

“Stabilization of black cotton soil using rice husk ash and lime”

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Abstract - In the construction field, stabilization of soil is important in order to improve its physical and engineering properties. We have chosen Nashik, Shinde village as our study area. The present investigation has been carried out for Black cotton soil by using rice husk which is a waste material which gives silica after burning it (RHA) and lime which is easily and cheaply available. This improves the compaction and strength of the soil subgrade. Lime and RHA were added 5%, 10%, 15% by weight of soil. Various tests were also carried out to find the soil properties so that to make Black cotton soil capable of taking more load from the structure to that of foundation.

Key Words: Black cotton soil, Soil stabilization, Rice husk ash

1. INTRODUCTION

In most part of INDIA, lands with Black cotton soil are used for farming, agriculture, sericulture etc. due to the unstable behavior of Black cotton soil. So it is very necessary to stable those soils to make use of it in other ways too. Due to moisture content variation, Black cotton soil undergoes problems such as swelling and shrinkage. Swelling – volume of soil increases due to increase in moisture content is called as swelling. Heaves produced on the soil are good examples of swelling of soil.

Shrinkage – volume of soil decreases due to decrease in moisture content is called as shrinkage. Ex-settlement seen in the foundation are due to the shrinkage property.

Methods such as mechanical stabilization and chemical stabilization are used to stable black cotton soil. As we are using lime and rice husk ash (RHA) which contains silica it comes under chemical stabilization. This silica replace other metallic ion such as sodium, magnesium etc. As clay surface is negatively charged, silicon make strong bond than other metallic ion present.

1.1 Statement of problem

We have chosen to use Rice husk ash and lime to stable the Black cotton soil at Nashik city, Shinde village to use that soil not only for agricultural purpose but also in construction point of view. In last year rainfall intensity was very more which lead to swelling of soil and during summer the soil gets shrink. So to reduce this instability problem we have chosen this study area.

1.2 Objectives of the study

The objective of study are:

To collect the data of soil.

To complete survey for given study area. To stabilize that area.

1.3 Literature Review

The literature review presented in this explains review of previous research work in stabilization of soil. In this review, construction of buildings, pavements and other structure on clayey soil is unavoidable and is a challenging issue for the geotechnical engineers and making suitable soil for construction from this unstable soil is must.

Ms. Aparna Roy (2014) presented a study which gave detail about soil which was stabilized by using rice husk ash on different % and using small amount of cement. The result obtained showed that there is increase in Optimum moisture content and decrease in maximum dry density when there is increase in Rice husk ash content. The CBR value and the unconfined compressive test improved with the rice husk ash content.

Gupta and Sharma (2014) studies the effect of fly ash, sand and marble dust on compaction and CBR values of expansive soil and there was approximately 200% increase in soaked CBR in the sample having soil - 52.36%, sand -22.44%, fly ash -13.2% and marble dust-12%

Shailendra Singh and Hemant B. Vasaiakar (2013) had stabilized black cotton soil using lime. Lime added to the soil was of 4% to 6%. It was found that the engineering properties of the black soil substantially improve by addition of lime.

Mohammad N.J. Alzaidy (2019) studied on effect of chemical additives on soil stabilization with lime, cement and fly ash. It was concluded that significant improvement in workability, strength, durability and mechanical behavior. On the other hand there is reduction in shrinkage, plasticity and swell characteristics. Using of chemicals and its suitability for soil is highlighted in this research.

2. MATERIAL AND METHODS

2.1 Materials

Following are the materials used for stabilization:

Black Cotton Soil

Rice Husk Ash (RHA) Lime

2.2 Methods

Series of tests were performed on 5% lime mixed with black cotton soil with rice husk ash in various percentages i.e. 5%, 10% and 15% by the weight of soil. Following tests were then conducted.

Water content test Specific gravity test

Liquid limit test by Casagrande's apparatus Plastic limit

Standard proctor test

California bearing ratio test (CBR)

3. DISCUSSION AND RESULT

3.1 Discussion

Physical properties of black cotton soil:

Specific gravity = 2.65 Liquid limit = 62.04% Plastic limit = 45.406% Water content = 15.72%

Chemical properties of rice husk ash:

Fe₂O₃ =0.21 SiO₂ =90.23 CaO =1.58 Al₂O₃ =2.54

MgO =0.53

Carbon =2.23 KaO =0.39

3.2 Result

The test results are summarized in table 1.

TABLE NO.1

SR. NO.	TESTS	RHA	5%RHA+ 5% LIME	10%RHA+ 5% LIME	15% RHA+5% LIME
1	Liquid limit	62.04%	34.23%	30.016%	37.40 8%
2	Plastic limit	88.81%	11.84%	43.19%	46.60 5%
3	Proctor test	21.88%	21.88%	26.047%	26.36 2%
4	CBR test	3.87%	4.99%	6.10%	6.92 %

4. CONCLUSIONS

From the results, it can be concluded that

With the increase in the rice husk percentage the liquid limit decreases

There is significant increase in the values of California bearing ratio. It increases from 3.87% to 6.92%.

The optimum moisture content obtained from Proctor test increases as the rice husk percentage increases.

Thus we can conclude that the bearing capacity of soil is increased and can bear more load on it and can be used for various construction purposes.

5. REFERENCES

- [1] Akshaya Kumar Sabat, "Engineering Properties of an Expansive soil Stabilized with Rice husk ash and Lime sludge" International Journal of Engineering and Technology (IJET), Vol 5, No.6 Dec 2013-Jan 2014.
- [2] Aparna Roy (2014), Soil Stabilization using rice husk ash and cement, "International Journal of Civil Engineering Research", ISSN 2778-3652, Vol 5 Number 1 pp 49-54.
- [3] Punmia B.C. 2007, "Soil Mechanics & Foundations" Laxmi Publications.
- [4] Koteswara, R. D. Anusha, M. and Pranav. P. R. T. (2012). Effect of Ferric Chloride and Rice Husk Ash in the Stabilization of Expansive Soil for the Pavement Subgrades, International Journal of Engineering Science and Advanced Technology, 2(2), 146 – 153.
- [5] D K Rao, P R T Pranav and M Anusha (2011), "Stabilization of Expansive Soil with Rice Husk Ash and lime" an experimental study," International journal of Engineering Science 5. Differential Free Index decreases from 54.3% to 7.1% and Tech-nology, Vol. 3, No. 11, pp.8076-8085.
- [6] R S Sharma, B R Phani Kumar, and B V Rao (2008), "Engineering behaviour of a Remolded Expansive Clay Blended with Lime and Rice Husk Ash", Journal of Materials in Civil Engineering , ASCE, Vol. 20, No. 8, pp.509-515.

- [7] S Chandra, S Kumar and R K Anand (2005), "Soil Stabilization with Rice Husk Ash and Lime Sludge". Indian Highways, Vol. 33, No. 5, pp. 87-98
- [8] Sabat, A.K. (2012) "Effect of Polypropylene Fiber on Engineering Properties of Rice Husk Ash - Lime Stabilized Expansive Soil," Electronic Journal of Geotechnical Engineering, 17(E), 651-660
- [9] Sabat, A.K. (2013) "Engineering Properties of an Expansive Soil Stabilized with Rice Husk Ash and Lime sludge," International Journal of Engineering and Technology, 5(6), 4826-4833.
- [10] IS 2720, "Methods of Test for Soil".