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Effect of Rice Husk Ash and Sugar Mill Waste as Admixture on Clay Soil

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***Abstract*— Soil stabilization using admixtures is the method which is helpful for the improvement of soil. In this paper Rice Husk Ash (RHA) and Sugar Mill Waste (SMW) are used as soil stabilizer on clay soil. Standard Proctor Compaction test and Unconfined Compression test are performed with and without replacements of 0%, 2%, 4%, 6% and 8% of Rice Husk Ash and Sugar Mill Waste. It has been find out that the Optimum Moisture Content has been increased with the increase in percentage of Rice Husk Ash as well as Sugar Mill Waste. The compressive strength of soil goes on increase up to 6% and then decreases at 8% in case of both Rice Husk Ash and Sugar Mill Waste. So, the optimum value we got is 6%.**

***Index Terms*— Optimum Moisture content, Maximum Dry Density, RHA, SMW.**

I. INTRODUCTION

By soil stabilization we can evaluate the various soil properties of a particular area. The improvement of soil at a site is indispensable due to rising cost of the land, and there is huge demand for high rise buildings. There is a need to concentrate on improving properties of soils using cost-effective practices like treating with industrial wastes those having cementations value.

II. ADMIXTURE STABILIZATION

The geotechnical properties of soil can be improved by adding various chemicals or other materials to the soil. This technique is more economical as the cost of transportation and processing of a stabilizing agent such as soil cement or lime to add these in soil material is probably more economical then importing aggregate.

A. Materials used as Admixture

B. Rice Husk Ash (RHA) :-

Rice Husk Ash (RHA) contains around 85%-90% of amorphous silica. With such large silica content; it becomes economical to extract silica from the ash. RHA is a good super-pozzolans. The effect of RHA on clay soil can be finding out by performing proctor test by which maximum dry density and optimum moisture content and the compressive strength of soil has been investigated.

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C. Sugar Mill Waste (SMW) :-

It was already known that sugarcane bagasse and sugarcane straw can be recycled in the manufacture of commercial cements & other composites, either as raw material or pozzolanic material. For use as pozzolans, the agricultural wastes need prior calcinations. In recent years, the possibility of mixing this solid waste of sugarcane with clay has been evaluated by getting an agglutinative material which permits an easy handling as well as an improvement in the environmental aspects.

III. IMPLEMENTATION METHODOLOGY

The objective of paper is to investigate the engineering properties of clay soil after improving with admixture. The clay samples were kept in air-dried condition for a week before the following tests are performed to check the Geotechnical properties of soil.

A. Proctor Compaction Test:-

The geotechnical properties of soil are dependent on the moisture and density at which the soil is compacted. A high level of compaction of soil enhances the geotechnical parameters of the soil. The aim of the Proctor Test is to determine the optimum moisture content and Maximum Dry Density of stabilized soil.
It is observed that dry unit weight increases with the increase in water content till the maximum unit weight (γ_d max.) is reached with further increase in water content, the dry unit weight decreases.

B. Unconfined Compressive Strength Test:-

Compressive strength of a soil is a significant factor to estimate the design criteria for the use as a pavement and construction material. Soil-RHA and Soil-SMW mixtures were prepared at 0%, 2%, 4%, 6% and 8% of optimum water content. The unconfined compressive strength was measured after 7 days curing.

IV RESULTS AND DISCUSSION CONCLUSION REFERENCES

Geotechnical properties studied in this investigation includes Index properties like liquid limit, plastic limit, Plasticity Index, Specific Gravity, Hydrometer analysis and engineering properties like compaction and strength characteristics of soil with and without replacement of various proportions of RHA and SMW has been used. Soil is replaced with 0%, 2%, 4%, 6% and 8% of RHA by dry weight of soil. In order to understand the effect of sugar mill waste, soil is replaced with 0%, 2%, 4%, 6% and 8% sugar mill waste. It is found that geotechnical properties of soil replacement by both RHA and SMW proved to be modifying properties of soil not for the enhancement.

TABLE I: INDEX PROPERTIES OF CLAY SOIL

Discription of Property	Value	Discription of Property	Value
Colour	Yellowish Brown	Plasticity Index (%)	12.74
Specific Gravity	2.74	Optimum Moisture Content (%)	17.3
Liquid Limit (%)	33.6	Maximum Dry Density(G/Cc)	1.75
Plastic Limit (%)	20.86	Soil Classification	CL

From the above table it is clear that soil is low compressibility clay.

A. Effect of Soil-RHA, Soil-SMW on Compaction Characteristics of Soil

Standard Compaction tests are conducted on soil with and without replacements of 0%, 2%, 4%, 6%, and 8% of Rice Husk Ash and Sugar Mill Waste. Compaction curves are plotted.

B. Results for Proctor Test for RHA :-

From the results it can be seen that the Maximum Dry Density (MDD) decreases while the Optimum Moisture Content (OMC) goes on increases with increase in percentage of Rice Husk Ash (RHA) and Sugar Mill Waste (SMW) in both cases.

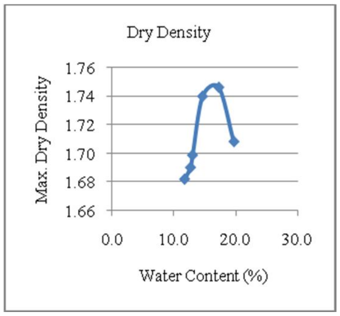

Fig 1: Graph for 0% RHA Proctor Test

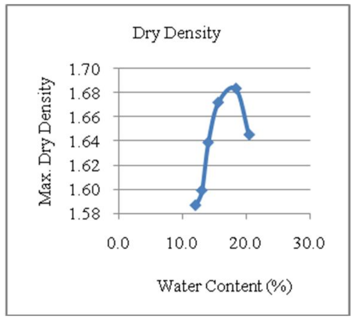

Fig 2: Graph for 2% RHA Proctor Test

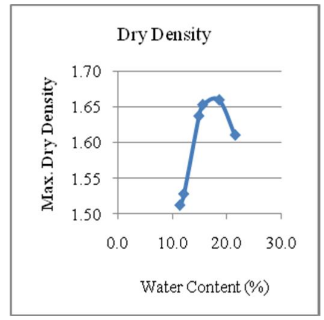

Fig 3: Graph for 4% RHA Proctor Test

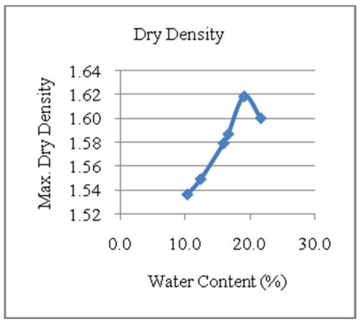

Fig 4: Graph for 6% RHA Proctor Test

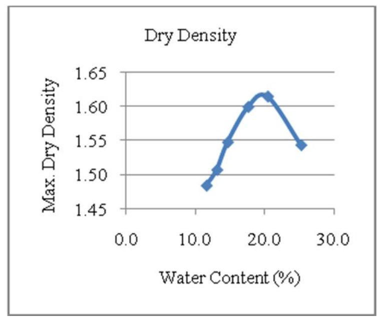

Fig 5: Graph for 8% RHA Proctor Test

C. Results for Proctor Test for SMW :-

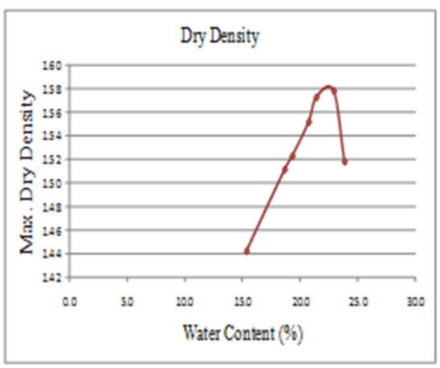

Fig 6: Graph for 2% SMW Proctor Test

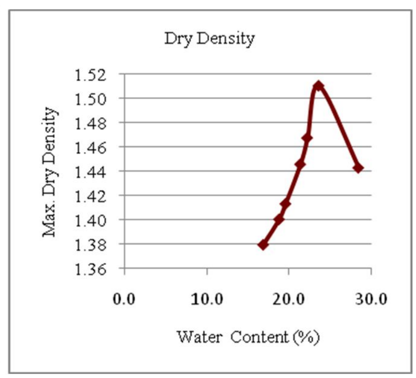

Fig 7 : Graph for 4% SMW Proctor Test

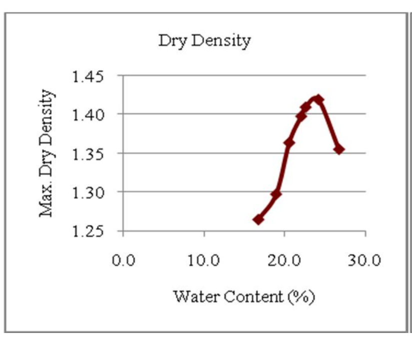

Fig 8 Graph for 6% SMW Proctor Test

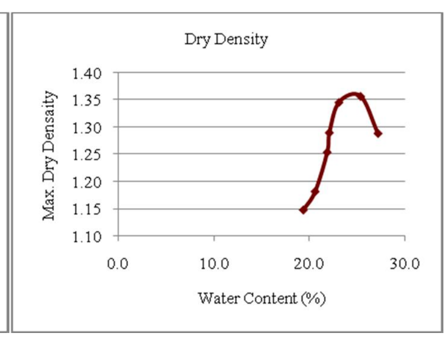

Fig 9: Graph for 8% SMW Proctor Test

D.Effect of Soil-RHA and Soil-SMW on Strength Characteristics

Unconfined compression tests are conducted on soil specimens with and without replacements of RHA and SMW for 0-7 days curing. The specimens are compacted to their respective MDD's and OMC's of the mixes. Stress-strain curves then plotted.

Sample Length (L)	:	7.5 cm	Proving Ring No:	:	09233
Diameter of sample (D)	:	3.8 cm	Area of Sample Cross Section of the sample (A_0)	:	11.33 cm^2
Proving Ring Constant	:	2.5 N per Division			

E. Observations and Calculations for UCS Test for RHA:-

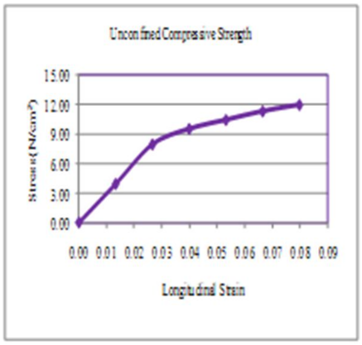

Fig 4.10: Graph for 0% RHA UCS Test

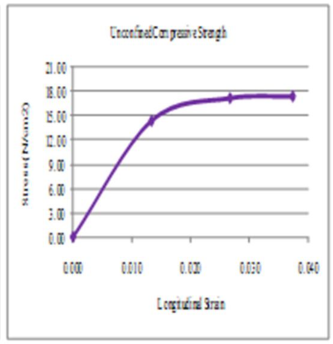

Fig 4.11: Graph for 2% RHA UCS Test

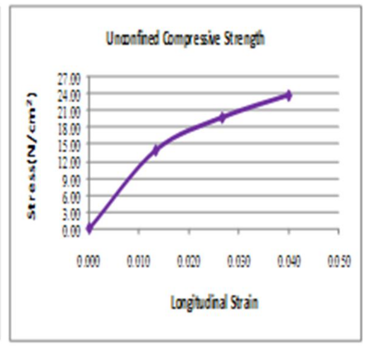

Fig 4.12: Graph for 4% RHA UCS Test

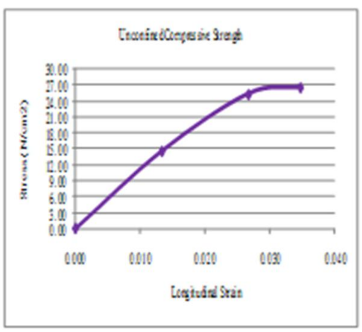

Fig .13: Graph for 6% RHA UCS Test

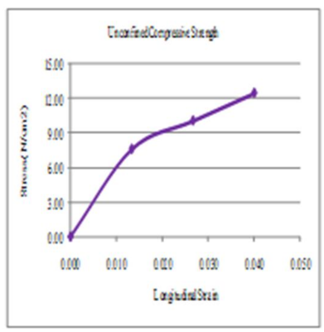

Fig .14: Graph for 8% RHA UCS Test

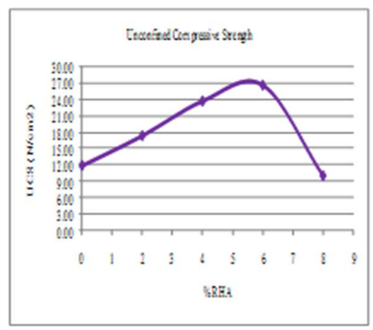

Fig .15: Graph for different Percentage RHA V/s UCS

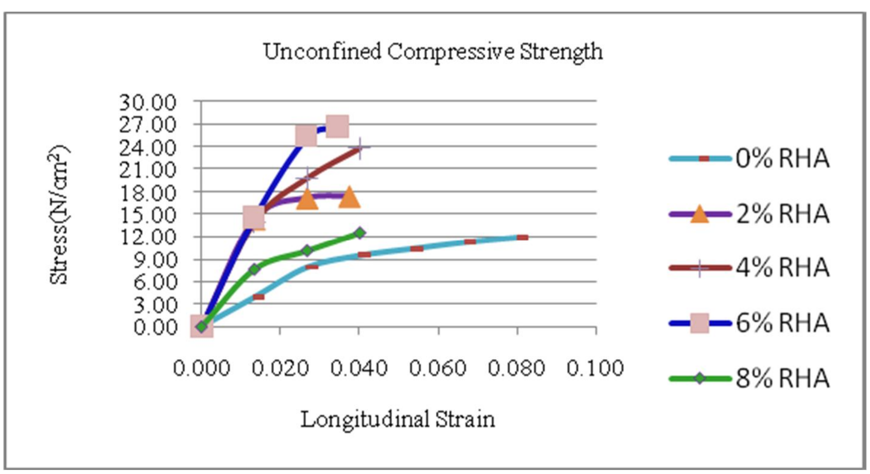

Fig .16: Comparative Graph for different percentages of RHA for UCS test

F.Observations and Calculations for UCS Test for SMW :-

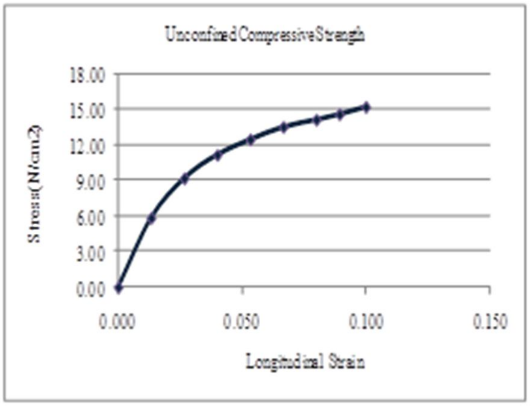

Fig .17: Graph for 2% SMW UCS Test

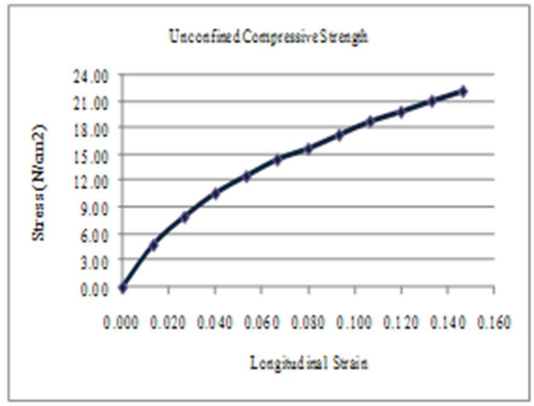

Fig .18: Graph for 4% SMW UCS Test

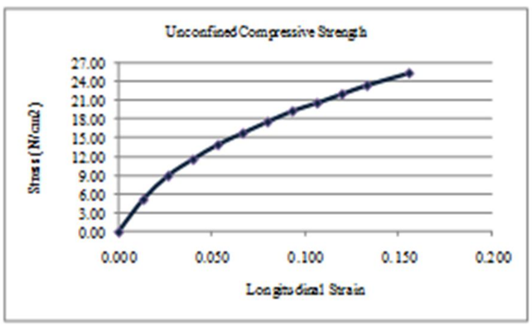

Fig .19: Graph for 6% SMW UCS Test

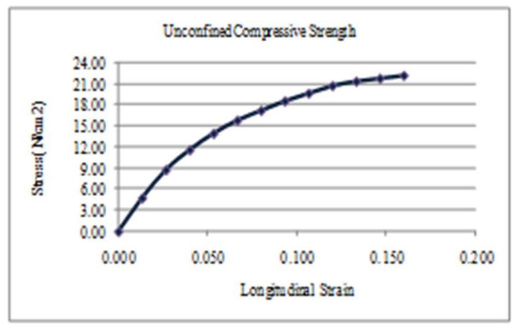

Fig .20: Graph for 8% SMW UCS Test

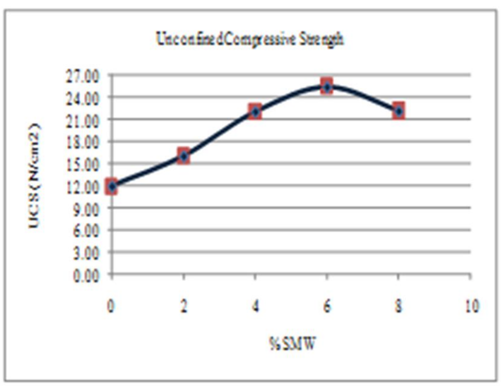

Fig .21: Graph for different percentage SMW V/s UCS

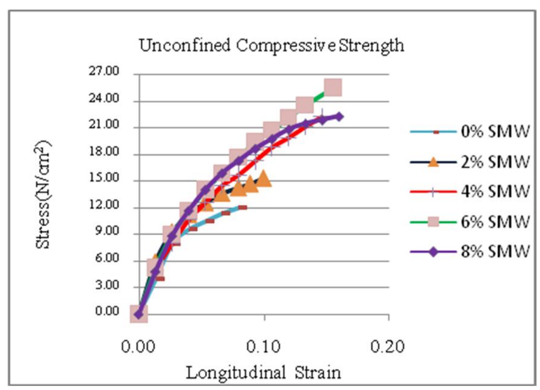

Fig .22: Comparative Graph for different percentages of SMW for UCS test

There is an increase in UCS value up to 6% Rice Husk Ash as well as Sugar Mill Waste for 7 days cured specimens and decreased at 8% for both sample.

V. CONCLUSION

Standard Proctor Compaction test and Unconfined Compression test are performed with and without replacements at 0%, 2%, 4%, 6% and 8% of Rice Husk Ash and Sugar Mill Waste. From the results it has been concluded that at natural condition the optimum moisture content of soil is 17.3% and maximum dry density is 1.75 gm/cc.

As we add the Rice Husk Ash as admixture by 2%, 4%, 6%, 8% the OMC goes on increases up to 20.5% but and MDD goes on decreases up to 1.61gm/cc at 8% RHA. Similarly by adding Sugar Mill Waste as admixture by 2%, 4%, 6%, 8% the OMC increases up to 25.3% and MDD goes on decreases up to 1.36 gm/cc. It has also been find out by comparing the results of OMC and MDD of both the admixtures that as compared to RHA the value of OMC increases but values of MDD goes on decreases in case of SMW.

The Unconfined compressive strength of clay at natural condition is 11.98 N/cm^2. As we add RHA as admixture the value of unconfined compressive strength of clay goes on increases up to 26.63 N/cm^2 at 6% RHA and then decreases up to 12.5 N/cm^2 at 8% RHA. The sugar mill waste when added as admixture the value of unconfined compressive strength of clay goes on increases up to 25.51 N/cm^2 at 6% SMW and then decreases up to 22.24 N/cm^2 at 8% SMW. The value of UCS goes on decreases in case of SMW as compared to RHA. It is found that RHA and SMW may widely use as a stabilizing agent.

REFERENCES

[1] G. V. Rama Subbarao, D. Siddartha, T. Muralikrishna, K. S. Sailaja, and T. Sowmya, "Industrial Wastes in Soil Improvement" International Scholarly Research Network ISRN Civil Engineering Volume 2011, Article ID 138149, 5 pages doi:10.5 4/02/2011/138149

[2] George Rowland Otoko & Esenwa Ifechukwude Cynthia,"Mechanical stabilization of a deltaic clayey soil using crushed waste periwinkle shells" International Journal of Engineering and Technology Research Vol. 2, No. 5, May 2014, pp. 1 - 7, ISSN: 2327 - 0349 (Online)

[3] Shiva Prasad. P.T.Ravichandran, R.Annadurai, P.R.Kannan Rajkumar, "Study on Effect of Crumb Rubber on Behavior of Soil" International Journal of Geomatics and Geosciences Volume 4, No 3, 2014

[4] Ashwani Jain, Nitish Puri, "1-Dimensional Consolidation Characteristics of Clay Stabilized With Major Industrial Wastes Of Haryana" Proceedings of Indian Geotechnical Conference December 22-24,2013, Roorkee.

[5] Dr. Gbenga M. Ayininuola, & Oluwatobi I. Olaosebikan, "Influence Of Rice Husk Ash On Soil Permeability" Transnational Journal of Science and Technology, TJST December 2013 edition vol.3, No.10 ISSN 1857-8047

[6] E.A. Meshida, G.L.Oyekan, A.O.Ogundalu, "Effects of Steel Mill Dust on the Strength Characteristics of Black Cotton Clay Soils" International Journal of Scientific & Engineering Research, Volume 4, Issue 5, May-2013 2242 ISSN 2229-5518.

[7] Y. Keerthi, P. Divya Kanthi, N. Tejaswi, K. Shyam Chamberlin, B. Satyanarayana, "Stabilization of clayey soil using cement kiln waste" International Journal of Advanced Structures and Geotechnical Engineering ISSN 2319-5347, Vol. 02, No. 02, April 2013

[8] Mohammed Y. Fattah , Falah H. Rahil , Kawther Y. H. Al-Soudany, "Improvement of Clayey Soil Characteristics Using Rice Husk Ash" Journal of Civil Engineering and Urbanism Volume 3, Issue 1: 12-18 (2013).

[9] Dr. Soosan George T, Alice T V, Mini M I, Professor, "Improvement of Kaolinite Clay Subgrade Using Coir Fiber Waste" International Journal of Emerging Technology and Advanced Engineering Journal, Volume 3, Issue 3, March 2013)

[10] Akshaya Kumar Sabat. Bidula Bose, "Improvement in Geotechnical Properties of an Expansive Soil using Fly Ash -Quarry Dust Mixes" EJGE © 2013 Vol. 18 [2013], Bund. Q. pp 3487-3500.

[11] Takeshi Kamei, Aly Ahmedb & KeizoUgai, "Durability of soft clay soil stabilized with recycled Bassanite and furnace cement mixtures." Soils and Foundations 2013;53(1):155–165.

[12] Arash Barazesh, Hamidreza Saba, Mehdi Gharib, "The Effect Of Adding Iron Powder On Atterberg Limits Of Clay Soils" International Research Journal of Applied and Basic Sciences ISSN 2251-838X / Vol, 3 (11): 2349-2354 Science Explorer Publications. 2013

[13] B.M.Patil & .A.Patil, "Effect of fly ash on swelling Characteristics of clayey soil." International Journal of Advanced Technology in Civil Engineering, ISSN: 2231–5721, Volume-2, Issue-2, 2013.