

TO STUDY THE EFFECT OF LIME AND RICE HUSK ASH ON COMPACTION PARAMETERS OF BLACK COTTON SOIL

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Abstract - Black cotton soils possess low strength and undergo excessive volume changes making their use in the construction very difficult because of its high swelling and shrinkage characteristics. For this the most effective and economical methods to improve clayey soil is addition of stabilizing agents such as lime and Rice Husk Ash (RHA).

In this study the experimental results obtained in the laboratory on black cotton soil treated with lime and RHA. A study is carried out to check the improvement in the properties of black cotton soil with lime and RHA in varying percentages. The objective of the present investigation is to study, the compaction properties of black cotton soil stabilized with lime and RHA. A compaction test has been conducted on 8% lime mixed black cotton soil blended with RHA in 5%, 10%, 15%, and 20% by weight of dry black cotton soil. The standard compaction test is done according to the procedures given in the relevant Indian Standard Codes.

When lime and RHA mixed soil is compacted, the maximum dry density decreases with increase in moisture content with increase in RHA content. The decrease in MDD explains that the RHA is a light weight material with low specific gravity and more voids. So it absorbs water more in the void space provided. Hence more water is added to compact RHA mixed soil. Therefore lime is added to decrease the water content and increase the MDD of the soil in good way.

Key Words: Black cotton soil, lime, Rice Husk Ash (RHA), Optimum Moisture Content (OMC), Maximum Dry Density (MDD)

INTRODUCTION

Black cotton soils of India are well known for their expansive nature. These expansive soils are called black cotton soils because of their predominant black color and the cotton crop that is grown abundantly on such soils. These soils cover about 0.8_106 km² area which is more than one-fifth of the country and extend over the states of Maharashtra, Gujarat, Southern part of Uttar Pradesh, eastern part of Rajasthan, southern and western part of Madhya Pradesh, and few parts of Andhra Pradesh and Chennai. Black cotton soil is a difficult soil for construction because of its periodic swell - shrink behavior and low strength. It is observed that on drying, the black cotton soil develops cracks of varying depth. In wetting and drying process, vertical movement takes place in the soil mass. All these movements lead to

failure of pavement, in the form of settlement, heavy depression, cracking and unevenness. The properties of the black cotton soils may be altered in many ways viz. mechanical, thermal, chemical and other means. Improvement of black cotton soils by chemical admixtures is a common stabilization method for such soils. Among various admixtures available lime, rice husk ash are most widely and commonly used for the stabilization of the black cotton soils. Rice husk ash is one of the major wastes found abundantly. The annual production of paddy is one of the major wastes found abundantly. In India, the annual production of paddy is about 100 million tones. The burning of rice husk generates about 20% of its weight as ash. There by generating more than 4 million tons of rice husk ash. Hence research work is done on utilization of rice husk ash in improvement of geotechnical properties of black cotton soil. Rice husk ash (RHA) is produced by burning of rice husk. Silica is the main element of rice husk ash. Lime is produced from paper manufacturing industry which is main constituent of lime. RHA as a pozzolanic material and lime sludge as a binder can be utilized to stabilize black cotton soil. In the present investigation, an attempt has been made to evaluate the changes in the compaction characteristics of black cotton soils such as optimum moisture content, maximum dry density, blended with constant percentage of lime as 8% and 5% to 20% at an interval of 5% of rice husk ash. Optimum Moisture Content of soil increases with increase in the percentage of lime and rice husk ash. Maximum Dry Density of clayey soil decreases with increase in the percentages of lime and rice husk ash content in clayey soil.

OBJECTIVES

In present experimental program the performance of Black Cotton Soil blended with lime and Rice Husk Ash is studied for the improvement in strength. The experimental program is planned to study the following objectives.

1. To study the compaction properties of Black Cotton Soil with varying percentage of rice husk ash from 5 to 20% at an interval of 5% and constant percentage of lime as 8 %.
2. To evaluate the feasibility of using Rice Husk Ash with lime as soil stabilization material.
3. To find out optimize proportion of lime and RHA to achieve maximum strength.

STANDARD PROCTOR TEST

Sample Standard Proctor Test is used to determine the compaction of different types of soil and the properties of soil with a change in moisture content. Compaction is the process of densification of soil by reducing air voids. IS: 2720 (Part VII) recommends the specifications. The mould recommended is of 100 mm diameter, 127.3 mm height and 1000 ml capacity. The rammer recommended is of 2.6 kg mass with a free drop of 310 mm and a face diameter of 50 mm. The soil is compacted in three layers. The mould is fixed to a detachable base plate. The collar is of 60 mm height.

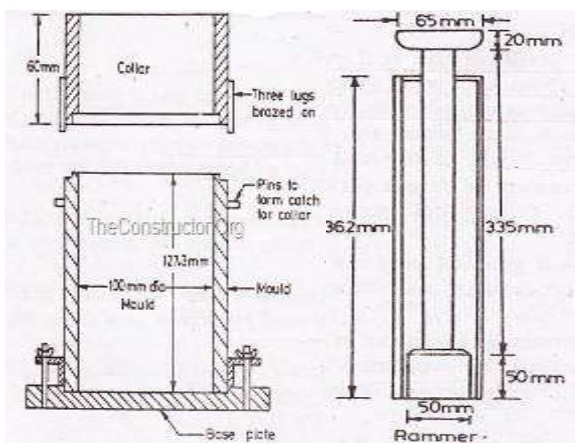


Fig -1: Standard Proctor Test Apparatus

MATERIAL

Black Cotton Soil

The black cotton soil used in this study was collected from Jaysinngpur.

Lime

Lime used in this study was purchased from Kolhapur.

Rice Husk Ash

Rice husk ash used in this study was collected from Shri Krishna Rice Mill, Gargoti, Tal-Bhudargad, Dist- Kolhapur.

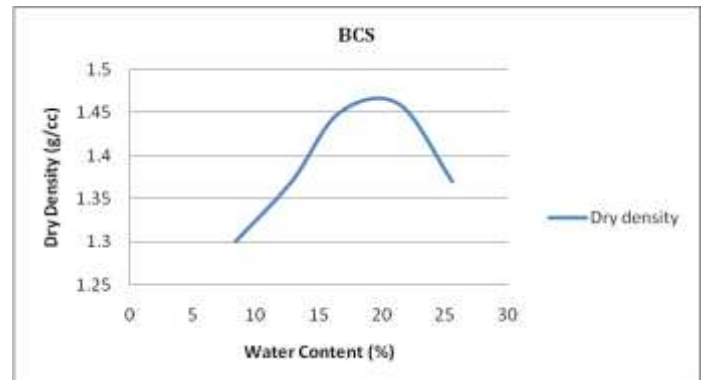
SAMPLE

- BCS -Black Cotton Soil
- SAM0 -Black Cotton Soil+8% lime
- SAM5 -SAM0+ 5% Rice husk ash
- SAM10 -SAM0+10% Rice husk ash
- SAM15 -SAM0+15% Rice husk ash
- SAM20 -SAM0+20% Rice husk ash

RESULTS AND DISCUSSION

1. BCS – Black Cotton Soil

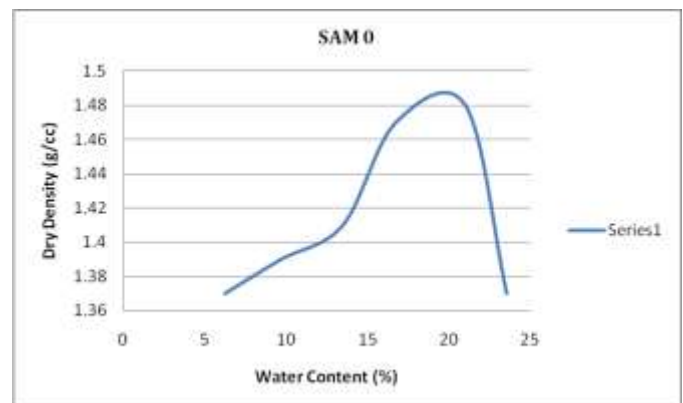
Water Content	8.4	12.85	16.61	21.28	25.51
Dry density	1.30	1.37	1.45	1.46	1.37



OMC =21.28% MDD=1.46 g/cc

2. SAM0- Black Cotton Soil+8% Lime

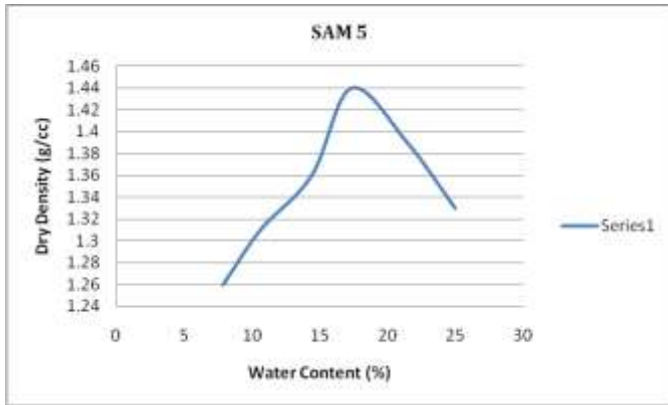
Water Content	6.2	9.66	13.46	16.72	20.98	23.53
Dry density	1.37	1.39	1.41	1.47	1.48	1.37



OMC=20.98%, MDD=1.48 g/cc

3. SAM5- SAM0+5% Rice Husk Ash

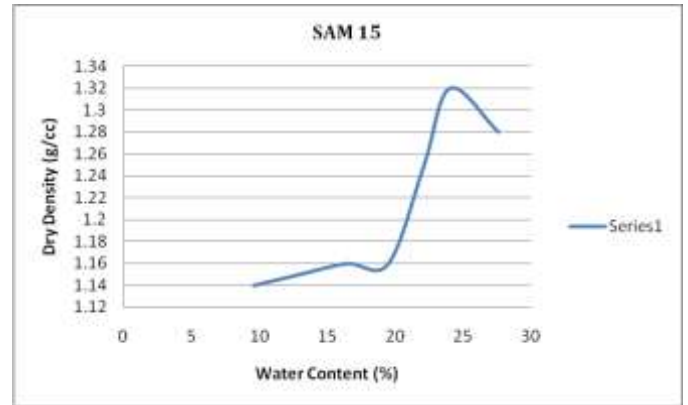
Water Content	7.8	10.5	14.3	17.3	21.4	24.9
Dry density	1.2	1.31	1.36	1.44	1.39	1.33



OMC=21.43%, MDD=1.39 g/cc

4. SAM10- SAM0+10% Rice Husk Ash

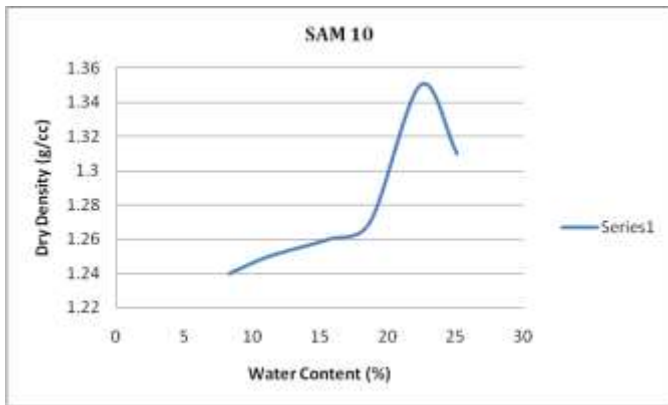
Water Content	8.34	11.23	15.63	18.71	22.43	25.13
Dry density	1.24	1.25	1.26	1.27	1.35	1.31



OMC=24.04%, MDD=1.32 g/cc

6. SAM 20- SAM0+20% Rice Husk Ash

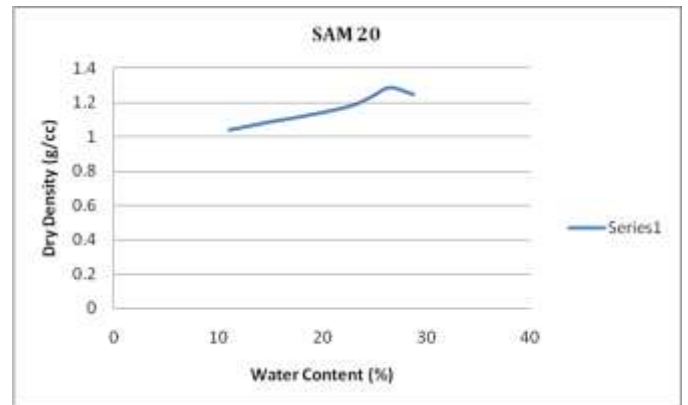
Water Content	11.08	15.22	18.12	22.68	24.88	26.53	28.78
Dry density	1.04	1.09	1.12	1.18	1.24	1.29	1.25



OMC=22.43%, MDD=1.35 g/cc

5. SAM15- SAM0+15% Rice Husk Ash

Water Content	9.57	12.93	16.44	19.55	22.13	24.04	27.61
Dry density	1.14	1.15	1.16	1.16	1.25	1.32	1.28



OMC=26.53%, MDD=1.29 g/cc

[1] The standard compaction test is done according to the procedures given in the relevant Indian Standard Codes. The test is done to determine the variation in optimum moisture content and maximum dry density in natural soil and RHA mixed soil with 8% of lime. The Dry density of soil sample increases with the increase in moisture content in natural soil to a certain limit and get decreased after reaching the maximum dry density value.

[2] When the RHA mixed soil is compacted, the maximum dry density decreases with increase in moisture content with increase in RHA content. The decrease in MDD explains that the RHA is a light weight material with low specific gravity and more voids. So it absorbs water more in the void space provided. Hence more water is added to compact RHA mixed soil.

Therefore lime is added to decrease the water content and increase the MDD of the soil in a good way.

3. CONCLUSIONS

The following conclusions can be derived from the present investigation:

- [1] The addition of RHA to the soil resulted in decrease in the value of MDD.
- [2] OMC of soil increases with increase in the percentages of lime and RHA.
- [3] MDD of clayey soil decreases with increase in the percentages of lime and RHA.
- [4] Lime is better stabilizing material than RHA.

REFERENCES

- [1] R. Satyanarayana P V V, Rama Rao R and Krishna Rao C V (2004), "**Utilization of Lime Fly Ash Stabilized Expensive Soil in Roads and Embankments**". *Proceedings of Indian Geotechnical Conference, Warangal (India)*.
- [2] Prof. N. R. Patil, Prof. Mrs. D. R. Kulkarni & Prof. S. D. Talegaonkar, "**Economical Pavement Design by Stabilizing Effect of Rice Husk Ash and Lime**" Paripex - Indian Journal Of Research. Volume : 2 | Issue : 3 March 2013
- [3] Gyanen. Takhelmayum, Savitha.A.L, Krishna Gudi, "**Laboratory Study on Soil Stabilization Using Rice husk ash Mixtures**" International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 2, Issue 1, January 2013
- [4] Udayashankar D.Hakari, S.C.Puranik, "**Stabilization of Black Cotton Soils Using Rice Husk Ash**" Global Journal of researches in engineering Civil And Structural engineering Volume 12 Issue 2 Version 1.0 February 2012.
- [5] Saeid. Amiralian, Amin. Chegenizadeh, and Hamid. Nikraz, "**A Review on The Lime and Rice Husk Ash Application in Soil Stabilization**" International Journal of Biological, Ecological and Environmental Sciences (IJBEES) Vol. 1, No. 3, 2012 ISSN 2277 – 4394
- [6] Rajesh Kumar Tripathi & Laxmikant Yadu, "**Comparison of Rice Husk Ash and Rice Husk Ash Stabilized Black Cotton Soil**", International Journal of Earth Sciences and Engineering ISSN 0974-5904, Volume 04, No 06 SPL, October 2011
- [7] P. P. Dahale, "**Disposal of Solid Waste for Black Cotton Soil Stabilization**", (Ijaest) International Journal Of Advanced Engineering Sciences And Technologies Vol No. 8, Issue No. 1, 113 – 120. 2011
- [8] Arvind Kumar, Baljit Singh Walia and Asheet Bajaj, "**Influence of Rice husk ash, Lime, and Polyester Fibers on Compaction and Strength Properties of Expansive**

Soil" Journal Of Materials In Civil Engineering © Asce / March 2007

- [9] Erdal Cokca, "**Use of class-C Rice Husk Ashes For The Stabilization of expansive soil**" JI.of Geotechnical and Geoenvironmental engg.,vol.127,pp.568-573, 2001