6th International Conference on Recent Development in Engineering Science, Humanities and Management
National Institute of Technical Teachers Training & Research, Chandigarh, India (ESHM-17)
14th May 2017, www.conferenceworld.in ISBN: 978-93-86171-36-8

USE OF AGRO-INDUSTRY WASTE FOR STABILIZATION OF CLAYEY SOIL

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ABSTRACT

Waste generated from agro-industries is serious concern in today's world as it leads to many harmful effects. There are lots of sugarcane and rice industries in India especially in the region of Uttar Pradesh, Haryana, Punjab, West Bengal etc. Waste generated from these industry i.e. sugarcane bagasse ash and rice husk ash requires a large area to dispose off and leads to environmental pollution also however these can be utilized for stabilization of poor soil which is not having desirable engineering properties.

This paper describes a trail study of effectiveness of Sugarcane Bagasse Ash and Rice Husk Ash to stabilize the clayey soil. The proposed stabilizer i.e. sugarcane bagasse ash and rice husk ash were mixed in clayey soil. Seven samples were made by the combination of stabilizers and parent clay sample and various tests were conducted in the laboratory to find out certain geotechnical characteristics and based on these test certain conclusion were drawn regarding the use of these stabilizer for stabilization of clayey soil. Result shows that stabilization of clayey soil using sugarcane bagasse ash and rice husk ash prove to be very simple, economical and pollution controlling.

Keywords : Clayey soil, Geotechnical characteristics,Rice husk ash, Sugarcane bagasse ash.

I. INTRODUCTION

Soil stabilization is a technique which was introduced many years ago with the aim to improve the soil and make it suitable for desired purpose. For this purpose several additives which are required for ground modification such as cement, lime, and mineral additives such as fly ash, silica fume and rice husk ash have been used under various context. Soil stabilization is the method to have improved load carrying capacity of soil. It includes change in properties like increase in stability, change or improvement in density and shrinkage & swelling behavior, change in chemical properties and water proofing material properties, by the technique of soil stabilization strength of locally available soil can be improved to desired level. The choice of particular soil stabilization techniquedepends on many factors which will include type andnature of soil, type and importance of project and economy of the project. Stabilization using lime, cement, bitumen, asphalt etc. is common and proves to be effective also but sometimes proves to be costly sometimes so certain other alternatives are required. Stabilization of clayey soil using agro-industry waste proves to be an effective way to improve the engineering properties of soil.

ISBN: 978-93-86171-36-8

II.OBJECTIVE OF STUDY

The aim of this study is to monitor the effect of sugarcane Bagasse Ash (SBA) and Rice Husk Ash (RHA) on clayey soils.

III. MATERIALSAND SAMPLING

Soil: soil used in the investigation is local soil of Kurukshetra. After removal of lumps of gravel and other visible undesirable fractions soil is sieved and its properties are found out as per relevant Indian Standard Code.

S.NO.	Property	Typical value
1	I.S. classification	CI
2	Plastic limit	23
3	Liquid limit	56
4	Plasticity index	33
5	MDD, gm/cc	1.6
6	OMC %	25
7	Specific gravity	2.55

TABLE-A Properties of parent clayey soil

Sugarcane bagasse ash: Sugarcane bagasse ash is collected from locally situated sugarcane mill at Shahabad of Kurukshetra district. Sugarcane bagasse ash is rich in oxides if silica and aluminum so possesses certain pozzolanic properties so utilized as a stabilizer to stabilize clayey soil. A general chemical composition of sugarcane bagasse ash is give below:

S.NO.	Description	Ash %
1	Aluminum oxide (Al_2O_5)	.38
2	Silica (SiO_2)	62.434
3	Iron Oxide (Fe_2O_3)	6.98
4	Manganese (Mn)	0.5
5	Calcium oxide (CaO)	2.51
6	Zinc (Zn)	0.3
7	Sulphur trioxide (SO_3)	1.48
8	Potassium oxide (K_2O)	3.53
9	Loss on ignition (LOI)	4.73
10	Copper (Cu)	0.1

TABLE- B Chemical composition of Sugarcane Bagasse Ash

Rice Husk Ash:rice husk ash is the end product remains after burning of rice husk. It contain good amount of amorphous silica so pozzolanic in nature. Rice husk ash is collected from Sonipat, Haryana. Chemical

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composition of rice husk may vary a little from place to place due to change in soil, climate etc. A general chemical compostion if rice husk ash is given below:

S.NO.	Constitutes	Ash %
1	SiO_2	86
2	Fe_2O_3	1.8
3	Al_2O_3	2.6
4	MgO	0.27
5	CaO	3.6
6	Loss on ignition	4.2

TABLE-C Chemical composition of Rice Husk Ash

Sampling:seven different samples were made using clayey soil and stabilizer i.e. Sugarcane Bagasse Ash and Rice Husk Ash.

Sample No.	Description
1	Soil=100%, SBA=0%,RHA=0%
2	Soil=90%, SBA=5%,RHA=5%
3	Soil=85%, SBA=10%,RHA=5%
4	Soil=80%, SBA=10%,RHA=10%
5	Soil=70%, SBA=20%,RHA=10%
6	Soil=60%, SBA=25%,RHA=15%
7	Soil=50%, SBA=30%,RHA=20%

TABLE-4 Samples

SBA- Sugarcane Bagasse Ash

RHA- Rice Husk Ash

IV.METHODOLGY

Standard Proctor Test: As densification improves the engineering properties sooptimum moisture content (OMC) and maximum dry density (MDD) both are important parameter for clayey soil. Standard proctor test is done on the parent clayey soil and all other samples.

California Bearing Ratio test (CBR): This test is most widely used method for the design of flexible pavement. CBR test is conducted on parent soil and all other prepared samples under soaked condition as it is the most critical condition to the designer. Sample is prepared in 3 layers giving 55 blows to each layer with the help of 2.6kg rammer.

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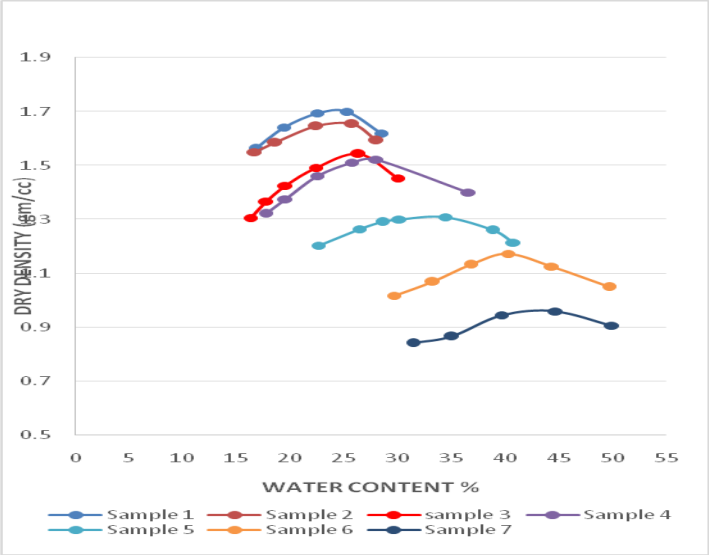
V. RESULT AND DISCUSSION

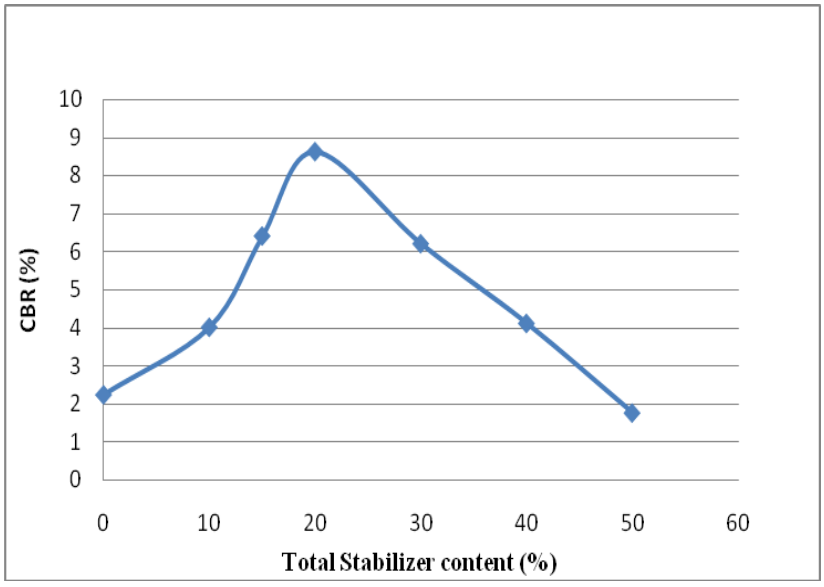
Compaction Result: standard proctor test was conducted to analyze the effect of stabilizer on maximum dry density (MDD) and optimum moisture content (OMC). Graph shown below shows the result of standard proctor test.



GRAPH-1 Moisture density relationship for different samples

Form the graph we find that MDD is 1.7gm/cc when no stabilizer is used and it decrease to 0.957 gm/cc when total stabilizer content is 50% however moisture content increase from 25% to 44% when stabilizer content is increased from 0% to 50%.

CBR Result:CBR test was conducted in critical condition i.e. soaked condition. It was conducted on parent clayey soil and all other samples. Results of CBR test were plotted in form of graph for better understanding. Graph shown below represent change in CBR value (%) with increase in total stabilizer content (%):



GRAPH-2 Change in CBR (%) with increase in total stabilizer (%)

ISBN: 978-93-86171-36-8

From the graph it is clear that CBR value increase from 2.237% to 8.632% and then decreases to 1.756% when stabilizer content is increased from 0% to 20% to 50%.

VI. CONCLUSION

Based on the present trail study following conclusion can be drawn:

1. With increase in stabilizer content (SBA and RHA) there is increase in OMC and decrease in MDD. MDD decreases from 1.7gm/cc to 0.957 gm/cc and OMC increase from 25% to 44% when stabilizer content is increased from 0% to 50 % which is probably due to low specific gravity of SBA and RHA.
2. With increase in stabilizer content CBR value increases and attains a maximum value (8.632% when total stabilizer content is 20%) and then start decreasing with increase in stabilizer content (1.756% when total stabilizer content is 50%)
3. Total stabilizer content 20% (SBA=10% and RHA=10%) gives most satisfactory results.
4. Overall study proves that sugarcane bagasse ash and rice husk ash gives satisfactory results when used as stabilizer so their use in stabilization of clayey soil will be advantageous as ii will be economical, pollution controlling and will also solve the problem of disposal to these waste.

VII. FUTURE SCOPE OF STUDY

1. Effect of SBA and RHA on other engineering properties of clayey soil can be studied.
2. Effectof SBA and RHA on expansive soils such as black cotton soil and soil other than clay can be studied.
3. Effect of SBA and RHA on the properties like water absorption by sorptivity, modulus of elasticity, permeability, shrinkage can be studied.

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