayey soil. The tests conducted on the clayey soil are Liquid Limit, Plastic Limit, Standard Proctor Test and California Bearing Ratio (CBR). The percentages of the coconut fiber used in the soil are 0%, 0.3, 0.5%, 0.8%, 1.1% and 1.4%. The various parameters which were investigated in thisresearch are dry density, optimum moisture content etc. It is concluded that the best results of OMC and MDD are obtained at 1.4% of coconut coir fiber .For CBR tests the highest values are also obtained at 1.4% of coconut fiber respectively. Hence the above proportion can be adoptedin the road pavement designs, reinforcement of foundation soils etc.

Keywords: CBR, Liquid Limit, Plastic Limit, Standard Proctar Test

I. INTRODUCTION

Historically, the coconut was known as Nux indica (the Indian nut) and also the Nargil tree, the tree of life. Western literature has also mentioned the Malayalam name Tenga for the coconut palm which relates to Tamil „Tennai‟, believed to be of Sri Lankan origin. Its geographical dispersion was aided by travelers and traders. Botanically, the coconut palm is a monocotyledon and belongs to the order Arecaceae, family Palmae and the species is known as Cocos nucifera Linn. The Philippines, Indonesia, India and Sri Lanka account for 78% of coconut production. The most important and economically valuable product of coconut palm is its fruit popularly known as the „nut‟. It is comprised of an external exocarp, a thick fibrous organic product coat known as the husk and underneath lies the hard defensive shell. Coating the shell is a white albuminous endosperm or 'coconut meat' and the internal pit is filled with a reasonable sweet fluid called 'coconut water'. In this section, use of coconut fiber/coir fiber in composites is discussed. Filtering electron microscopy (SEM) is completed to understand why the mechanical properties of composites arranged from treated and untreated coir are extraordinary and furthermore to understand the impact of fiber treatment on the fiber–lattice interfacial grip. The coconut palm includes a white 'meat' which has a rate by weight of 28 enclosed by a defensive shell and husk which have a rate by weight of 12 and 35 individually. The husk from the coconut palm involves 30% weight of fiber and 70% weight of essence material. it demonstrates the sythesis of the coir fibers (Verma et al ., 2013). The vital properties of coconut fiber are:

- It is a renewable resource and CO 2 -neutral material.
- The fiber is abundant, non-toxic, biodegradable, low density and low cost.
- The fiber has a high degree of water retention and is rich in micronutrients.

Coconut (Cocos nucifera) plays a significant role in the economy of India. Apart from the importance of copra and coconut oil, which is widely used in the manufacturing of soaps, hair oil, cosmetics and other industrial products, the husk is a source of fiber which supports a sizable coir industry. The tender nut also supplies coconut water. oconut is grown in more than 90 countries in an area of 14.231 million ha with a total production in terms of copra equivalent of 11.04 million MT. Indonesia (25.63%), the Philippines (23.91%), and India (19.20%) are the major coconut-producing countries of the world. The coconut palm can tolerate a wide range of soil conditions, although a variety of factors such as drainage, soil depth, soil fertility and layout of the land have an influence on the growth of the palm. The major soil types that are best for the growth of coconut in India are laterite, alluvial, red sandy, loamy, coastal sandy and reclaimed soils with a pH ranging from 5.2 to 8.0. Coconut palms require a continuous supply of water, which can be provided by rainfall of the order of 2000 mm per annum, or from groundwater (at a depth of 1–3 m), although they cannot tolerate waterlogging . The palms grow best at average temperatures of around 26–27°C, so they cannot grow above 750 m. Growth is stimulated by a suffi cient supply of chlorine in the soil, and the coconut can withstand up to 1% salt in the soil. These conditions are generally found in tropical and subtropical coastal regions with little rainfall. Coconut palms can also grow on deep alluvial soil. The quality of the seeds is very important to the yield from the palm. The seeds should originate from a healthy and productive stock plant. Two main groups are cultivated in the commercial sector: the tall plants of the Typica group, whichgenerally need to be cross-fertilized, and dwarf types of the Nana group, where self- pollination is prevalent. S tock plants that are suitable seed providers produce 100 nuts per year, 12–14 syncarpy of differing ages, and up to 180 g copra per nut. The fully ripened nuts which are intended to provide seeds are harvested after 11–12 months. The nuts germinate quicker at the lower end, or in the middle, of the syncarpy and should not be allowed to fall but should be cut down, and carefully lowered. Following the harvest, the produce should be stored for a short break in a covered and well- ventilated place. B efore sowing, the nuts are sorted and only those containing water are used. The shell is cut away on the germinating side of the nut to facilitate germination and then the nuts are soaked in water for 14 days before being sown in loose soil which can drain easily. The nuts are laid in the soil lengthways at a distance of 45 cm with the upper side still visible. Coconut fi bers are used as mulching material between the rows.The nuts can also be sown in a glasshouse with 95% humidity. On smallholdings, the nuts are often set out in shaded areas, lightly dug in and then covered with organic material (Augstburger et al .2000). Although coconut is grown in more than 90 countries, the Philippines, Indonesia, India and Sri Lanka contribute about 78% of the world " s production. In 2007–08, India contributed 27.86% of global coconut production.

II. OBJECTIVES

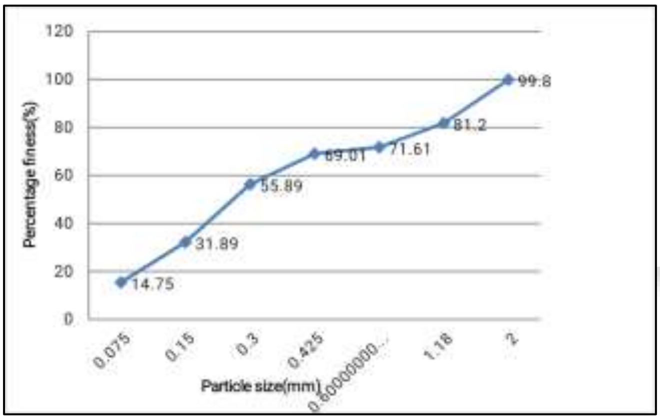
1) To study the coconut fibre
2) To find the Results on use of coconut fibre for soil Stabilisation.
3) To compare the results with together use of fibres and separate use.
4) To determination of CBR value of Coconut Reinforced Soil.
5) Comparison of the CBR values of the reinforced and unreinforced soils.

III. TEST RESULTS AND DISCUSSION

Data Analysis & Results Obtained6.1Sieve Analysis

S.no	Sieve(mm)	Total sampleweight retained on sieve	Cumulative weight retaining on the sieve	% age of soil retained onsieve	% age of soil passed on sieve
1	2.00	1.287	1.287	0.16	99.84
2	1.180	192.908	194.195	18.56	81.28
3	0.600	91.649	285.844	9.67	71.61
4	0.425	18.027	303.871	2.6	69.01
5	0.300	129.595	433.466	13.12	55.89
6	0.150	251.530	684.996	24.76	31.89
7	0.075	156.129	841.125	17.14	14.75
8	Pan	146.642	987.642	14.75	0

Table 6.1:



Graph 1: Particle size distribution curve

Values of Coefficient of Curvature and Coefficient of Uniformity ;D10 =0.06

D30 = 15

D60 = 0.300 + 0.0625

D60 =0.3625

From the particle size distribution curve, we have the values of D10, D30,D60 are(0.06,0.15,0.3625).

Coefficient of Uniformity ;

(Cu) = D60 / D10

=0.3625/0.06 = 6.041

Coefficient of Curvature

2

(Cc) = (D30)/D60 x D10

2

=0.150 /0.3625 x 0.06 = 1.03

Therefore according to IS 2720 PART 4, the soil is well graded clayey soil

A. *Specific gravity test*

Table Observation table for specific gravity of parent soil

CONTAINER NO.	I
Mass of empty pycnometer (M1)	0.631
Mass of pycnometer + mass of dry soil (M2)	0.832
Mass of pycnometer + soil + distilled water (M3)	1.58
Mass of pycnometer + fill with water only (M4)	1.428
Specific gravity Gs = M2 = M3/(M2-M1)-(M3-M4)	2.66

Table 6.2:

Therefore, specific gravity of parent soil = 2.66

B. *Liquid limit*

Observation Table For Liquid Limit and Plastic Limit

DETERMINATION NO.	1	2	3	4
No. of blows	45	40	20	16
Container no.	A	B	C	D
Wt. of container W1 (g)	48	51	47	47
Wt. of container + wet soil W2(g)	65	70	74	59
Wt. of container + dry soilW3(g)	62	66	67	55
Wt. of moisture content (W2-W3)	3	4	7	4
Wt. of dry soil (W3-W1)g	14	15	20	8
Water content = (W2-W3/W3-W1) x 100	21.42%	26.66%	35%	44.4%

Table 6.3:

C. Liquid Limit (Flow Curve)

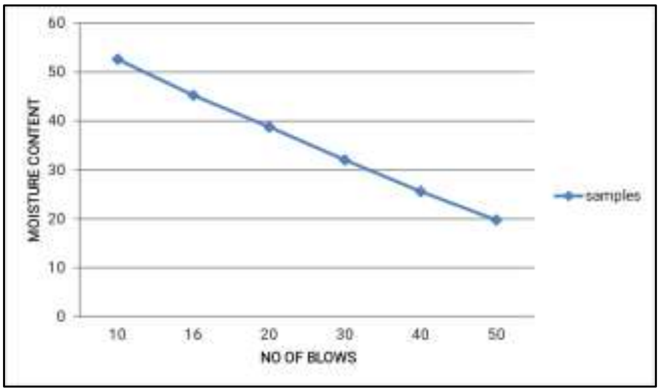


Table 6.4: Liquid and Plastic limit

S. No	Parameter	Range/Value
1	Liquid limit	44.40%
2	Plastic limit	30.76%
3	Plasticity Index	14.36%

IV. CONCLUSION

From the above experimental study it has been revealed that the soil samples reached the highest values of all the parameters when the percentages of coconut fibre reached to1.4%. The OMC and Dry Density of the soil got increased from 11% to 20% and 1570 mg/cm3 to 1752 mg/cm3 respectively with increase in the coconut fibre content percentage. CBR values has also been increased from 1.96% to 4.48% for CBR at 2.5mm penetration and 1.68% to 4.16% for CBR at 5mm penetration with increase in the coconut fibre content.

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