Utilization of Banana Fiber For Manufacturing of Eco Friendly Brick

P. Kalai Selvi[1] , S.T. Namitha Sheen[2]
[1]Dept of Civil Engineering
[2]Assistant professor, Dept of Civil Engineering
[1, 2] Sri Ramakrishna Institute Of Technology ,Coimbatore, Tamil Nadu, India.

Abstract- *Black cotton soil is a typical volume change which loses its strength on wetting due to increase in its volume and in absence of water it shows more cracks due to increase in its volume. Present Paper describes the strength behavior of Black cotton soil treated with lime and banana fiber as stabilizers. It was found that the engineering properties of black cotton soil substantially improved by addition of lime. Experimental work has been carried out with various percentage of lime content and banana fiber. The experimental work is based on percentage of lime content and fiber in soil tests : Liquid limit, Plastic limit, Shrinkage limit tests. After testing the soil the bricks are manufactured using this soil sample.*

Keywords- Expansive soil, Lime, banana fiber.

I. INTRODUCTION

"Black cotton soil are commonly known as expansive soil because of their texture. It starts swell or shrink excessively when it comes in contact with moisture. When an engineering structure is associated with clay soil, it experiences either heave or settlement . Design and construction of civil engineering elements and structures with and on expansive soils is a challenging task. The solution of this problem is the stabilization of soil with appropriate stabilizing agent. The black cotton soil contains high percentage of montmorillonite which results in high degree of expansiveness. The strength of these soils change according to the amount of water present in the voids of the soils. The Liquid limit and plastic limit are two important parameters of plasticity index, which is the main index parameter of the classification of fine-grained soils. Plasticity index has also been used in correlation with many other engineering properties like internal friction angle, undrained shear strength, lateral earth pressure over consolidation ratio etc. Shrinkage limit, in which soils tend to shrink when they lose moisture. Most economical and effective method for stabilizing expansive soils is using admixtures that causes change in volume. Expansive soils contain the clay mineral montinorillonite with claystones, shales, sedimentary and residual soils. Clay exists in the moisture deficient, unsaturated condition

II. LITERATURE REVIEW

Marwan Mostafa , Nasim Uddi, "Compressed earth block with banana fibre resisting flexural and compressional force.'' ,earth block which is a combination of different proportion of clay, sand ,coarse aggregate ,cement with banana fibre after the study of characteristics of fibre. The sample is made of different proportion and tested for the result. The result from this paper helps us to set a boundary limit for the mix design for material and get a compressive and flexural value**.**

***Sachin N.Bhavsar , et al , "S*tabilization of black cotton soil with brick dust" ,** as stabilizing agent **,** broken brick such as waste bricks are powdered and then mixed it with black cotton soil so that it can stable the soil economically and thus improves the engineering properties of soil . here the percentage of brick dust added to soil is of 20 % , 30% by its weight . depending on its final profitable result the percentage of brick dust is added to soil for stabilization process .

Rathan Raj , et al , "Stabilization of soil with rice husk" , rice husk is burnt so that the ash contains silica which is good resistance to the fire such that it enhances the engineering properties of soil such as shear strength , compressive strength . the percentage of amount of rice husk added to soil is 5% where in addition to it lime and cement is added with the varying proportion so that a final proportion of 5% rice husk , 7% of lime and 5% of cement is added to it and a combination of these admixture gives a valid result .

Vinay Agrawal and Mohit Gupta , " Stabilization on black cotton soil using marble dust", as a stabilizing agent. . The evaluation involves the determination of the swelling potential of expansive soil in its natural state as well as when mixed with varying proportion of marble dust (from 0 to 30%). Addition of marble dust decreases liquid limit, plasticity index and shrinkage index, increase plastic limit and shrinkage limit. Also experimental results shows that the swelling percentage

decreases and rate of swell increases with increasing percentage of marble dust in expansive soil for curing period of 7 and 28 days. The rate of swelling and swelling percentage of the stabilized specimens was affected by curing in a positive direction such that effectiveness of the stabilizer increases**.**

III. NEED OF STABILIZATION OF SOIL

Soil stabilization is a technique for increasing or maintaining the stability of soil mass and to enhance their engineering properties.

Stabilization allows for the establishment of soil as well as the determination of admixture content to be used to achieve the desired engineering properties. Benefits of the stabilization process can include higher resistance values, reduction in plasticity, lower permeability. Stabilization of black cotton soils with admixtures controls the chemical potential of soils for a change in volume, and improves the strength of soils. Soil stabilization is done by various methods by adding lime ,fly ash, rise husk ash, chemicals, fibers or by adding different geo materials like geo synthetic, geo grid and geo form. Soil stabilization allows engineers to distribute a larger load and reduce settlement in foundation work and to make building materials more stable for long period of life .

IV. OBJECTIVE OF STABILIZATION

Lime are very effective in improving the index and engineering properties of soil. Hence the present study is focused towards understanding the same by performing laboratory studies

The objectives of the present investigation are:

To investigate the effect of lime and fiber to soil on

- Index properties
- Strength characteristics
- Mineralogical characteristics

As after the improvement of the soil property the soil is moulded to a shape of brick with a good compressive strength.

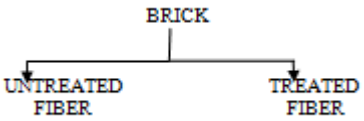
V. RESULT FOR BASIC TEST ON BLACK COTTON SOIL

The soil has different physical and engineering properties, such as specific gravity, grain size distribution, liquid limit, plastic limit, unconfined compressive strength, differential Free swell index. Those properties are determined by using the following tests.

SL.NO	PROPERTIES	RESULT
1	Specific Gravity	2.74
2	Sieve Analysis % Of Gravel % Sand % Of Clay and Silt UniformityCo-efficient(Cu) Co-efficientof Curvature(Cc)	 0.62% 43.38% 56% 6.15 0.7
3	Liquid Limit(WL)	33.6%
6	Differential Free Swell Index(DFSI)	30%

VI. COMPOSTION OF BRICKS

The bricks which are manufactured here it's of two composition . Two types of banana fiber are used in which one set of composition is mixer of 2% of lime and varying with various percentage of untreated fiber in it . In second composition mixer lime 2% and various percentage of treated fiber is added and casted .

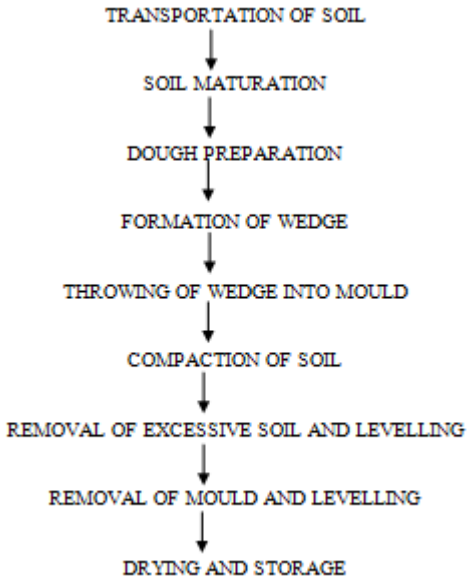


Lime is fixed as 2% in whole composition with varying percentage of treated and untreated fiber of 10%,15%,20%,25% and 30% . The treatment of fiber is done by soaking the fiber in 1% of NaOH solution for 5 hours , then fixed with the soil and moulded into the brick.

Sizing of banana fiber

VII. MANUFACTURING OF BLACK COTTON SOILBRICKS

STEP BY STEP PROCEDURE

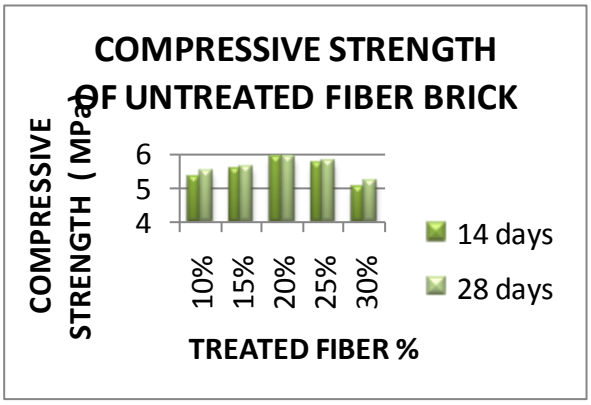


SIZE OF BRICK : **190 X 90 X 90 mm**

VIII. LABORATORY TEST RESULT OF BRICK

COMPRESSIVE TEST OF TREATED FIBER

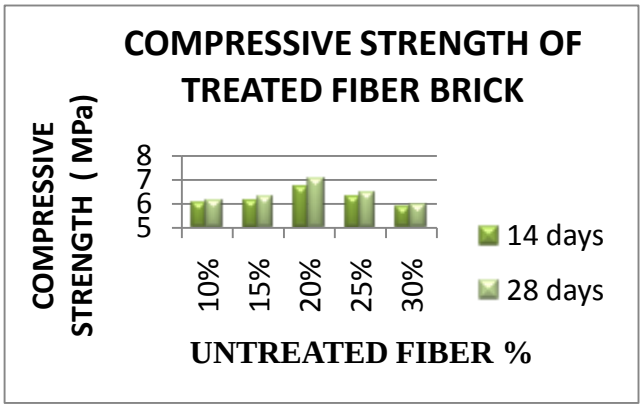
Compressive strength (kN/mm^2) = load applied (kN) / area (mm)



COMPRESSIVE TEST OF TREATED FIBER

Compressive strength (kN/mm^2) = load applied (kN) / area (mm)

S.NO.	FIBER % (UNTREATED)	COMPRESSIVE STRENGTH (MPa) 14 DAYS	COMPRESSIVE STRENGTH (MPa) 28 DAYS
1	10	5.33	5.46
2	15	5.56	5.60
3	20	5.89	5.91
4	25	5.70	5.77
5	30	5.03	5.20



S.NO.	FIBER % (TREATED)	COMPRESSIVE STRENGTH (MPa) 14 DAYS	COMPRESSIVE STRENGTH (MPa) 28 DAYS
1	10	6.03	6.12
2	15	6.14	6.25
3	20	6.69	6.99
4	25	6.31	6.45
5	30	5.83	5.91

IX. CONCLUSION

From the results it is concluded that the impact of lime and banana fiber on clay soil is positive. By adding lime and fiber to the soil it gives maximum improvement in the engineering properties of the soil. So use of lime and fiber is preferable for stabilization because it gives positive results as stabilizer and also it enhances its economical nature. The optimum value is observed as 20% of fiber replacement. At this percentage the brick gave the most profitable result for the strength.

REFERENCES

[1] "Problems related to black cotton soil" Gourley et al. 1993.
[2] "Effect of lime on the index properties of black cotton soil and mine tailings mixtures" H.N.Ramesh, A.J.Krishnaiah and S.Shilpa shet. IOSR Journal of Engineering (IOSRJEN) e-ISSN: 2250-3021, p-ISSN: 2278-8719 Vol. 3, Issue 4 (April. 2013), ||V3|| PP 0107.
[3] Holtz, W. G., and Gibbs, H. J.(1956). Engineering Properties of Expansive Clays. Transactions, ASCE, Paper No. 2814, Vol. 121.
[4] "Stabilization of expansive soil with rice husk ash, lime and gypsum – an experimental study". Koteswara Rao. D. and Anusha M. international journal of engineering science and technology (IJEST). ISSN: 0975-5462 Vol. 3 No. 11 November 2011 8076.
[5] Osinubi, K.J. (1995) "Lime modification of black cotton soil. Spectrum Journal, vol.2 No. 1&2, PP 112122."