International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 4 Issue 6, September-October 2020 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Effect of Waste Fly Ash & Rice Husk Ash on Residual Soils

Kotagiri Manoj Kumar[1], P. Hanuma[2]

[2]Assistant Professor, [1,2]Department of Civil Engineering,
[1,2]Sri Sunflower College of Engineering &Technology, Lankapalli, Andhra Pradesh, India

ABSTRACT

In developing countries like India, due to remarkable development in road infrastructure, soil stabilization has become major issue in constructional activity, stabilization is not only a method of altering or modifying of one or more soil properties to improve the engineering. Characteristics and performance of a soil, but also processing available materials for the production of low –cost design and construction

Black cotton soils which expand when moisture content of soils is increased the clay mineral Montomorillonite is main responsible for expansive characteristics of soil. the expansive soils called swelling of soils or black cotton soils a large part of south India is covered with expansive soil another problem with this soil is strength is decreases with increases of degree of saturation heavy damages may occur buildings roads runways pipe lines and other structures built on such soils if proper preventive measures are not method. The damages can be prevented to a large extent if characteristics of expansive soil properly assessed suitable measures taken in design construction and maintenance of structures built on soils. This presents experimental investigation to study the effect of Rice husk ash and Fly ash on swelling and shrinkage and mechanical properties of a soil. After finding out the experimental results in lab to know the evaluation and performance of RHA & FA ash on the black cotton soil in the laboratory. Black cotton soil and FA & RHA has prepared by varying of different proportions with respect to dry the density.

How to cite this paper: Kotagiri Manoj Kumar | P. Hanuma "Effect of Waste Fly Ash & Rice Husk Ash on Residual Soils" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-4 | Issue-6, October 2020, pp.643-647, URL: www.ijtsrd.com/papers/ijtsrd33470.pdf

IJTSRD33470

INTRODUCTION

The availability of buildable land is decreasing day by day in India due to population growth, rapid industrialization and scarcity of land with good natural bearing capacity. This leads to construction of buildings on poor soils which eventually lead to structural foundation failures. The expansive soils are the one which are more problematic for construction and are predominantly available in majority places in Andhra Pradesh. These soils undergo swelling and shrinkage as the moisture content changes in it. Due to high swelling and shrinkage, these soils pose lot of problems to the structures founded on them. For a safe construction, it is necessary to improve the quality of ground by adopting some suitable ground improvement techniques. Many innovative foundation techniques have been devised as a solution to the problem of expansive soils. The selection of any one of the techniques is to be done after detailed comparison of all techniques and adopting a well-suited technique for the particular system. Lime and Cement are commonly used as stabilizers for altering the properties of expansive soils. From the recent studies, it is observed that solid waste materials such as Rice husk ash and fly ash are used for this intended purpose with or without lime or cement.

Table-1 soil classification system based on particle size:

Soil type	Particle size
GRAVEL	80-4.75 mm
SAND	
➢ Coarse	4.750 -2.000mm
➢ Medium	2.000 -0.475mm
➢ fine	0.475 -0.075mm
SILT	0.075-0.002mm
CLAY	Less than 0.002 mm

MATERIALS

Fly ash or flue ash, also known as pulverised fuel ash in the United Kingdom, is a coal combustion product that is composed of the particulates (fine particles of burned fuel) that are driven out of coal-fired boilers together with the flue gases. Ash that falls to the bottom of the boiler's combustion chamber (commonly called a firebox) is called bottom ash. In modern coal-fired power plants, fly ash is generally captured by electrostatic precipitators or other particle filtration equipment before the flue gases reach the chimneys. Together with bottom ash removed from the bottom of the boiler, it is known as coal ash. Depending upon the source and composition of the coal being burned, the components of fly ash vary considerably, but all fly ash includes substantial amounts of silicon dioxide (SiO_2) (both amorphous and crystalline), aluminium oxide (Al_2O_3) and calcium oxide (CaO), the main mineral compounds in coal-bearing rock strata.

The minor constituents of fly ash depend upon the specific coal bed composition but may include one or more of the following elements or compounds found in trace concentrations (up to hundreds ppm): arsenic, beryllium, boron, cadmium, chromium, hexavalent chromium, cobalt, lead, manganese, mercury, molybdenum, selenium, strontium, thallium, and vanadium, along with very small concentrations of dioxins and PAH compounds. It also has unburnt carbon.

In the past, fly ash was generally released into the atmosphere, but air pollution control standards now require that it be captured prior to release by fitting pollution control equipment. In the United States, fly ash is generally stored at coal power plants or placed in landfills. About 43% is recycled, often used as a pozzolan to produce hydraulic cement or hydraulic plaster and a replacement or partial replacement for Portland cement in concrete production. Pozzolans ensure the setting of concrete and plaster and provide concrete with more protection from wet conditions and chemical attack.

In the case that flies (or bottom) ash is not produced from coal, for example when solid waste is incinerated in a waste-to-energy facility to produce electricity, the ash may contain higher levels of contaminants than coal ash. In that case the ash produced is often classified as hazardous waste.

Fig-1 Fly ash

Table-2 Parameters of fly ash

Parameters	Fly Ash
Density	2.17 g/cm^3
Bulk density	1.26 g/cm^3
Moisture content	2%
Particle shape	Spherical/Irregular
Colour	Grey
pH	6.0-10.0
Specific gravity	1.66-2.55
Grain size distribution	Sandy silt to silty loam
Porosity	45%-55%
Water holding capacity	45%-60%
Electrical conductivity (dS/m)	0.15-0.45

Rice husk ash:

Rice husk ash (RHA) fillers are derived from rice husks, which are usually regarded as agricultural waste and an environmental hazard. Rice husk, when burnt in open air outside the rice mill, yields two types of ash that can serve as fillers in plastics materials.

Fig- 2 Rice husk ash

Table-3 Compaction Test Samples at 10%RA with variation of Fly ash%:

Samples Prepared for Compaction Test	
1	BC + 10%RA+2.5% FA
2	BC + 10%RA+5%FA
3	BC + 10%RA+8%FA
4	BC + 10%RA+10%FA

Table-4 Type of Samples prepared in PHASE 3:

Notation	Sample
BC	Black Cotton Soil
RA10-FA0	BC + 10%RA
RA10 –FA 2.5	BC + 10%RA+2.5%FA
RA10-FA 5	BC + 10%RA+5%FA
RA10-FA 8	BC +10%RA+8%FA
RA10-FA 10	BC+10%RA+10% FA

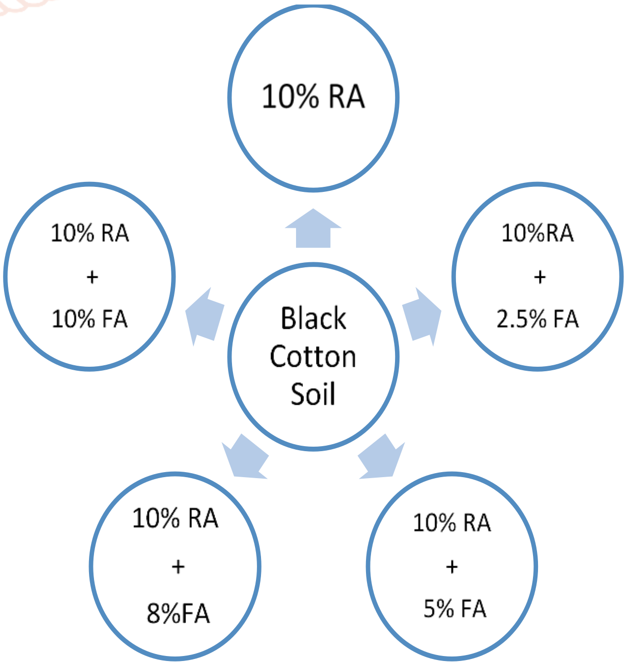
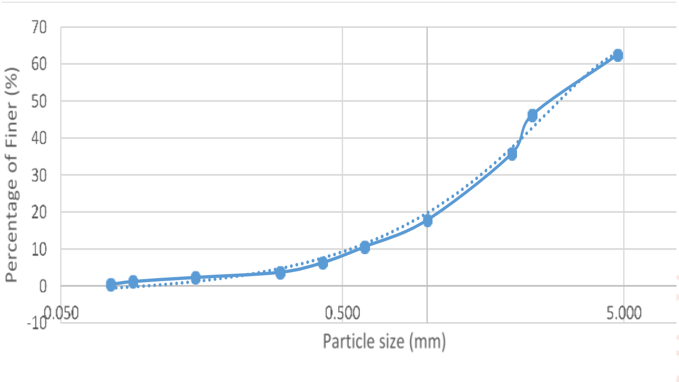


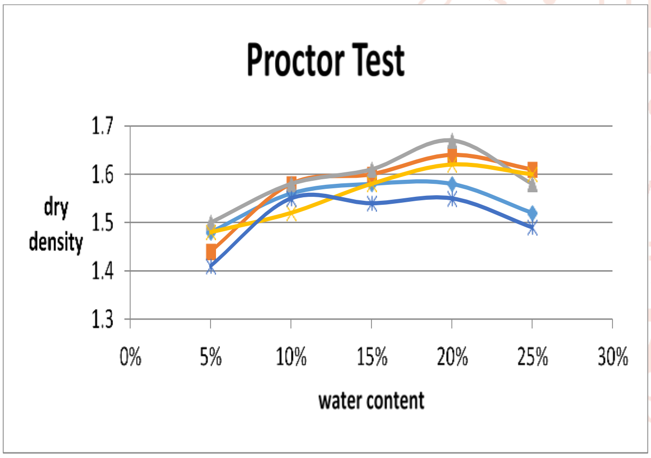
Fig -3 Schematic Representation of Samples prepared

Table-4 Sieve Analysis:

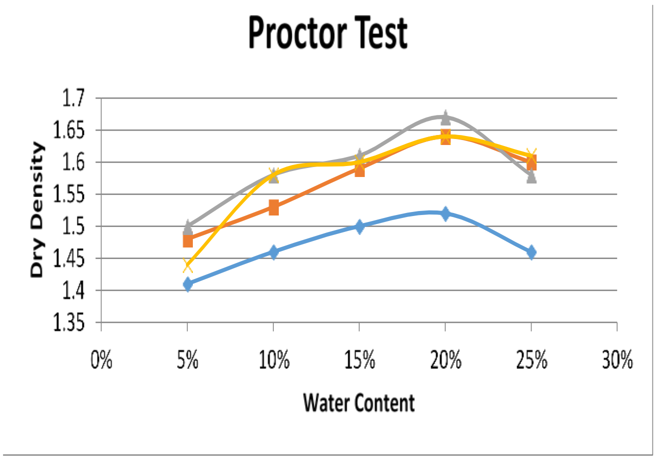
IS Sieve	Weight Retained (g)	Percentage Retained (%)	Cumulative Percentage (%)	Percentage of Finer (%)
4.750	375	37.5	37.50	62.5
2.360	163	16.3	53.80	46.2
2.000	104	10.4	64.20	35.8
1.000	180	18	82.20	17.8
0.600	72	7.2	89.40	10.6
0.425	43	4.3	93.70	6.3
0.300	26	2.6	96.30	3.7
0.150	14	1.4	97.70	2.3
0.090	11	1.1	98.80	1.2
0.075	8	0.8	99.60	0.4
PAN	4	0.4	100.00	0



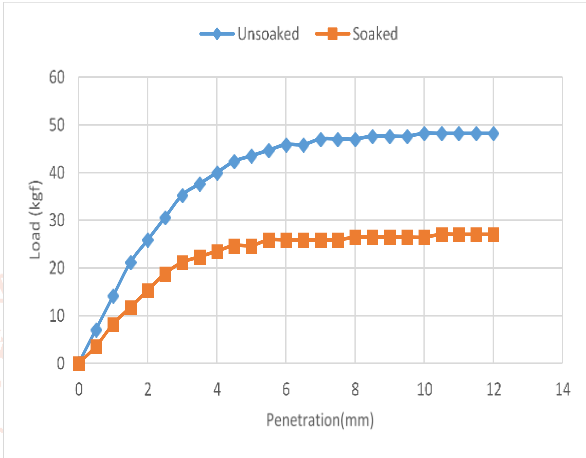
Graph-1 Sieve analysis graph



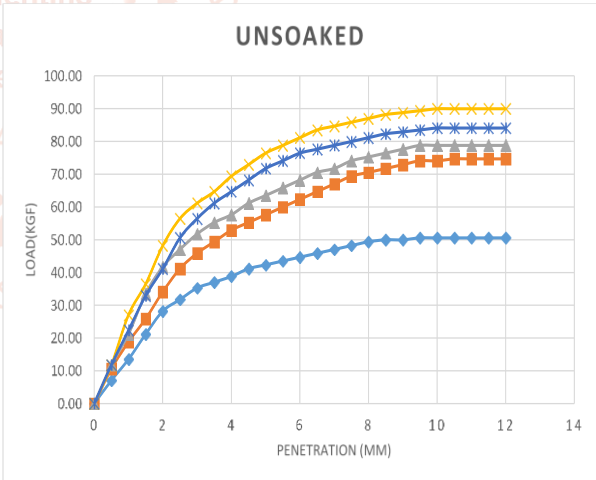
Graph-2 Compaction curves for soil samples With 0%, 5%,10%,15%and 20% of RA



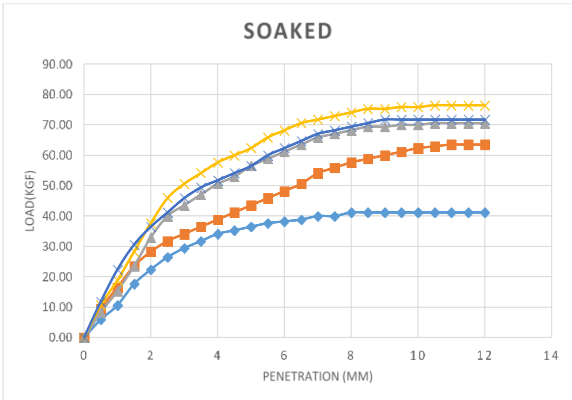
Graph-3 Compaction curves for soil samples with 10% RA at different percentages of FA



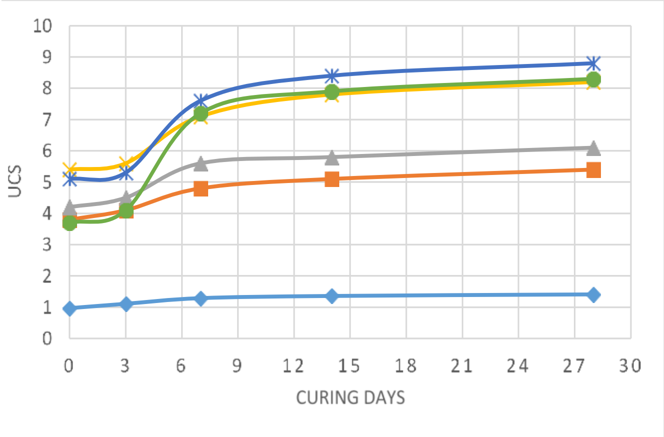
Graph-4 Load Vs Penetration graph for Black Cotton Soil (Unsoaked & Soaked)



Graph-5 Load Vs Penetration graphs of Unsoaked CBR at different percentages of RA & FA



Graph-6 Load Vs Penetration graphs of soaked CBR at different percentages of RA & FA



Graph-7Variation of UCS at different curing periods

CONCLUSIONS

In this study, the major properties studied are OMC, MDD, CBR, UCS, and Consolidation. Based on the all investigations on all samples and when compared with normal soil, following conclusions were made

Compaction Test and CBR Test:

- Maximum dry density was increased with the addition of FA and RA
- When 5%,10%,15%,20% RA added, higher MDD observed for 10% of RA addition
- When FA added, MDD value was increased.
- Both the Unsoaked and soaked condition of CBR were studied and Peak value was obtained at 8% FA addition in both conditions.
- From 0 to 8% addition of FA, CBR value was gradually increased in both unsoaked and soaked condition.
- But, CBR value was decreased after 8% of FA addition (i.e., at 8%)

Unconfined compressive strength:

- UCS was calculated for 0, 3, 7, 14, 28 curing days.
- UCS values are gradually increased 0, 3, 7, 28 curing days for respective addition of FA and RA
- The curing period of mix is a governing parameter as the chemical reaction of stabilizers is depends on it.so it can be concluded that the strength will increase with increase in curing period.
- UCS of treated soils was higher than that of untreated soils.
- UCS value of sample is Increased from 0.97 to 8.8 kg/cm^2

Consolidation Characteristics:

Coefficient of Compressibility, Compression index, Coefficient of Volume change were calculated for all samples. And observed that, there is decrement in all coefficients with addition of FA and RA. i.e., consolidation characteristics are improved through the addition of these additives.

- Addition of combination of FA with RA makes the soil mixes durable, low cost and effective for soil stabilization.
- DFS is greater than 35%, its expansiveness should be considered
- As per Holtz(1969) classified expansive soils based on clay content,
- Based on plasticity Index (%) Swelling potential becomes "Medium"
- As per Chen (1988) classified on expansive soils based on plasticity index (%)
- Based on plasticity Index (%) Swelling potential becomes "High"
- Compression Index (C_C) generally varies from 0.3 to 0.075 for clays
  We get the value of 0.043 that means "Low plastic clayey soil"

REFERENCES:

[1] "Experimental Study on Stabilization of Black Cotton Soil by Fly Ash, Coconut Coir Fiber & Crushed Glass" by Amit Tiwan, H. K. Mahiyar, International Journal of Emerging Technology and Advanced Engineering – IJETAE, ISSN 2250-2459, Volume 4, Issue 11, November 2014, FA.330-333.

[2] "Effect on Strength Characteristics of Expansive Soil Using Sisal Fibre and Waste Materials" by Amrutha Mathew, Dr. Raneesh. K. Y, International Journal of Science and Research – IJSR, ISSN: 2319-7064, Volume 5, Issue 9, September 2016, FA.1702-1707.

[3] "Compressibility Behavior of Black Cotton Soil Admixed with Lime and Rice Husk Ash" by Dr. A. V. Narasimha rao, B. Penchalaiah, Dr. M. Chittranajan, Dr. P. Ramesh, International Journal of Innovative Research in Science, Engineering and Technology – IJIRSET, ISSN: 2319 – 8753, Volume 3, Issue 4, April 2014, FA. 11473 – 11480

[4] "Consolidation Characteristics of Fly Ash and Lime Treated Black Cotton Soil" by Vijayakumar Sureban, Proc. Of International Conference on Recent Trends in Transportation, Environmental and Civil Engineering - TECE, 201, FA. 49 – 52.

[5] Soil Stabilization by using PHOSPOGYPSUM & Fly ash. Divavya Krishnan, V. Jannani, P. T. Ravichandran, R. Annadurai, Manisha gunturi - International journal of engineering trends and technology – volume 9 Nov 14-mar 14

[6] "Experimental study on black cotton soil with calcium carbide residue & baggage ash" Neeraj kumrawat, S. K. ahirwar international journal of engineering sciences & management. ISNN : 2277- 5528

[7] "Experimental study on strength behaviour of expansive soil treated with PHOSPOGYPSUM and Wood ash" Roshini R, Divvya Krishnan K , P. T. Ravichandran) (International journal of Science & Research)

[8] "Foundation on expansive soils" chen FH(1988) Elsevier sciences publishing company, NEWYORK

[9] "Engineering properties of expansive clays" HOLTZ, WG and GIBBS,HJ ,TransASCE121

[10] "Volumetric changes in expansive clay soils and control by lime Treatment," Holtz, WG,(1969) second international Research and engineering conferences on expansive clay soils,PP157-173,Texas A& M Press

[11] "Consolidation Characteristics of Fly Ash and Lime Treated Black Cotton Soil" by Vijayakumar Sureban, Proc. Of International Conference on Recent Trends in Transportation, Environmental and Civil Engineering - TECE, 201, FA. 49 – 52

[12] "Compressibility Behavior of Black Cotton Soil Admixed with Lime and SAW dust Ash"by C. C. ikeagwuani ,Nigerian journal of technology vol 35, no 4 oct 2016

[13] "Compressibility Behavior of Black Cotton Soil Admixed with Lime and Rice husk Ash" by A. O. EBEREMU, H. sada ,Nigerian journal of technology vol 32, no 3 nov 2013

[14] S srikanth. swapan, k das" nature of fire side deposits in a baggage and ground nut shell ash",volume74

[15] Is 2720 (part 8-1980), Indian standard, "methods for test for soils" part 8, determination of water content dry density relation using heavy compaction.