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Effect of Waste Generated From Agricultural and Coal based Industries on Cohesive Soil

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ABSTRACT

In the developing country like India, industries are growing day by day and waste generated from these industries need attention. Bulk quantity of waste produced is a serious concern in today's era. In India, around 75% of the total power generation is from thermal power station and out of this 75%, 90% is coal based producing huge amount of fly ash which needs a large area for its disposal. Sugarcane ash or bagasse ash is waste generated after heating of bagasse (bagasse is the residue left after the juice has been extracted from the sugarcane) and India is the second largest producer of sugarcane among the world countries so a huge amount of sugarcane ash is generated every year. Disposal of which is a serious issue to concern.

Chemical analysis of both sugarcane ash and fly ash shows that these are pozzolanic in nature as rich in oxides of silica and alumina so can be utilized for enhancing the strength of cohesive. A tentative planning of investigation is been done in this study. Different combination of cohesive soil, sugarcane ash and fly are selected for sampling purpose and a testing program is planned on the cohesive soil and on different samples prepared. Test will mainly consist of unconfined compressive strength test, standard proctor test and tests to find out index properties

Keywords: sugarcane ash, fly ash, unconfined compressive strength test, standard proctor test, index properties.

I. INTRODUCTION

Sugarcane Ash: Bagasse is the fibrous matter that remains after the whole juice has been extracted from the sugarcane and deposited as waste and clutter the environment. For every 10 tonnes of sugarcane crushed sugarcane factory produce 3 tonnes of bagasse. This bagasse is used as a fuel in sugarcane mills for the generation of steam which eventually results in sugarcane bagasse ash (SBA) or sugarcane ash (SA). This ash is dumped in open areas which create environmental problems. When this sugarcane bagasse ash (SBA) is left in open it ferments and decay, which can result in respiratory disease basically chronic lung condition pulmonary fibrosis commonly known as bagassiosis. However, this SBA is a very good pozzolanic material as it contains good amount of oxides of silica and aluminum so can be used as a stabilizer in stabilizing clayey soils.

Fly Ash: Fly is the residue remain after the combustion of pulverized coal. It is collected by the mechanical or electrostatic separators from the power plant. It is about 75% of the total ash produced. Properties of fly ash varies widely from one plant to other plant and also from hour by hour in the same plant. It composition varies with type of fuel burnt, burning temperature, load on boiler, atmospheric conditions etc. and its colour vary from light to dark grey or even brown.Depending upon the source and makeup of coal burned, ingredients of fly ash varies considerably, but all type of fly ash contains silica dioxide (both amorphous and crystalline) and calcium oxide &

alumina i.e. pozzolanic in nature. In past, fly ash was released in atmosphere generally but now pollution control board decide that it to be captured before release so now-a-days fly is stored in plant or in farms. Combustion of coal produced around 80 percent of fly ash and 20 percent bottom ash. Ministry of power and planning commission indicates that total coal requirement and fly ash generation will be around 1800 million tons and 600 million tons by the year 2031-2032. Till now we are able to use only 50 percent of total fly produced and there is no planning for rest 50%.

II. AIM OF INVESTIGATION

The aim of this study is to plan an investigation process to find out effect of sugarcane ash and fly ash on cohesive soil so that if result are satisfactory than utilization of these waste can be done to improve cohesive soils.

III. LITRATURE REVIEW

Patrick *et al.* discussed the use of sugarcane with lime to stabilize the clayey soil. Sugarcane ash mainly contain silica and potassium, aluminum and magnesium as minor component and exhibit pozzolanic properties. The research investigates the properties of clayey soil when stabilized with lime, sugarcane ash and combination of these two. Research mainly covered grading test, plasticity index (PI) and California bearing ratio (CBR). First varying percentage of lime (4%, 5%, 6%) of lime was used to stabilize clay soil and then plasticity index and CBR were determined. The same procedure was repeated for bagasse ash and finally the varying combination of lime and bagasse ash 1:4, 2:3, 3:2, and 4:1 were used.The PI of soil decrease with increase in quantity of sugarcane ash, lime and lime to ash ratio. The addition of lime or bagasse ash help in reducing the swelling and shrinkage hence reduction in plasticity. CBR increased with increase in amount of lime added but decreased in case of sugarcane ash.

Choobbasti and Ghodrat worked on clayey soil using lime and fly ashand the results indicate that adding lime and fly ash (FA) causes increase in dry density and decrease in optimum water content. Stabilization of clayey soil with lime and rice husk results into decrease in liquid limit and plastic limit soil. There were sign of decrease in compressibility of soil. Stabilization using fly ash (FA) and lime results into increase in shear strength of the soil.

Anil and Sivapullaiah worked on the use of fly ash and ground granulated blast furnace slag (GGBS) to stabilize the expansive clayey soil. The investigator added some quantity of lime also to increase the pozzolanic reactions and to increase the PH. The geotechnical characteristics were investigated through the atterberg limit tests, compaction tests and unconfined compressive strength test.Both OMC and MDD found to be decrease with the addition of GGBS. This is due to predominant effects of reducing clay content and increased frictional resistance respectively. It was observed that the strength of soil increases with increase in curing period with increase in GGBS content along with fly ash. Based on the result of this research investigator said that clayey soil can be effectively stabilized using fly ash and GGBS and can be used in high way embankment and it can provide fill material of comparable strength to most soils.

Chittaranjan *et al.* author give a trial study of using sugarcane ash as a stabilizer to stabilize the clayey soil. Sugarcane ash (SA) was used in different proportions (0%, 3%, 9%, 12%, and 15%) and compaction & CBR characteristics were studied. Study shows that there is increase in optimum moisture content (OMC) and decrease

in maximum dry density (MDD) as there is increase in SA content. Result of CBR test shows increase in CBR value.

Amu *et al.* worked on modification of geotechnical properties of lateritic soil using sugarcane straw ash to obtain a cheap and economical way of stabilization. There were three types of soil samples namely sample A, B and C and different tests were conducted on stabilized (by adding 2%, 4%, 6% and 8% of sugarcane straw ash) and unstabilized samples. Results show that OMC increase from 19% to 20.5%, 13.3% to 15.5% and 11.7% to 17.0% for sample A, B and C respectively. There was increase in CBR from 6.31% to 23.3%, 6.24% to 14.88% and 6.35% to 24.88% for sample A, B and C respectively. Based on the result found, sugarcane straw ash was an effective stabilizer to improve the geotechnical properties of lateritic soils.

IV. SUGARCANE ASH, FLY ASH AND SOIL

Sugarcane ash: It is planned to collect sugarcane ash from locally situated sugarcane mill at Shahabad of Kurukshetra district. A general chemical composition of sugarcane bagasse ash is given in table A:

TABLE- A composition of Sugarcane Ash

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

Fly Ash: Fly ash will be collected from Panipat thermal Power Plant, Panipat, Haryana. A general chemical composition of fly ash is given in Table B:

TABLE – B Composition of Fly Ash

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

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

TABLE – C Samples

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%

SA- Sugarcane Ash

FA- Fly Ash

Soil:soil to be used in the investigation will be local soil of Samani village of district Kurukshetra, HARYANA.

V. EXPERIMENTAL PROGRAME

Following tests are planned to be conducted on the cohesive soil after removal of lumps and gravel as per IS code:

TABLE – D Test planned

S.No.	Test	IS code
1	Liquid limit	IS 2720 part – 5
2	Plastic limit	IS 2720 part – 5
3	Specific gravity	IS 2720 part – 3
4	Standard proctor test	IS 2720 part – 7
5	IS classification	IS 1948 : 1978
6	UCS	IS 2720 part – 10

After these test standard compaction test and unconfined test will be done on the samples (refer table A) prepared and results will be analyzed to come on to the certain conclusion regarding use of these waste for improvement of cohesive soils.

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