International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 3 Issue 5, August 2019 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

An Experimental Study on Stabilization of Loose Soil by Using Jute Fiber

K. Ravi Kanth[1], K. Deepthi[2]

[2]Assistant Professor

[1,2]Sri Sun Flower Engineering College, Challapali, Lankapalli, Andhra Pradesh, India

How to cite this paper: K. Ravi Kanth | K. Deepthi "An Experimental Study on Stabilization of Loose Soil by Using Jute Fiber" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-3 | Issue-5, August 2019, pp.659-662, **https://doi.org/10.31142/ijtsrd26441**

IJTSRD26441

ABSTRACT

Stabilization is one of the methods of modifying the properties of a soil to improve its index parameters as well as strength parameters and it can be used for a variety of engineering works. Expansive soil is the major problem for civil engineers, either for construction of road and foundation works by using the stability of soil and reduces the construction cost. soil is stabilized by in objectives of this research were to investigate the effect of Jute fiber on the engineering property (optimum moisture content and maximum dry density, plastic limit, liquid limit, compaction, unconfined compressive strength, triaxial and California bearing ratio test) of the soil. Jute fiber is most suitable for increasing the strength of the soil and it is eco-friendly material.

In the present study, the soil samples prepared with the addition of Jute fibers by 0.25%, 0.5%, 0.75%, and 1% the average length of Jute fiber is going to use in this study is approximately 10-15mm. At first, Optimum Moisture Content (OMC) was determined through the proctor test. At those OMC, several tests like CBR, UCS were conducted. CBR test was carried in both Unsoaked and soaked condition and maximum values were obtained where 0.75% Jute fiber was added.

INTRODUCTION

Soil is the biologically active, porous medium that has developed in the uppermost layer of Earth's crust. Soil is one of the principal substrata of life on Earth, serving as a reservoir of water and nutrients, as a medium for the filtration and breakdown of injurious wastes, and as a participant in the cycling of carbon and other elements through the global ecosystem. It has evolved through weathering processes driven by biological, climatic, geologic, and topographic influences. Since the rise of agriculture and forestry in the 8th millennium BCE, there has also arisen by necessity a practical awareness of soils and their management. In the 18th and 19th centuries the Industrial Revolution brought increasing pressure on the soil to produce raw materials demanded by commerce, while the development of quantitative science offered new opportunities for improved soil management. The study of soil as a separate scientific discipline began about the same time with systematic investigations of substances that enhance plant growth. This initial inquiry has expanded to an understanding of soils as complex, dynamic, biogeochemical systems that are vital to the life cycles of terrestrial vegetation and soil-inhabiting organisms—and by extension to the human race as well. This article covers the structure, composition, and classification of soils and how these factors affect the soil's role in the global ecosystem. In addition, the two most important phenomena that degrade soils, erosion and pollution, are discussed.

Soil Stabilization using Lime

Slaked lime is very effective in treating heavy plastic clayey soils. Lime may be used alone or in combination with cement, bitumen or fly ash. Sandy soils can also be stabilized with these combinations. Lime has been mainly used for stabilizing the road bases and the subgrade. Lime changes the nature of the adsorbed layer and provides pozzolanic action. Plasticity index of highly plastic soils is reduced by the addition of lime with soil. There is an increase in the optimum water content and a decrease in the maximum compacted density and the strength and durability of soil increases. Normally 2 to 8% of lime may be required for coarse grained soils and 5 to 8% of lime may be required for plastic soils. The amount of fly ash as admixture may vary from 8 to 20% of the weight of the soil.

RED SOIL:

Red soil is a type of **soil** that develops in a warm, temperate, moist climate under deciduous or mixed forest, having thin organic and organic-mineral layers overlying a yellowish-brown leached layer resting on an alluvium red layer. Red soil are generally derived from crystalline rock.

Fig1.0 Red soil

Sieve analysis:
A sieve analysis or gradation test, is a practice or procedure are commonly used to assess the particle size distribution or also called gradation. The size distribution is often of critical importance to the way the material performs in use. A sieve analysis also can be performed on any type of non-organic or organic granular materials including sands, crushed rocks, clays, etc. Take 1000gm of the soil sample after taking a representative sample. Conduct sieve analysis using a set of standard sieves as given in the datasheet. The sieving may be done either by hand or by mechanical sieve shaker for 10 minutes. Weigh the material retained on each sieve. The percentage retained on each sieve is calculated on the basis of the total weight of the soil sample taken. From these results the percentage passing through each of the sieves is calculated. Draw the grain size curve for the soil in the semi-logarithmic graph provided.

Plastic limit:
About 15g of air dried soil passing through IS sieve 425 microns is taken for plastic limit determination and is mixed with a sufficient quantity of water which would enable the soil mass to become plastic enough to be easily shaped into a ball. A portion of the ball is taken and rolled on a glass plate with the palm of the hand into a thread of uniform diameter throughout its length. When a diameter of 3mm has reached the soil is remolded into a ball. The process of making the thread and remolding is continued till the thread at a diameter of 3mm, just starts crumbling. Collect the pieces of the crumbled soil threads in a moisture content container. Repeat the procedure at least twice more with fresh samples of plastic soil each time.

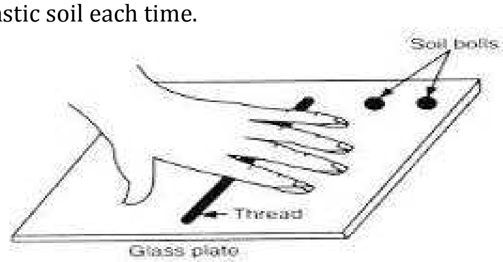
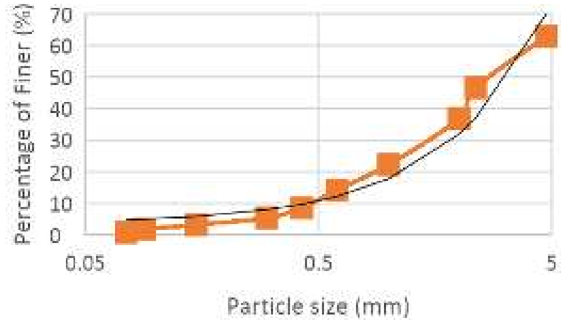


Fig1.0: Making of threads to determine the Plastic Limit

Table1.0: Observation table for Specific Gravity:

S. No	Observation	Weight (g)
1	Weight of the empty Container (W1)	630
2	Weight of Container + Dry Soil (W2)	1250
3	Weight of Container + Dry Soil + Water (W3)	1830
4	Weight of the Container + Water (W4)	1447

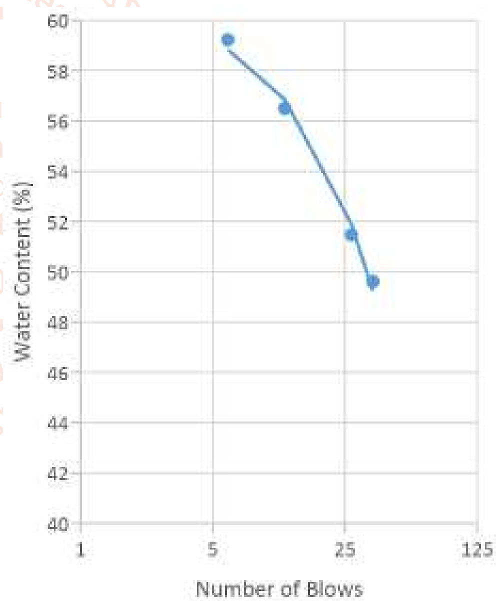
Specific gravity of Soil = 2.75



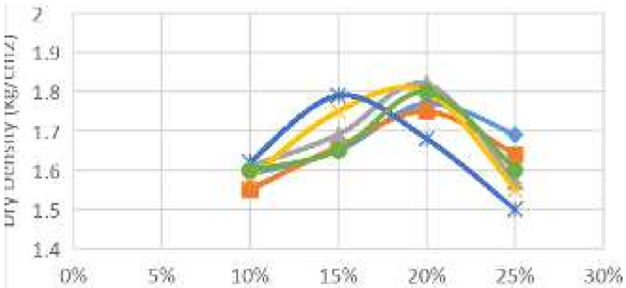
Graph1.0: Sieve Analysis Graph

S. No	Observations & Calculations	Test 1	Test 2	Test 3	Test 4
1	Number of Blows	33	28	24	20
2	Mass of Empty Container (M_1)g	17	17	17	17
3	Mass of Container + Wet Soil (M_2)g	59	58	60	51
4	Mass of Container + Dry Soil (M_3)g	49	48	49	45
5	Water Content $W = (M_w/M_d)$ x100 %	31.25	32.2	34.30	21.4

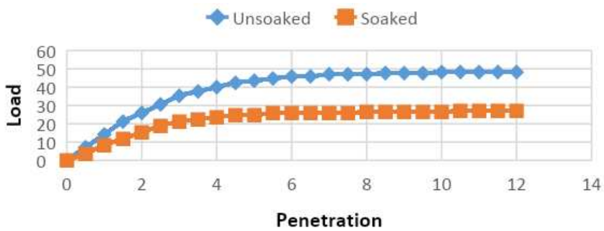
Table 2.0: Liquid Limit Calculations:



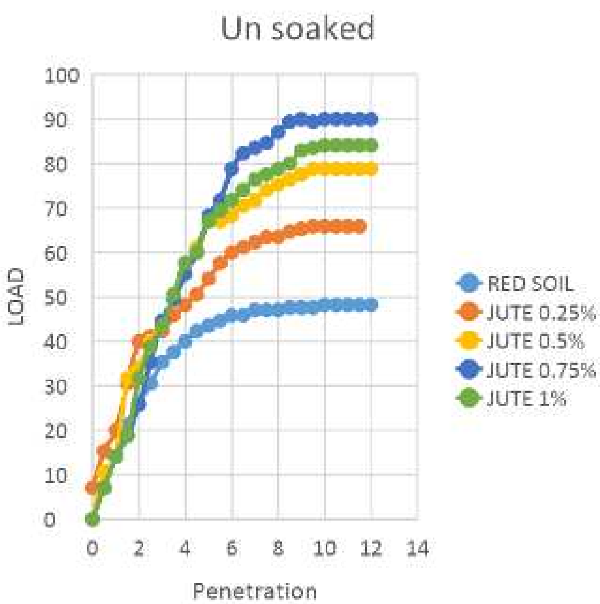
RED SOIL + 10%GGBS + 1.0%JUTE				
Observations & calculations	% of water			
	10%	15%	20%	25%
empty wt of mould, a(g)	4980	4980	4980	4980
wt of mould + compacted soil, b (g)	9029	9344	9546	9254
wt of compacted soil, b-a(g)	4049	4364	4566	4274
wt of cup	36	36	36	36
wt of cup + wet soil	55	52	47	46
wt of cup + dry soil	52	50	45	44
wt of soil	16	14	9	8
mass of water	3	2	2	2
water content , W	14	18	13.3	22
Bulk density	1.8	1.94	2.03	1.9
dry density	1.6	1.65	1.8	1.6



Graph.2: Compaction curves for soils with different percentages of jute fiber



Graph 2: Load Vs Penetration graph for RED Soil (Unsoaked & Soaked



Graph 3: Load Vs Penetration graphs of Unsoaked CBR at different percentages of JUTE

Conclusions

In this study, the major properties studied are OMC, MDD, CBR, UCS, and Consolidation. Based on all investigations on all samples and when compared with normal soil, the following conclusions were made

Compaction Test and CBR Test:

- In Standard Procter Test, the increase in JUTE percentage the dry density increases up to 0.75% and after the MDD value has been decreasing trend. Though, a decrease in OMC has been observed with an increase in JUTE %
- Maximum dry density was increased with the addition JUTE
- When 0.25%.0.5%,0.75% & 1% added, higher MDD observed for 0.75% of JUTE
- Both the Unsoaked and soaked condition of CBR were studied and Peak value was obtained at 0.75% SCBA in both conditions.

Unconfined compressive strength:

- In UCS, Due to an increase in JUTE percentage the UCS value having increasing trend with respect to the parent soil.
- In UCS, Due to an increase in JUTE percentage, the UCS value has been observed increasing trend up to 0.75% after that having a decreasing trend.
- The Curing period of the mix is a governing parameter as the chemical reaction of stabilizers is depends on it.so it can be concluded that the strength will increase with the increase in the curing period.
- UCS of treated soils was higher than that of untreated soils.
- UCS value of the sample is increased from 0.97 to 8.8 kg/cm^2

REFERENCES:

[1] "Study on the Effects of Marine Clay Stabilized with Banana Fibre" by Teresa Sunny, Annie Joy, International Journal of Scientific Engineering and Research - IJSER, ISSN: 2347-3878, Volume 4 Issue 3, March 2016, pg: 96-98.

[2] "Effect of Jute Fibre on Engineering Characteristics of Black Cotton Soil" by Harshita Bairagi, R.K. Yadav, R. Jain, International Journal of Engineering Sciences & Research Technology – IJESRT, ISSN: 2277 – 9655, Volume 2, February 2014, pg:705–707.

[3] "Experimental Study on Stabilization of Black Cotton Soil by Fly Ash, Coconut Coir Fiber & Crushed Glass" by Amit Tiwan, H.K. Mahiyar, International Journal of Emerging Technology and Advanced Engineering – IJETAE, ISSN 2250-2459, Volume 4, Issue 11, November 2014, pg.330-333.

[4] "Effect on Strength Characteristics of Expansive Soil Using Sisal Fibre and Waste Materials" by Amrutha Mathew, Dr. Raneesh. K. Y, International Journal of Science and Research – IJSR, ISSN: 2319-7064, Volume 5, Issue 9, September 2016, pg.1702-1707.

[5] "Effect of Sisal Fiber and GGBS on Strength Properties of Black Cotton Soil" by Abhijith S, Aruna T, International Journal of Innovative Research in Science, Engineering and Technology – IJIRSET, ISSN (o): 2319-8753, Volume 4, Issue 7, July 2015, pg.5409-5417.

[6] "Effect of Random Inclusion of Jute Fibers on Strength Characteristics of Lime Treated Expansive Clay" by Sabreena Mohammad, Deeba Qadir, Sarmistha R. Paul, International Journal of Innovative Research in Science and Engineering – IJIRSE, ISSN(o) 2454 – 9665, Volume 3, Issue 04, April 2017, pg.865 – 870

[7] "Effect of Jute Fibers on Engineering Properties of Lime Treated Black Cotton Soil" by Harshita Bairagi, R.K. Yadav, R. Jain, International Journal of Engineering Research & Technology –IJERT, ISSN: 2278 – 0181, Volume 3, Issue 2, February 2014, pg.1550 – 1552.

[8] "effect of Random Inclusion of Sisal Fiber on Strength Behavior of Black Cotton Soil" by Manjunath K. R, Venugopal G, Rudresh A. N, International Journal of Engineering Research & Technology – IJERT, ISSN: 2278 – 0181, Volume 2, Issue 7, July 2013, pg.2227 – 2232.

[9] "Compressibility Behavior of Black Cotton Soil Admixed with Lime and Rice Husk Ash" by Dr. A. V. Narasimha Rao, B. Penchalaiah, Dr. M. Chittranajan, Dr. P. Ramesh, International Journal of Innovative Research in Science, Engineering and Technology – IJIRSET, ISSN: 2319 – 8753, Volume 3, Issue 4, April 2014, pg. 11473 – 11480

[10] "Consolidation Characteristics of Fly Ash and Lime Treated Black Cotton Soil" by Vijayakumar Sureban, Proc. Of International Conference on Recent Trends in Transportation, Environmental and Civil Engineering - TECE, 201, pg. 49 – 52.

[11] "Experimental study on stabilization of clay soil using coir fiber" by T. Subramani, D. Udayakumar, International Journal of Application or Innovation in Engineering and management – IJAIEM, ISSN: 2319-4847, Volume 5, Issue 5, May 2016, pg.192-203.

[12] "Stabilization of Black Cotton Soil using Lime" by Shailendra Singh, Hemant B. Vasaikar, International Journal of Science and Research – IJSR, ISSN: 2310-7064, Volume 4, Issue 5, May 2015, pg.2090-2094.

[13] "Quality Assessment for Stabilization of Black Cotton Soil by Using Lime" by Amruta A. Badge, Lobhesh N.Muley, Kunal R.Raul, International Journal of Innovation in Engineering and Technology – IJIET, ISSN: 2319-1058, Volume 5, Issue 2, April 2015, pg.49-53.