International Journal of Research in Engineering, Science and Management
Volume-2, Issue-5, May-2019
www.ijresm.com | ISSN (Online): 2581-5792

Stabilization of Cochin Marine Soil using Treated Bamboo Strips and Arecanut Fiber

Ajmi Haneef[1], Anna Neha Mary Thomas[2], Brozia George Varghese[3]
[1,2,3]*B.Tech. Student, Department of Civil Engineering, Baselios Thomas I Catholicose College of Engineering and Technology, Koothattukulam, India*

***Abstract*: The marine soil is highly saturated, soft, sensitive and normally consolidated. They usually have a low density, low shear strength and expansive in nature. Hence, there is a need for improvement of their properties. When paved roads are built on these type of soft soil, large deformation occurs, which increase the maintenance cost and lead to interruption of traffic service. The main objective is to study the effects of Arecanut fiber on the engineering properties of marine soil and the reinforcing effect of randomly distributed treated bamboo strips on the engineering properties of marine soil. Arecanut fiber is one of the products of palm trees fruit. These are mixed in the ratio 0%, 0.25%, 0.5%, 0.75% and 1% by total weight of the soil sample taken. Bamboo strips of 8 cm length and 2 mm thickness are used and these are treated in NaOH for 24 hours and then inserted in soil. The usage of treated bamboo strips can lead the development of new technique particularly in stabilizing the soil. We take a detailed study on the improvement of stability and strength of clayey soil by the use of bamboo strips. Bamboo strips are used in the form of radial and square mesh like reinforcement at d/2 and d/3 depth. The main test conducting is UCC (Unconfined Compressive Strength). The best mix of soil is determined.**

***Keywords*: Arecanut Fiber, Bamboo Strips, Cochin Marine Soil**

1. Introduction

Soils with low bearing capacity can be strengthened economically for building purposes through the process of soil stabilization using different type of soil stabilizers. The process of soil stabilization helps to achieve the required properties in a soil needed for the construction work. In India, the modern era of soil stabilization began in early 1970's, with a general shortage of petroleum and aggregates, it became necessary for the engineers to look at means to improve soil other than replacing the poor soil at the building site. In recent times, with the increase in the demand for infrastructure, raw materials and fuel, soil stabilization has started to take a new shape. Here, in this project, soil stabilization has been done with the help of randomly distributed treated bamboo strips and palm bunch ash obtained from waste materials. The improvement in the shear strength parameters has been stressed upon and comparative studies have been carried out using different methods of shear resistance measurement. Soil stabilization is the treatment of soils to enable their strength and durability to be improved such that they become totally suitable for construction beyond their original classification. The soil found in the ocean bed is classified as marine soil. It can even be located onshore as well. A large portion of Indian nation, especially Kerala is covered with marine soil. Marine soil is also found in the states of West Bengal, Orissa, Andhra Pradesh, Tamil Nadu etc. The present study is carried out considering the bamboo strips of certain length made in the form of mesh. The main focus of the study is the overall strength of stabilized material used in the pavement. The main aim using bamboo strips are to increase the shear strength of clayey soil and seepage can be reduced, so it can be used for construction purposes. Treated bamboo can reduce the water absorption of the clayey particles. The main advantages of these materials are they are locally available and are very cheap. They are biodegradable and hence do not create disposal problem in environment.

2. Objective

- To study the reinforcing effects of randomly distributed arecanut fibers on the engineering properties of Marine soil.
- To analyze the strength characteristics of marine soil with different patterns of arrangement of treated bamboo strips.

3. Methodology

A. Source of materials

1) Soil sample

The marine soil was collected from Thykoodam, Ernakulam district, Kerala from a bore hole depth of 50m.

Fig. 1. Cochin marine soil

2) Arecanut fiber

The coir fibers used for the study was collected from Piravom, Ernakulam district. It was air dried to remove moisture. The coir fiber used was of diameter 0.35mm and length 30mm.

Table 1
Physical Properties of Arecanut Fiber

Diameter	Length	Young's Modulus	Tensile strength
0.35mm	35mm	28 N/m^2	2.3 N/m^2

3) Bamboo strips

The bamboo strips used in this study was locally available. It was air dried to remove moisture. The bamboo were cut to obtain a uniform strips of 8 cm length and 2 mm thickness. For chemical treatment the bamboo strips used were dipped in NaOH solution for 24 hours. After 24 hours, the strips were removed from the beaker and allowed to dry at the room temperature for a week. Treating bamboo strips helps in removing impurities and to decrease the tendency of fiber to absorb water. Bamboo strips are used in the form of radial and square mesh like reinforcement at d/2 and d/3 depth.

Fig. 2. Square mesh reinforcement

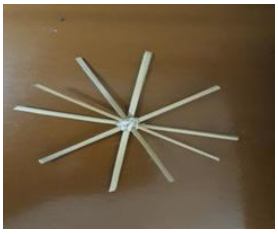

Fig 3. Radial mesh reinforcement

B. Conduction of tests to determine the basic properties of black cotton soil

1) Specific gravity of soil

Specific gravity is the ratio between the mass of any substance of definite volume divided by mass of equal volume of water. The specific gravity of the soil has been determined using pycnometer, as per IS: 2720 (part III 1980).

2) Liquid limit

Liquid limit is the water content in which the soil behaves practically like a liquid but has small shear strength. The test has been carried out using the standard Casagrande apparatus as per IS 2720 (part V – 1965).

3) Plastic limit

Plastic limit is defined as minimum water content at which soil remains in plastic state. The plastic limit has been determined according to the IS: 2720 – (part V -1970).

4) Hydrometer analysis

Hydrometer analysis is a widely used method of obtaining an estimate of the distribution of soil particle sizes from the 0.075 mm sieve to around 0.01 mm. It is conducted according to IS 2720 (Part 4:1980).

5) Standard Proctor Test

The Proctor compaction test is a laboratory method of experimentally determining the optimal moisture content at which a given soil type will become most dense and achieve its maximum dry density. Compaction behavior has been found out as per IS: 2720 – (part VIII -1980).

6) Unconfined Compression Test

The UCC test were conducted by using unconfined compression testing machine. According to IS: 2720 (part 10 – 1973). UCC is conducted for both arecanut fiber and bamboo strips arrangement.

4. Result and discussions

Compaction: From the test series conducted with arecanut fiber for the percentages 0.25%, 0.5%, 0.75 % and 1% it is observed that the maximum dry density increases from 1.32 kN/m^3 to 1.52 kN/m^3 at 0.75% of arecanut fiber beyond which it decreases as shown in Fig. 4.

Table 2
Basic property of cochin marine soil

S. No.	Properties	Value
1	Specific gravity	2.64
2	Liquid limit	39%
3	Plastic limit	26%
4	Plasticity index	13%
5	Optimum moisture content	30%
6	Maximum dry density	1.32 kN/m^3
7	Unconfined compressive strength	341.2 kN/m^2

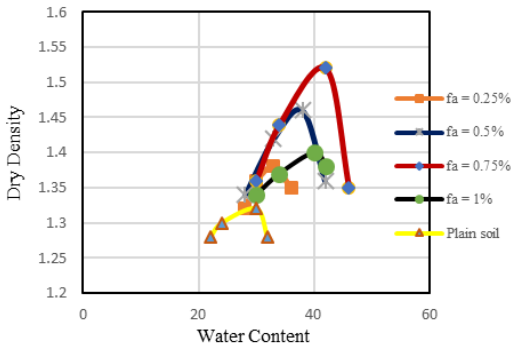

Fig. 4. Compaction behavior of marine soil with arecanut fiber

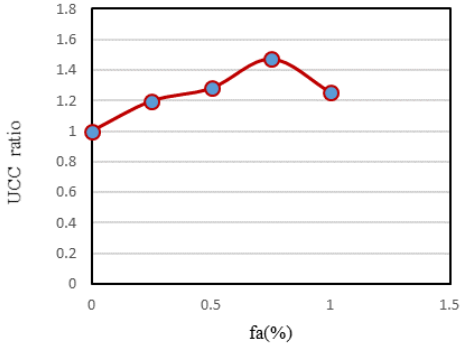

Fig. 5. Unconfined compressive strength of Cochin marine soil with arecanut fiber

Unconfined Compression Test (UCC): The results of UCC tests on marine soil treated with different percentages of arecanut fiber are shown in Fig. 5. From the results it can be seen that with the increase in percentage of fiber content, the UCC value increases to 1.47% for 0.75% of arecanut fiber. As the depth of bamboo reinforcement increases the UCC ratio also increases, the maximum value was observed for square reinforcement at d/3 depth as 1.99.

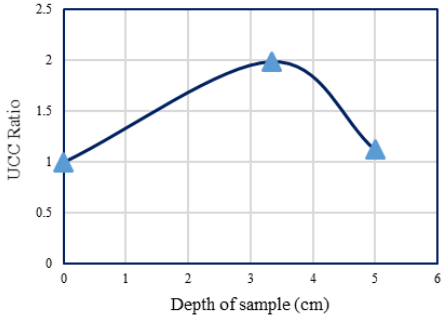

Fig. 6. Unconfined compressive strength of Cochin marine soil with Square mesh reinforcement

5. Conclusion

- Arecanut fiber inclusions have got marginal effects on the compaction characteristics of Cochin Marine Soil.
- Optimum values of UCC ratio for arecanut fiber reinforcement was obtained for a fiber content of 0.75% for all the Test series.
- As the fiber ratio increases, the UCC strength of Cochin Marine Soil was found to be increasing.
- Optimum values of UCC ratio for bamboo strip reinforcement was obtained for square mesh reinforcement at d/3 depth of sample.
- The use of bamboo strips and arecanut fibers as stabilisers can reduce their impact on environment and also the cost of construction especially in foundations, low volume pavements etc.

References

[1] V. Ramya (2018), "Stabilization of Black Cotton Soil Using Bamboo Slag and Silica Fume" International Journal of Innovative Research in Science, Engineering and Technology Volume 7, Special Issue 5.

[2] Yi-Xian Wang, Pan-Pan Guo (2017), "Laboratory Investigation on Strength Characteristics of Expansive Soil Treated with Jute Fiber Reinforcement," American's Society of Civil Engineers.

[3] Sharan Veer Singh, "Stabilisation of Soil by Using Waste Plastic Material" International Research Journal of Engineering and Technology (IRJET), 2017.

[4] Dipika Devi, Boken Jempens, 'Shear Strength Behavior of Bamboo Fiber Reinforced Soil," International Research Journal of Engineering and Technology (IRJET) 23(3), 2016.

[5] Mega Mohan and Usha Thomas, "A Study on the Improvement in Strength Behavior of Lateritic Soils Reinforced with Arecanut Fiber and Tender Coconut Shell Charcoal Using Experimental and Probabilistic Methods" Indian Geotechnical conference, 2016.

[6] Arjun Singh, Elezabeth Joy, Linda Mary John, Tessmol Mathew, "Stabilization of Cochin Marine Soil Using Locally Available Materials," International Journal of Innovative Science, Engineering & Technology, Vol. 4, Issue 5, 2016.

[7] Chinnu A.S, "Experimental Study on Strength Behavior of Kuttanad Soil using Treated Coir Fiber" International Journal of Engineering Research & Technology, Vol. 5, no. 9, 2016.