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UTILIZATION OF FLY ASH AND SUGARCANE ASH FOR IMPROVEMENT OF COHESIVE SOIL

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ABSTRACT

Disposal of waste generated from industries is a hot issue in modern era. Various methods are being employed daily to use this waste in an ecofriendly and effective manner. This study describe the use of sugarcane ash and fly ash in stabilization of cohesive soils. Sugarcane ash is obtained from bagasse and is a rich source of silica so a pozzolanic material and fly ash is also a super pozzolona obtained from burning of coal in the power plant. Both of these waste as being pozzolanic in nature can be utilized for enhancing the geotechnical characteristics of clayey soil.

The present study is basically a trial study which aims to investigate the effect of sugarcane bagasse ash and fly ash on compaction characteristics and unconfined compressive strength (UCS) of cohesive soil. After conducting all the test on parent cohesive soil different samples were made by combination of sugarcane ash and fly ash and standard compaction test and unconfined compressive strength test were conducted on each of them to investigate the effect of stabilizer on cohesive soil. Results show that there was an increase in OMC and decrease in MDD as there was increase in total stabilizer content. Also, UCS attains its maximum value when total stabilizer content used was 20%.

Keywords: sugarcane ash, fly ash. OMC, MDD, UCS, standard proctor test.

I. INTRODUCTION

Clayey soil were having undesirable engineering properties. They tend to low shear strength on wetting or other physical disturbances. Clayey soil are normally associated with volumetric changes when subjected to change in water content because of seasonal water fluctuations. Furthermore, problems of high compressibility can cause severe damage to civil engineering construction. Therefore, these soil must be treated before commencing the construction operation to achieved desired properties. Different methods were available to improve the engineering properties of such soil are densification, chemical stabilization, reinforcement and techniques of pore water pressure reduction. Stabilization using sugarcane ash and fly ash is very simple, economical and pollution controlling way of improving the properties of soil for specific purpose. It also solves the problem of disposal of sugarcane ash and fly ash up to a certain extent.

II. AIM OF INVESTIGATION

The aim of this study is to monitor the effect of sugarcane Ash (SA) and Fly Ash (FA)) on cohesive soils.

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III. SOIL, STABILIZERS AND SAMPLING

Soil: soil used in the investigation is local soil of Samani village of district Kurukshetra, HARYANA. 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	CH
2	Plastic limit	25
3	Liquid limit	58
4	Plasticity index	33
5	MDD, gm/cc	1.7
6	OMC %	26
7	Specific gravity	2.59

TABLE-A Properties of parent clayey soil

Sugarcane ash: It was 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)	.36
2	Silica (SiO_2)	61.44
3	Iron Oxide (Fe_2O_3)	6.98
4	Manganese (Mn)	0.5
5	Calcium oxide (CaO)	2.41
6	Zinc (Zn)	0.3
7	Sulphur trioxide (SO_3)	1.49
8	Potassium oxide (K_2O)	3.63
9	Loss on ignition (LOI)	4.73
10	Copper (Cu)	0.1

TABLE- B Chemical composition of Sugarcane Ash

Fly Ash: Fly ash used in the study was collected from Panipat thermal Power Plant, village Assan, Jind Road, Panipat, HARYANA. It was classified as ML as per I.S. 1498 (1970). Basically it contains silica dioxide (both amorphous and crystalline), alumina and calcium oxide i.e. pozzolanic in nature. A general chemical composition of fly ash is given below:

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S.NO.	Constitutes	Ash %
1	SiO_2	55
2	Fe_2O_3	7
3	Al_2O_3	23
4	MgO	2
5	CaO	9
6	Loss on ignition	6

TABLE-C Chemical composition of Fly Ash

Sampling: By the combination of cohesive soil, fly ash and sugarcane ash seven different sample were made. These are listed in table below:

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

TABLE-4 Samples

SA- Sugarcane Ash

FA- Fly Ash

IV. EXPERIMENTAL PROGRAME

Compaction Test: As densification improves the engineering properties of any soil sooptimum moisture content (OMC) and maximum dry density (MDD) both are important parameter for clayey soil. Standard proctor test is done on all samples as per I.S. 2720 – part – 7 – 1980.

Unconfined compression test (UCS): A UCS test as per I.S. 2720 – part – 10 was conducted on all the seven samples prepared.

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.

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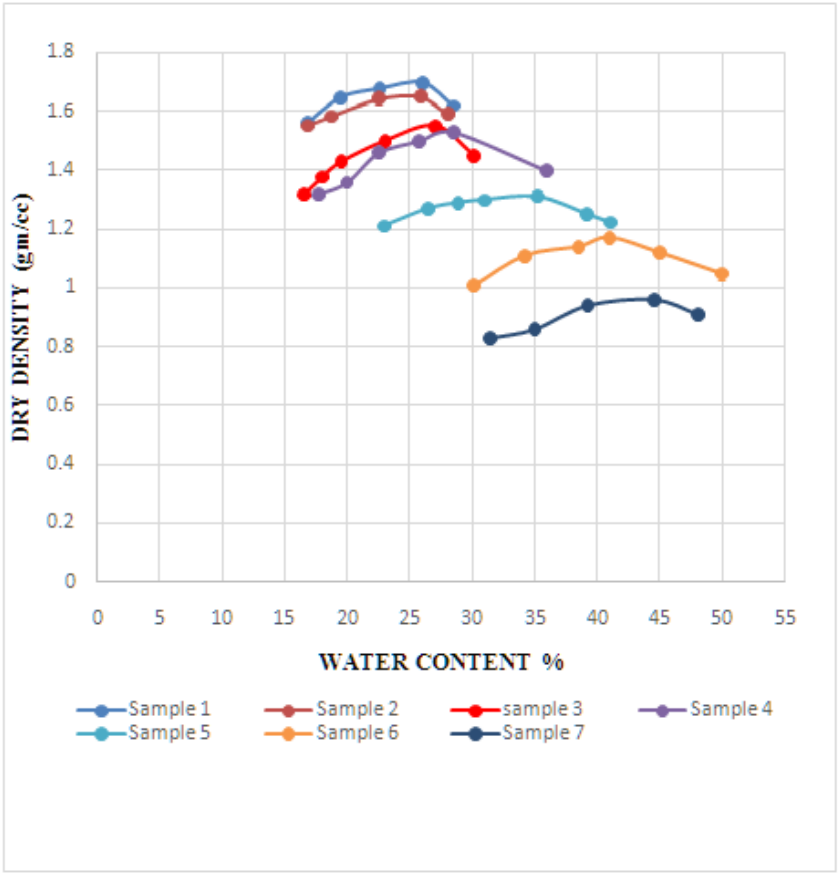
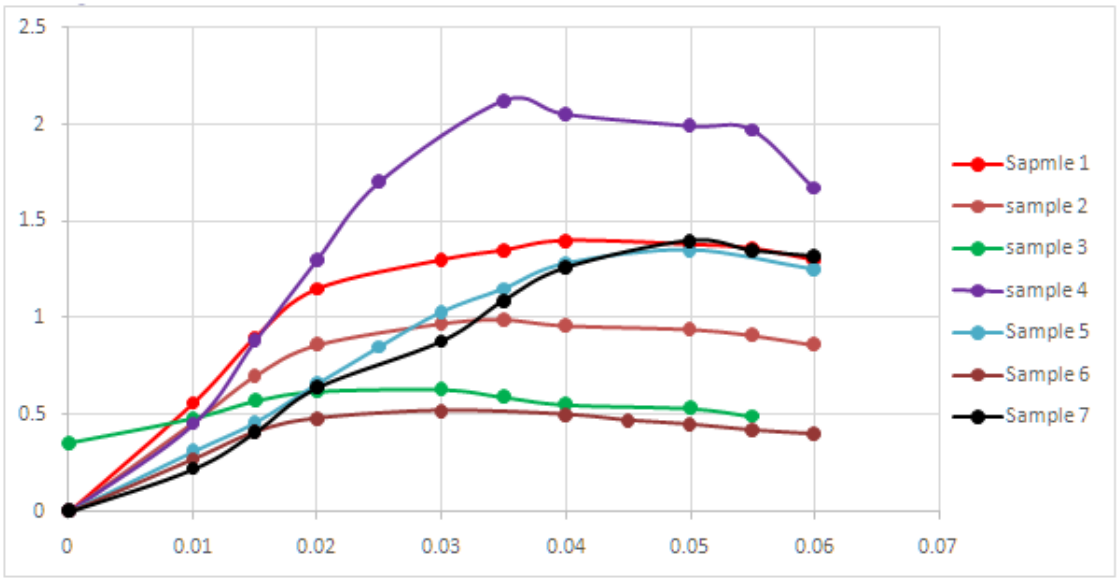


GRAPH-1 Moisture density relationship for different samples

Form the graph we find that MDD is 1.7gm/cc when no stabilizer is used and it decrease to 0.96 gm/cc when total stabilizer content is 50% however moisture content increase from 26% to 44.5% when stabilizer content is increased from 0% to 50%.

UCS Result:7 days unconfined compressive strength tests were conducted on the OMC from standard compaction test. Variation in strength as soil is replaced by SBA and RHA is shown in graph 2.



GRAPH-2

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From the graph it is clear that UCS value initially decreases and then increases (when total stabilizer content is 20%) however further increase in total stabilizer content (more than 20%) results into decrease in UCS value.

VI. CONCLUSION

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

1. With increase in stabilizer content (SA and FA) there is increase in OMC and decrease in MDD. MDD decreases from 1.7gm/cc to 0.96 gm/cc and OMC increase from 26% to 44.5% 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 UCS value increases and attains a maximum value (when total stabilizer content is 20% UCS is 2.12 kg/cm^2) and then start decreasing with increase in stabilizer content.
3. Total stabilizer content 20% (SBA=10% and RHA=10%) gives most satisfactory results.
4. Overall study proves that sugarcane ash and fly ash gives satisfactory results when used as stabilizer so their use in stabilization of cohesive soil will be advantageous as ii will be economical, pollution controlling and will also solve the problem of disposal to these waste.

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