Novelty Journals

ISSN 2394-966X

International Journal of Novel Research in Life Sciences
Vol. 6, Issue 3, pp: (79-83), Month: May - June 2019, Available at: www.noveltyjournals.com

Coconut coir fiber's impact on compaction properties of soil

Vipasha Rishi[1], Gagandeep[2]

[1,2]Assistant Professor Department of Civil Engineering,
[1]Chandigarh University, Mohali, Punjab, India
Email: deepg0607@gmail.com[1] , vipasharishi@gmail.com

Abstract: **In the present study, it is seen that If the stability of the soil is not adequate then failure of structure occurs in the form of settlement, cracks etc. To avoid this, properties of soil must be improved by artificial means. Many research have been conducted for stabilization of soil by using cementing, chemical materials e.g. fly ash, cement, Calcium chloride, Sodium chloride etc. In this respective research, coconut coir fiber has been used to check its impact on compaction properties of soil. Compaction test has been performed by adding 0.5% and 1 % of coir fiber in the soil. Diameter of the coir fiber is 0.5mm. Results show that on increasing the percentage of coir fiber the MDD decreases and the OMC increases.**

Keywords: **Coconut coir fiber, MDD and OMC.**

1. INTRODUCTION

Construction of houses and highways or other civil engineering structures on weak or soft soil is highly dangerous because such soil is liable to differential settlement due to its poor shear strength and high compressibility. The recent trend is, to consider the beneficial reuse of waste creation from industries. A modern approach is to examine the use of COCUNUT COIR FIBER in the soil. It is more economical both in terms of cost and energy to increase the bearing capacity of the soil rather than going for deep foundation or raft foundation. It helps in reducing the soil volume change due to change in temperature or moisture content. The **coir** can be purchased from the market. It is the fibrous portion of the coconut extracted mainly from the green nut shown in Fig.1.

Fig.1 Coir Fiber

2. METHODOLOGY

The soil was chosen from the road construction work of NH-95 near Chandigarh university Gharuan. The soil from the site was taken to the laboratory for testing work. For classification of soil, particle size analysis has been carried out. After knowing the type of soil, Standard proctor test with the use of coir fiber was done as per the procedure given in (***IS 2720:1980 (Part VII))***.

Novelty Journals

ISSN 2394-966X

International Journal of Novel Research in Life Sciences
Vol. 6, Issue 3, pp: (79-83), Month: May - June 2019, Available at: www.noveltyjournals.com

2.1. *Standard proctor test (IS 2720:1980 (Part VII))*

1. 3kg of soil was sieved through 4.75 mm sieve.

2. The mould of proctor test was cleaned, dried and greased.

3. Total 2 kg of soil with the 0.5% of coir fiber was taken in the tray and mixed properly, initially7% of water content was added.

4. The weight and volume of empty mould was calculated. After fixing of the the collar to the mould, the mould was placed on a solid base.

5. The soil was to be added in 3 equal layers, by giving 25 numbers of blows with rammer to 1/3rd of the whole soil sample, the top surface of the layer was scratched with spatula before putting the second layer.

6. The final layer of the soil was added at least 5 mm above the top surface of collar to strike off when the collar is detached.

8. Using a straight edge the top surface of the soil was trimmed off after removing the collar.

9. In the end the base plate and mould was cleaned from the outside and the weight of mould was taken without collar.

10. Bulk density (g/cm^3) (ϒd) = Dry soil weight (g) / Soil volume (cm^3).

11. (Dry density) $\Upsilon_d = \Upsilon_b / (1+w)$.

12. the was taken out and the whole procedure was repeated using different % of water.

13.ϒd for various water contents was calculated and a graph between water content and Υ_d was plotted to find the value of MDD (maximum dry density) and OMC (optimum water content).Fig.2 shows the compaction curve for finding maximum dry density and optimum moisture content.Fig.3 is showing the conducting of standard proctor test on soil using coir fiber.

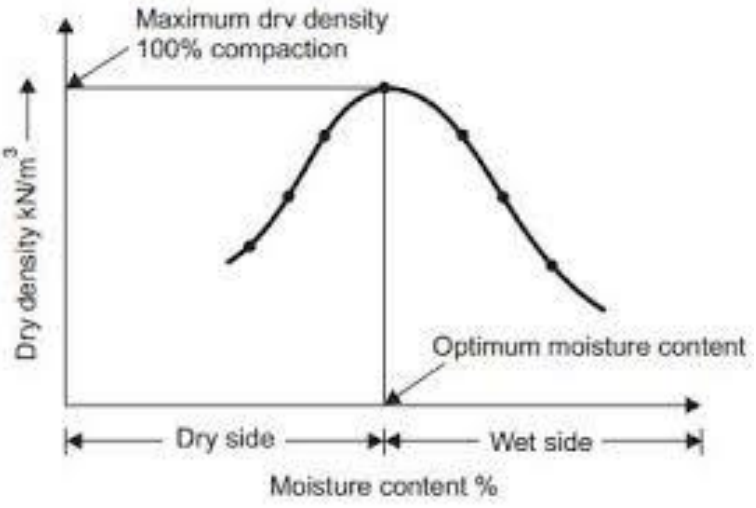

Fig. 2 Compaction curve for finding max dry density and optimum water content [8]

3. RESULTS AND DISCUSSION

Table 1 depicts the max weight retained on each sieve, % retained and the cumulative weight retained, from which we calculate the % finer. Using this table a graph has been plotted between percentage finer and sieve sizes on semi-log graph, which ultimately shows the value of D_{10}, D_{30} and D_{60} in Fig.3.From the particle size distribution graph, Fig.4 the values of D_{10}, D_{30} and D_{60} are 0.2, 0.49& 1.18 respectively. Using the formula the values of Cu and Cc have been calculated. Coefficient of uniformity (Cu) is 5.9 and Coefficient of curvature (Cc) 1.0.From which the type of soil as perIS 1498:1970 was classified as **well graded soil**.

Novelty Journals

ISSN 2394-966X

International Journal of Novel Research in Life Sciences
Vol. 6, Issue 3, pp: (79-83), Month: May - June 2019, Available at: www.noveltyjournals.com

3.1 Grain Size Analysis

Table 1: Grain Size Analysis

Sieve Size	Weight Retained(g)	% Retained	Cumulative %	% Finer
4.75	133	6.65	6.65	93.35
2.36	262	13.1	19.75	80.25
1.18	405	20.25	40	60
0.6	350	17.5	57.5	42.5
0.3	312	15.6	73.1	26.9
0.15	439	21.95	95.05	4.95
0.075	84	4.2	99.25	0.75
Pan	13	0.65	99.9	0.1
Total	**1998**			

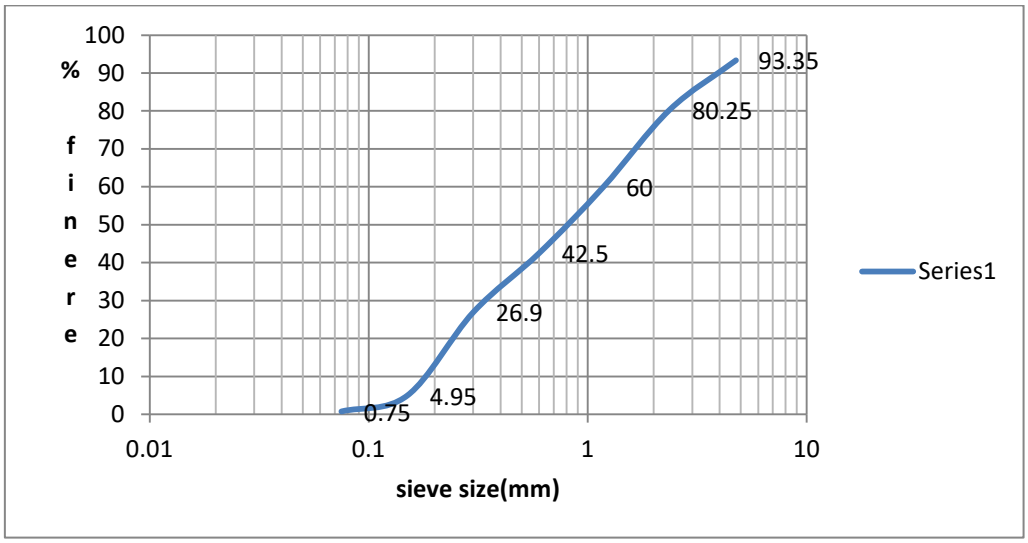

Fig 3: Graph of cumulative % passing versus the logarithm sieve size

Table 2: Maximum Dry Density and Optimum Moisture Content using 0.5% Coir Fiber

Water Content taken initially	**7%**	**11%(OMC)**	**13%**	**15%**	**19%**
Weight of empty mould (g)	3826	3826	3826	3826	3826
Volume of mould(cm3)	1000	1000	1000	1000	1000
Weight of soil + mould (g)	5600	5733	5757	5760	5615
Weight of compacted soil without mould (g)	1774	1907	1931	1934	1789
Density (g/cc)	1.774	1.907	1.931	1.934	1.789
Dry density (g/cc)	1.65	**1.71**	1.70	1.68	1.50

Novelty Journals

ISSN 2394-966X

International Journal of Novel Research in Life Sciences
Vol. 6, Issue 3, pp: (79-83), Month: May - June 2019, Available at: www.noveltyjournals.com

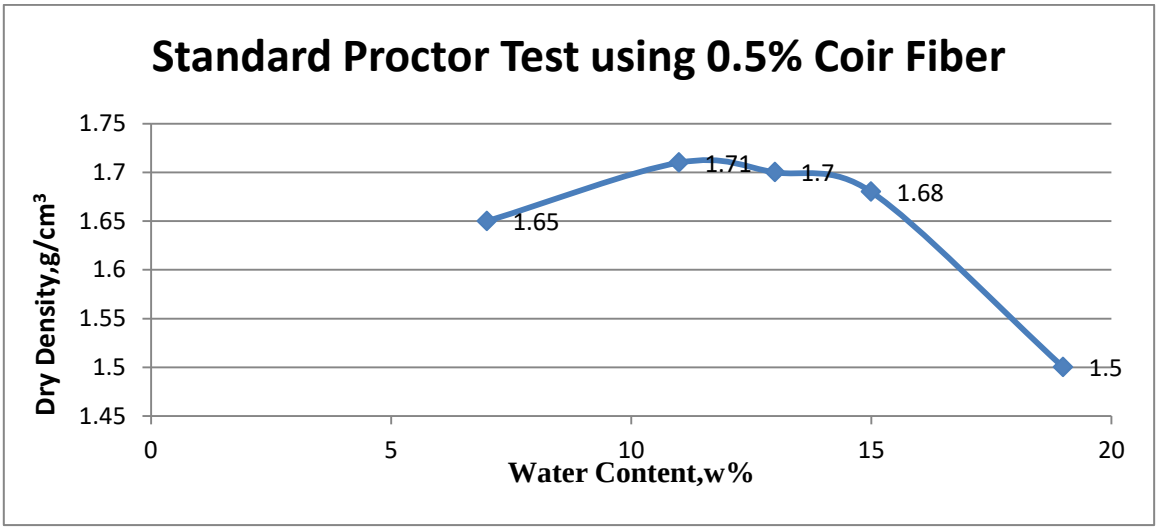

Fig 4: Standard Proctor Test using 0.5% Coir Fiber

Table 3: Maximum Dry Density and Optimum Moisture Content using 1% Coir Fiber

Water Content taken initially	**7%**	**11%**	**13%**	**15%(OMC)**	**19%**
Weight of empty mould (g)	3826	3826	3826	3826	3826
Volume of mould(cm^3)	1000	1000	1000	1000	1000
Weight of soil + mould (g)	5522	5620	5700	5768	5224
Weight of compacted soil without mould (g)	1696	1794	1874	1942	1398
Density (g/cc)	1.696	1.794	1.874	1.942	1.398
Dry density (g/cc)	1.58	1.61	1.65	**1.68**	1.17

Table 2 and Table 3 shows the values of dry densities and water content for 0.5 % and 1 % of the coir fiber respectively.Fig.4 and Fig.5 shows the graph between values of dry densities and moisture contents for 0.5% and 1% of coir fiber respectively.in 0.5% of coir fiber the value of maximum dry density is 1.71 g/cm^3 and the value of optimum moisture content is 11%,similarly in case of 1 % coir fiber the maximum dry density is 1.68 g/cm^3 and the value of optimum moisture content is 15%.

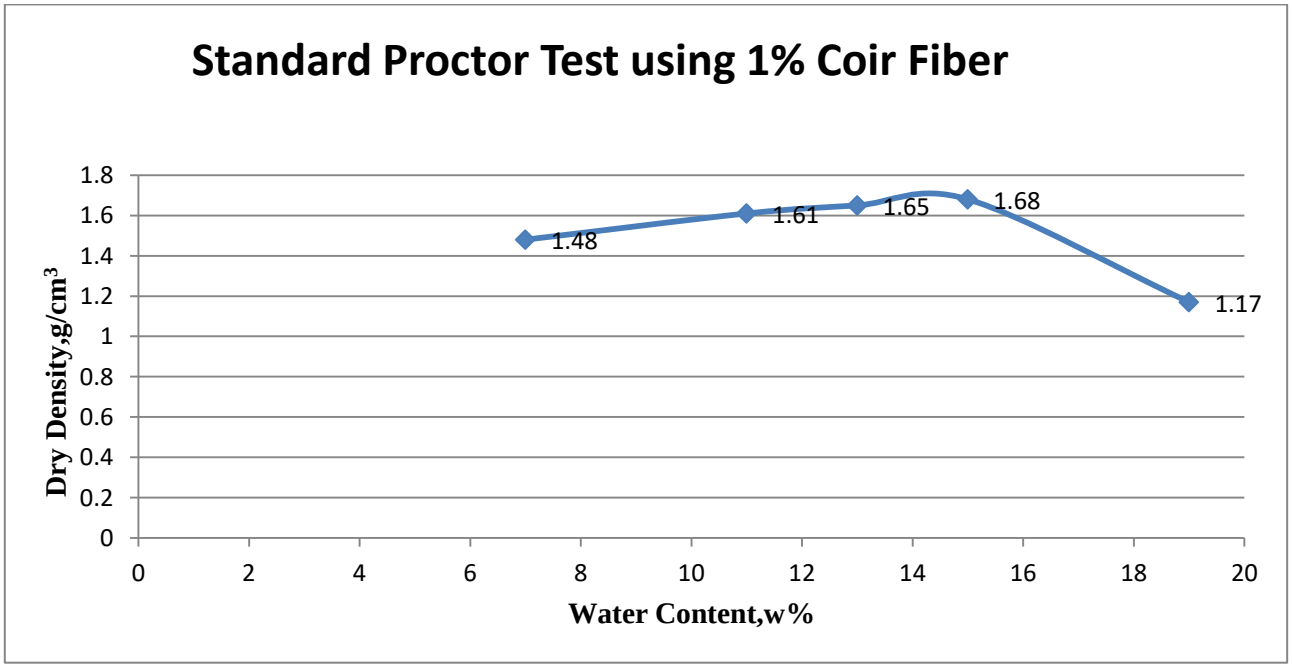

Fig 5: Standard Proctor Test using 1% Coir Fiber

4. CONCLUSIONS

- Coir fiber is a waste material which could be utilized in a sub base for flexible and rigid pavements.
- The OMC of soil-coir mix increases with increasing the percentage of coir fiber.
- Maximum dry density is decreasing on increasing the coir fiber,because the fiber has a weight less than the weight of the soil particles at the same volume which leads to decrease in MDD, at the same time increasing the surface area of the mixture (soil + fiber)which needs more water to reach the optimum, that would be the cause behind the increase in OMC.

REFERENCES

[1] Gray, D.H., and Ohashi, H. (1983), "Mechanics of fiber reinforcing in sand, Journal of Geotechnical Engineering",ASCE 112(8): 335-353.

[2] Gray, D.H., and Al-Refeai, T.(1986), "Behaviour of fabric- versus fiber-reinforced sand, Journal of Geotechnical Engineering," ASCE, 112(8): 804-820.

[3] Charan H.D. (1995), "Probabilistic analysis of randomly distributed fiber soil." Ph.D. Thesis, Dept. of Civil Egg. I.I.T Roorkee, Roorkee, India

[4] Michalowski, R.L. &Cerma'k, J. (2002). "Strength anisotropy of fiber reinforced sand", Compute. Geotech. 29, No. 4,279-299.

[5] Gosavi, M., Patel, K.A, Mittal, S. and Saran, S (2004). "Improvements of properties of black cotton soil subgrade through synthetic reinforcement", Journal of Institution of reinforced with randomly distributed fibers". Journal of Geotechnical Engineering, ASCE. 716 (11), 1661-1677

[6] Ranjan, G., Vasan, R.M. and Charan, H.D. (1996)," Probabilistic analysis of randomly distributed fiber-reinforced soil", Journal of Geotechnical Engineering, ASCE, 122(6): 419-426

[7] Rao, A.S. Rao, K.V.N., Sabetha, G. and SurestL K. (2006)." Load deformation behavior of fiber-reinforced gravel beds overlying soft clay". A National Conference on Corrective Engineering Practices in Troublesome Soils (CONCEPTS), Kakinad4 8-9 luly, 2006, 187 -190

[8] Singh, H.P., Sharma, A., and Chanda, N.(2011), "Study Of Strength Characteristics of Coir Reinforced Soil", International Conference on Advances in Material and Techniques for Infrastructure Development held at NIT Calicut Kerala, India. Paper No.: G002, 28-30 September.

[9] Lawton E.C., Khire, M.V. and Fox, N.S. (1993). "Reinforcement of soils by multiorientedgeosynthetic", Journal of Geotechnical Engineering ASCE, 119(2), 257-275

[10] Fatani, N.M., Bauer, G.H., and Al-Joulani, N.(1999) . "Reinforcing soil with aligned and randomly oriented metallic", Journal of ASTM Geotech Testing (1), pp 78-87.

[11] SP 20 (1997): "Manual on route location design construction maintenance of rural roads (other districts roads and village roads)" Publication, Indian Road Congress, New Delhi.

[12] IS 2720:1980 (Part VII), Indian Standard Method of Test for Soils, Determination of Water Content-Dry Density Relation Using Light Compaction.

[13] IS 1498:1970, Indian Classification and Identification of Soils for General Engineering Purposes.