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IMPROVEMENT OF PROPERTIES OF SOIL USING JUTE AND GYPSUM

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Abstract- *Soil is a term which has different meanings as for agricultural purposes it is the uppermost layer of earth on which different types of plants grow and we cultivate the crops. The lower portion of earth crust which support different type of foundations and carries loads are called as hard strata or rock. For engineering purposes soil may be defined as the mixture of minerals, aggregates, organic matter etc. It may be loose or cohesive. As naturally available soil has different content of water. Our purpose is to study the clayey soil with stabilizer. Clayey soil has very worst engineering properties like its bearing capacity is poor and higher compressibility. So the improvement of engineering properties of clayey soil at the site of work is indispensible. There are many stabilizers like jute, gypsum, rice-husk ash, cement lime, HHF, shredded rubber tyres etc. are used to strengthen the properties of soil. In this study, we added jute and gypsum as stabilizing material to increase the engineering properties of clayey soil. The purpose of this study is to improve the strength of the clayey soil by making soil-jute and soil-jute-gvpsum mixture. Several specimens are prepared to examine the properties of soil. Some specimens are prepared by adding varying length of l cm, 1.5 cm and 2cm jute and the parent soil. Some specimens are prepared by adding 1.5% of jute and 0.5% of gypsum with parent soil, with varying length of 1 cm, 1.5 cm and 2cm of jute as used earlier. The Standard proctor test is performed to determine Optimum Moisture Content (OMC) and Maximum dry density (MDD) of the soil. The Unconfined compressive strength test is conducted to investigate compressive strength of soil mixture.*

Key Words: Clayey Soil, Jute, Gypsum, Soil Stabilization, Waste Products, Environment Friendly..

1.INTRODUCTION

Study of stabilization or stabilization of soil is one of the best or easily available methods to improve the properties of soil. There are many stabilizers like fly ash, HHF, rice-husk ash, cement lime, shredded rubber, jute, gypsum tyres etc. are used to strengthen the properties of soil. Mainly used stabilizers are cement and lime these two are costly ones that means by using these construction costs get high. So, in the present study, we added jute and gypsum as stabilizer to increase the engineering properties of clayey soil. The purpose of this study is to increase the strength of the clayey soil by making soil-jute and soil-jute-gypsum mixture.

For this study we are going to performed tests on the soil sample and determine its properties, and nature of soil. Also the properties and characteristics of stabilizing material is firstly determined. So that we can easily use the quantity and quality of stabilizer. After this tests are to be performed to obtain the optimum moisture content (OMC) and maximum dry density (MDD) of soil and the unconfined compressive strength of soil samples by adding constant content of 1.5% of jute, varying length of jute as 1cm, 1.5cm and 2cm and content of gypsum as 0.5%. The tests are performed for obtaining optimum moisture content (OMC) and maximum dry density (MDD) of soil and the unconfined compressive strength of soil samples are

- Standard Proctor test
- Unconfined Compression Test

On several no of samples the tests are performed one by one by making mix of jute + parent soil and jute + gypsum + parent soil keeping jute content as 1.5% and gypsum as 0.5% and varying length of jute as 1 cm, 1.5cm and 2cm

1.1 Objective of the study

The focused of study is on

- In present study we are going to use environment friendly waste products to improve the properties of soil.
- Evaluation of strength characteristics of blended soil using different percentage of gypsum and jute by varying length of jute.
- Determination of appropriate Jute and Gypsum content at which we get maximum strength of soil.

2. EXPERIMENTAL INVESTIGATIONS

2.1. Material used

2.1.1. Soil

we used clayey soil in nature for our study. Various tests are performed in laboratory to determines its index and engineering properties of soil by IS methods

2.1.2. Jute

Jute is one of the most affordable natural fibers and its production is second to cotton and it has multiplicity of uses of vegetable fibers. It falls into the category of bast fiber (fiber collected from the phloem of the plant i.e: bast, sometimes called the skin)

2.1.3. Gypsum

Gypsum is a rock like mineral commonly found in earth crust. Its chemical formula is $CaSO_4 2HO$ i.e; Calcium sulphate dehydrate.

Table 1: Properties of parent soil

Parameters	Results
Maximum Dry Density(MDD)	1.65 gm/cc
Optimum Moisture Content(OMC)	20%
Liquid Limit	46.50%
Plastic Limit	25.40%
Plasticity Index	21.10%
Specific gravity	2.62
USCS classification	CI

Table 2: Properties of jute

Parameters	Results
Maximum Dry Density(MDD)	1.65 gm/cc
Optimum Moisture Content(OMC)	20%
Liquid Limit	46.50%
Plastic Limit	25.40%
Plasticity Index	21.10%
Specific gravity	2.62
USCS classification	CI

Table 3: Properties of gypsum

Category	Sulfate minerals
Color	Colourless to white,may be yellow, tan, blue, pink, redish brown or gray due to impurities.
Luster	Vitreous to silky, pearl or waxy
Streak	White
Cleavage	Ideal [perfect on (010), distinct on(100)]
Diaphaneity	Transparent to translucent
Mohs hardness	2
Specific gravity	2.31-2.33
Crystal system	Monoclinic
Chemical composition	Hydrous calcium sulphate
Uses	To manufacture plaster and dry wall, fertilizer and soil conditioner

2.2. Preparation of samples

Soil is collected and percentage of sample is taken. after sampling is done the tests to be conducted on them. Different samples are prepared with varying length of jute 1cm, 1.5cm, 2cm keeping content of jute 1.5% and gypsum 0.5% with parent soil. Thesis has been made to find optimum value of moisture content for the mixed samples by conducting a no of tests.

2.3. Laboratory tests

2.3.1. Compaction Test

In compaction test we determine the compactness of the soil by making mixture of soil and different lengths of jute keeping content of jute 1.5% and gypsum 0.5% in order to obtain the optimum moisture contents and maximum dry densities of various specimens or samples

2.3.2. Unconfined Compression Test

It is performed to obtain the unconfined compressive strength of soil. samples are prepared same as in compaction test.

3. RESULTS AND DISCUSSIONS

3.1 Compaction Test

From the proctor test, it has been experimental that the optimum moisture content (OMC) decreases by the adding up of jute in parent soil and maximum dry density (MDD) increases. Initially OMC & MDD of the parent soil were 20. & 1.65 gm/cc respectively as the proctor test conducted on parent soil. But after the accumulation of jute with gradual increase in the length of jute, it is observed that the maximum water content increases and maximum dry density decreases noticeably. In addition varying the length of the jute in the parent soil with the constant amount (1.5%) of jute. it has been observed that the OMC

of the mixture shows a declining tendency with increase in the jute length i.e; for lcm length of jute optimum moisture content is 27.06, 25.45 for 1.5cm jute length and 22.05 for 2cm jute length. Also the MDD for the above jute varies as 1.53gm/cc, 1.54gm/cc and 1.64gm/cc for 1cm, 1.5cm and 2cm respectively. The maximum dry density shows the increasing fashion with the increase of the jute length in the soil mix. From results it is clear that as optimum water content decreases and maximum dry density increases as per the opposite relationship between MDD and OMC.
Again by addition of 0.5% gypsum with the above jute mixture, it shows small increase in optimum moisture content of the respective jute mixture as

- For 1cm jute length mixture, the optimum moisture content is 27.06. for the jute mixture and 24.38. after the addition of 0.5% gypsum.
- For 1.5cm jute length mixture, the optimum moisture content is 25.45 for the jute mixture and 25.69 after the addition of 0.5% gypsum.
- For 2cm jute length mixture, the optimum moisture content is 22.05 and 25.58 after the addition of 0.5% gypsum.

3.2 Unconfined Compressive Strength Test

From the UCS test conducted for the same samples as described earlier in the proctor test, the strength of sample shows increasing tendency with the addition of varying length of jute keeping content as constant 1.5%, for parent soil strength obtained 1.75kg/cm^2 amount .i.e. But for the jute mixture the strength obtained 2.1kg/cm^2 2.3 kg/cm^2 and 2.9 kg/cm^2 for 1cm length 1.5cm and 2cm respectively. And again by addition of gypsum in the three jute mixture sample, The strength shows a extreme increase as 1cm jute mixture shows an increase of strength from 2.1 kg/cm^2- 3.4kg/cm^2 after the addition of 0.5%gynsum. 1.5cm jute length mixture shows an increase of strength from 2.3 kg/cm^2- 5.1 kg/cm^2 after the addition of 0.5%gypsum. 2cm jute length mixture shows an increase of strength from 2.9 kg/cm^2 to 5.2 kg/cm^2 after the addition of 0.5%gypsum.

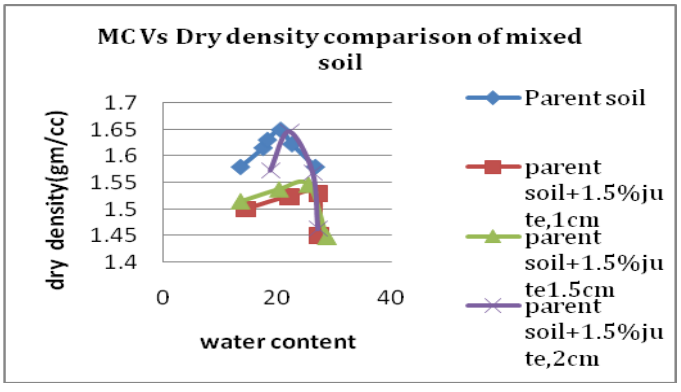

Fig. 1: graph showing MC Vs DD curves of mixed sample of jute

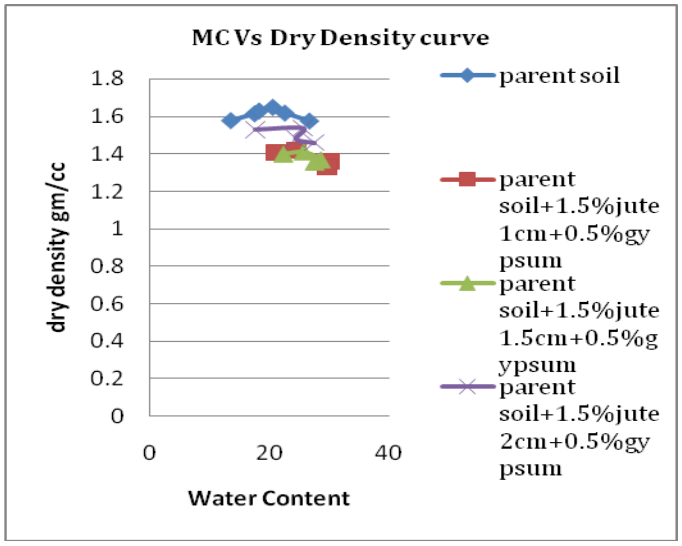

Fig.2: Showing MC Vs DD curves of jute-gypsum mixture with parent soil

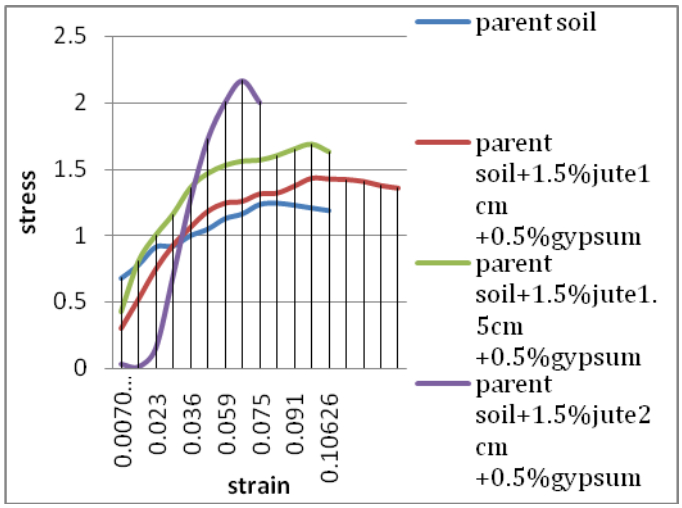

Fig.3: Showing Sress Vs Strain curves of mixed soils of jute

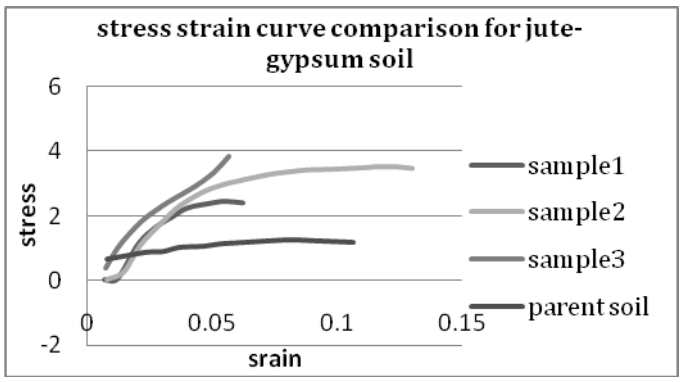

Fig.4:Showing Stress Vs Strain curves of jute-gypsum mixed soil

4. CONCLUSIONS

In this thesis we conduct several no of tests to improve the engineering properties of soil. After tests we observed as

l. When the length of jute (1cm, 1.5cm, 2cm) is increases with constant addition of jute (1.5%) and gypsum also 0.5% the maximum dry density of soil-jute mixture and soil-jute-gypsum mixture increases with the decrease in optimum moisture content in jute-soil mixture and in jute-gypsum-soil mixture it slightly increases

2. In the UCS test, when length of jute fibre increases 1cm, 1.5cm and 2cm in soil mixture then the compressive strength increases progressively. But After the addition of gypsum in soil mixture, its compressive strength increases suddenly

3. Both mixture samples i.e; Soil with jute and soil with jute & gypsum fails by formations of vertical cracks in UCS testing machine.

References

1. Akshaya kumar sabat, radhikesh p. nanda (2011), “effect of marble dust on strength and durability of rice husk ash stabilized expansive soil” international journal of civil and structural engineering volume 1, no 4, 2011 PP.939-948

2. Aravind Pedarla, Srinivas Chittoori (2010) “Influence of Lime Dosage on Stabilization Effectiveness of Montmorillonite
Dominant Clays”

3. Dr. Robert M. Brooks (2009),” Soil stabilization with flyash and rice husk ash”, International Journal of Research and Reviews in Applied Sciences, Volume 1, Issue 3(December 2009 PP. 211-217.

4. Anil Kumar Sharma and P.V. Sivapullaiah, ”Improvement of Strength of Expansive soil with waste Granulated Blast Furnace Slag”, Geo Congress 2012 Oakland, California, United States PP 3920-3928.

5. Aziz, M.A. And Ramaswamy, S.D. (1984), - Studies On Jute Fabric Upon Coir Grid Matting For Subgrade Strengthening, Revue Generale Das
Routes ET Das Aerodromes, No. 614, Paris, Pp. 56-58.

6. Aziz, M.A. And Ramaswamy, S.D. (1984), Studies, On Jute Fabric Upon Coir Grid Matting For Sub Grade Streng. Henin (In French), Journal
Revue Generale Routes ET Des Aerodromes, Paris, Issue No. 59e, Annee, Pp 775-779.

7. Froco And Associates (1966), Itsekson (2003) Jain, R. (2001), "Swelling Behavior Of Reinforced Black Cotton Soil", An M. Tech Thesis
Submitted To M.A.N.1. T. Bhopal.

8. Jain (2002) “Construction of Rural Roads on Sub-Grades Having Different CBR Values A Cost Comparison", An M.Tech Thesis Submitted To
M.A.N.I.T. Bhopal.

9. Mitchell and Freitag (1959) Mohjuddin, G. (1994), Jute Geotextiles, 2nd International Workshop On Geotextiles, Central Board Of Irrigation
And Power, 1994, Pp. 77-85.

10. Ramaswamy, S. D. And Aziz, M.A. (1989), Jute Geotextiles For Roads, Geotextiles Vol. 1, Tata Me. Graw Hill Publishing Co. Ltd., New
Delhi, Pp. 159-166.

11. Ramaswamy, S. D. And Aziz, M.A. (L989), Jute Geotextiles For Roads, - Proc. Iut. Workshop on Geotextiles, CBIP, Bangalore, Nov, Vol. 1,
Pp. 259-266.

12. Ramaswamy, S.D. (1994) Development of Natural Geotextiles and Application Trends, - Proc. Int. Symposium on Bio composites and Blends
Based On Jute and Allied Fibres, New Delhi, Pp. 29-33