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Use of Expansive soil with Rice Husk Ash and lime for Rammed Earth Constructions

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ABSTARCT

Expansive soil has been a problem in India as in other countries. Current research found that there is a potential use of silica waste, resulting from burnt rice husk, as a pozzolonic material. This paper presents the results of study on the utilisation of ashes produced from uncontrolled rice husk burnt at Bavla.

In this research, a series of laboratory tests has been conducted. The tests were carried out individually or in a combination in which the Rice Husk Ash (RHA) content were varied from 40, 50and 60 percent, and the lime content from 3, 7 and 10 percent (by the dry weight of soil). All the samples have been remoulded at their optimum moisture content (OMC) and maximum dry density (MDD). The research shows that lime – rice husk ash decreased the swell of expansive soil and improved its strength and Weathering Test.

INTRODUCTION

Several methods of soil improvement using Pozzolanic materials have been developed and used successfully in practice. It has been applied in a variety of civil engineering works, like in the construction of base courses where good materials are not economically available; for wall construction. A considerable amount of research concerning stabilisation of soil with additives such as cement, lime, lime – fly ash and salt, bitumen and polymers is available in the literature. But soil stabilisation with lime and rice husk ash (RHA) is a relatively new method.

The ash is mainly derived from the *opaline*, which is present in the cellular structure of husk and about 80 to 90 % of which is silica. The high percentage of siliceous materials in the RHA makes it an excellent material for stabilisation. This paper presents result of a study using open field burnt RHA and lime on the selected geotechnical properties of expansive soil.

MATERIALS AND METHODS

Rice Husk Ash (RHA)

RHA used for the study was manufactured at Bavla. Paddy was separated into husks and grains. This separated husk was used as a fuel for boiling rice grains in the boiler, thereby producing ash as a by-product. The temperature maintained in the boilers was about 600-7000C. The chemical properties obtained for RHA shows presence of high amount of silica, Al_2O_3 and Fe_2O_3, thereby confirming it to be a good Pozzolanic material.

CONSTITUENT	COMPOSITION (%)
Fe_2O_3	1.61
SiO_2	82.49
MgO	0.57
SO_3	0.062
Al_2O_3	1.17
Loss on ignitions (Lol)	5.38

Table – 1 Constituent Composition (%)

To assess the effect of RHA on the expansive clays properties, the RHA was blended with lime as the lime-pozzolana mix. A series of laboratory tests were conducted namely the physical and index properties, UCS CUBES WALLET test. The tests were carried out in a combination in which the RHA content was varied from 40, 50, and 60 percent, and the lime content from 3, 7, and 10 percent (by the dry weight of soil). All the samples have been remoulded at their optimum moisture content (OMC) and maximum dry density (MDD). The samples were cured for different days and curried in plastic bags to prevent the loss of moisture and air dried.

RESULT AND DISSCUSION

The tests result such as liquid limits, plastic limits, MDD, OMC, UCS Cubes and wallet are presented in the Table no -2

Description	100% BCS	40% BCS + 60 % RHA	50% BCS + 50 % RHA	60% BCS + 40 % RHA	100 % RHA	50% BCS + 47 % RHA +3% LIME	50% BCS + 43 % RHA +7% LIME	50% BCS + 40 % RHA +10 % LIME
Grain Size Analysis : IS 2720								
Gravel (%)	0	0	0	0	0	0	0	0
Coarse Sand (%)	0	0	0	0	0	0	0	0
Medium Sand (%)	0	0	0	0	0	0	0	2
Fine Sand (%)	1	5	4	3	6	5	13	14

Silt (%) / Clay (%)	99	95	96	97	94	95	87	84
Linear Shrinkage : IS 2720								
Linear Shrinkage	21%	5.20%	5.60%	9.28%	0%	-	-	-
Free Swell Index : IS 2720								
Free Swell Index	100%	30%	40%	50%	10%	-	-	-
Atterberg's Limits : IS 2720								
Liquid Limit (%)	81	75	80	81	85	74	80	86
Plastic Limit (%)	35	46	45	42	79	69	68	77
Plasticity Index (%)	46	29	35	39	6	5	12	9
Standard Proctor Test : IS 2720								
MDD (g/cc)	1.40	0.89	0.95	1.00	-	0.97	0.96	0.91
OMC (%)	33	66	60	56	-	56	57	66
Unconfined Compressive Strength : IS 2720								
UCS (N/mm2) (Wet)	0.18	0.09	0.11	0.08	-	-	-	-
UCS (N/mm2) (dry)	1.96	1.11	1.21	1.58	-	-	-	-
UCS (N/mm2) (wet)	-	-	-	-	-	0.42	0.93	1.17
UCS (N/mm2) (dry)	-	-	-	-	-	0.63	0.6	0.62
UCS (N/mm2) (wet)	-	-	-	-	-	0.49	1.23	1.67
wallet (N/mm2)	-	-	-	-	-	-	0.38	-
CUBES RESULT (wet) (N/mm2)	-	0.11	0.12	0.07	-	-	-	-
7th DAY CUBES RESULT(dry) (N/mm2)	-	-	-	-	-	0.44	1.41	1.56
28Tth DAY CUBES RESULT (dry) (N/mm2)	-	0.12	0.18	0.52	-	1.02	2.28	2.11

Table – 2 test results

Bar chart - 1 shows that the increasing of the LIME proportion increasing of the UCS values after the 7th day curing, 28th day curing & 28th day air dried after 7day curing condition. Bar chart – 2 shows that the proportion of the 50% BCS + 50 % RHA gives Cube Compressive Strength is higher at a time of the casting of cubes.

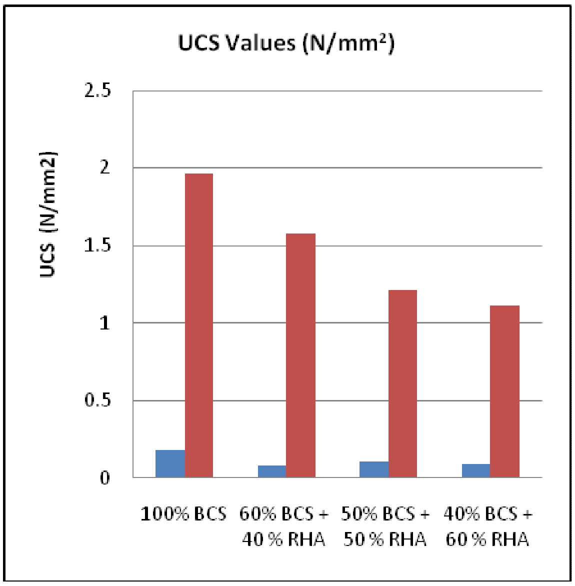

Chart – 1 UCS value(7 day)

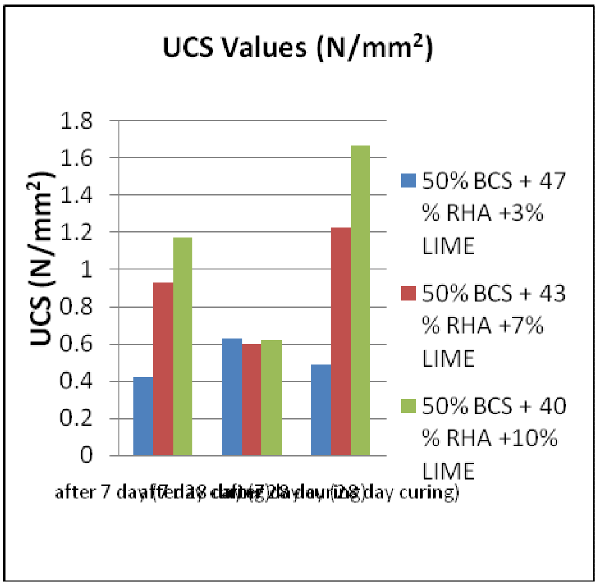

Chart – 2 UCS value(7 & 28 day)

Bar chart - 3 shows that the increasing of the BCS proportion increasing of the Cube Compressive Strength after 28th days in air dried condition. Bar chart - 3 shows that the proportion of the 50% BCS + 40 % RHA +10% LIME gives Cube Compressive Strength is higher after the 7th day the casting of cubes. Bar chart - 4 shows that the proportion of the 50% BCS + 43 % RHA +7% LIME gives Cube Compressive Strength is higher after the 28th day the casting of cubes.

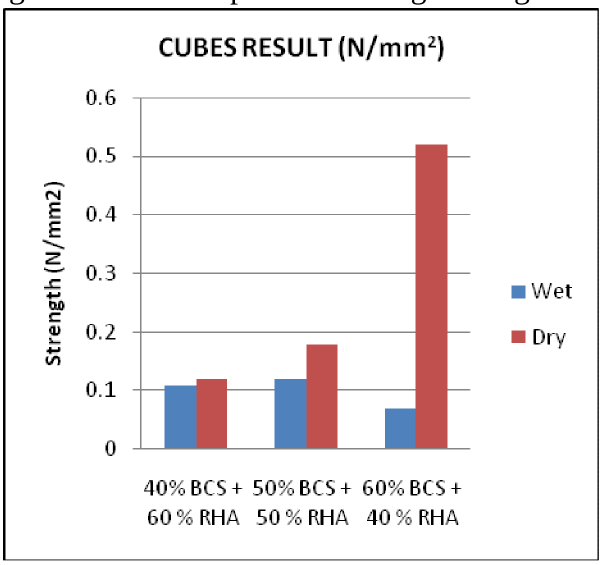

Chart – 3 Cubes Result (7 days)

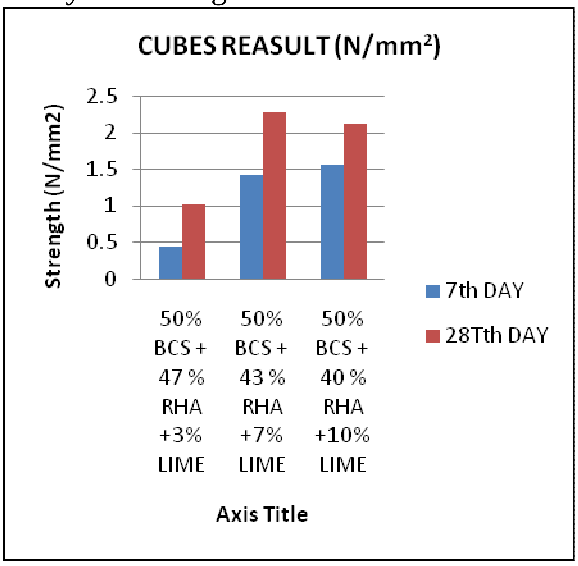

Chart – 3 Cubes Result (28 days)

Weathering Test

Fig – 1 40% BCS + 60 % RHA

Fig – 2 50% BCS + 50 % RHA

Fig – 3 60% BCS +40 % RHA

Fig - 4 50% BCS + 47%RHA +3% LIME

Fig - 5 50% BCS + 43 % RHA +7% LIME

Fig - 6 50% BCS + 40 % RHA +10% LIME

The samples disintegrate. (Refer Figure) It was observed that when spray test was conducted on 40% BCS + 60 % RHA cubes, the sample had disintegrated to about 100% weight in around 7 minutes. Whereas when weathering test was conducted on 50% BCS + 50 % RHA disintegrated to about 100% weight in around 9 minutes and 60% BCS + 40 % RHA disintegrated to about 100% weight in around 11minutes.The samples disintegrate. (Refer Figure) The same test was when conducted on 50% BCS + 47 % RHA +3% LIME it was noticed that the sample had disintegrated to about 20% weights in after 120 minutes. Whereas when weathering test was conducted on 50% BCS + 43 % RHA +7% LIME disintegrated to about 4% weights in after 120 minutes and 50% BCS + 40 % RHA +10% LIME disintegrated less than 1% weights in after 120 minutes.

CONCLUSION

- The UCS values of cylinders BCS was higher than that of the various propositions of the BSC+RHA & BCS + RHA + LIME. For, the sample size increased the compressive strength decreased in the propositions of the BCS + RHA whereas BCS + RHA + LIME cube compressive strength is increasing.
- There is a reduction in compressive strength when RHA is added to BCS due to the lack of formation of cementation compounds in the absence of free lime. The Wallete compressive strength of 50% BCS + 43 % RHA +7% LIME are comparable to masonry compressive strength (as per IS: 1905) for masonry units having crushing strength not less than 3.5N/mm2.

- BCS sieved through 2 mm is used for the same proportion; it results in disintegration of the sample due to the lack to binding between BCS & RHA. Degree of pulverization affects the resistance against weathering.
- The addition of RHA increases LL at the same time making soil more impervious thereby increases the resistance of soil to weathering effect. So that in that propositions adding the LIME at different propositions. After adding the LIME content its give the good performers against Weathering.

REFERENCES

[1] Peter Walker, Rowland Keable, Joe Martin, and Vasilios Maniatidis., “Rammed earth designand construction guidelines”, Publisher: BRE Bookshop UK, ISBN 1 86081 734 3, **2005**.

[2] Prasanna Kumar P and B V Venkatrama Reddy, Moisture Content & Compressive Strength Relationships for Cement Stabilised Rammed Earth Walls, International Symposium on earthen Structures, Department of Civil Engineering, Indian Institute Of Science Bangalore, August **2007**

[3] Dimension Teknik Sipil, Vol. 4, No. 2, 100 - 105, September **2002**,ISSN 1410-9530 UTILIZATION OF UNCONTROLLED BURNT RICE HUSK ASH IN SOIL IMPROVEMENT (Agus Setyo Muntohar)

[4] Koteswara Rao. D et al. / International Journal of Engineering Science and Technology (IJEST) ,(ISSN: 0975-5462 Vol. 3 No. 11 November **2011**) (Stabilization Of Expansive Soil With Rice Husk Ash, Lime And Gypsum) (Koteswara Rao. D, Pranav. P.R.T)

[5] International Journal of Research and Reviews in Applied Sciences ISSN: 2076-734X, EISSN: 2076-7366 Volume 1, Issue 3(December **2009**) Potentials of Rice Husk Ash for Soil Stabilization (Dr. ROBERT M. BROOKS)

[6] ISSN 0974-5904, Volume 04, No 06 SPL, October **2011**, pp. 42-45 Comparison of Rice Husk Ash Stabilized Black Cotton Soil (Laxmikant Yadu, Rajesh Kumar Tripathi, Dharamveer Singh)

[7] Effect of the Combination of Lime and Natural Pozzolana on the Durability of Clayey Soils (EJGE Vol. 15 [**2010**], Bund. L) (Khelifa Harichane, Mohamed Ghrici, Wiem Khebizi, Hanifi Missoum)

[8] International Research Journal of Applied and Basic Sciences.Vol., 3 (4), 796-800, **2012** (ISSN 2251-838X ©2012 ECISI Journals) Experimental Investigation of Impact of Adding Lime on Atterberg Limits in Golestan Province Soils (Mehdi Gharib, Hamidreza Saba, Arash Barazesh)

[9] Suitability of local soil for cost saving construction techniques” By Martijn Schildkamp.Architect and Founder of smart shelter Foundation DEC-**2009**

[10] Referred IS Codes for Establishing Properties. (IS 2720(Part IV) **1985**, IS 2720(Part V) 1985, IS: 2720(Part VII) **1985**, IS 2720(Part 10) **1991**,IS 2720(Part 20) **1992**, IS 2720(Part 40) 1977, IS 1725 **1982**)