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IMPROVEMENT OF EXPANSIVE SOIL TREATED WITH POND ASH

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Abstract

There is a lot of clay in the broad earth. Lime, iron, magnesium, alumina, and potash make up chemically expanding soil, but they are deficient in nitrogen, phosphorus, and organic matter. They are suitable for growing cotton because they can grip water.This project intended to test various expansive soil properties with pond ash at various percentages of 12%, 24%, 36%, and 48%.On expansive soil samples with varying percentages of pond ash, a series of tests such as the Liquid limit test, Plastic limit test, Standard proctor test, Specific gravity of soil, California Bearing test (CBR), and Unconfined compressive strength are performed. After conducting all of the tests, we discovered that adding pond ash increased the strength of expansive soil by a certain percentage, or 36%, and that as the percentage of pond ash was increased further, the strength of the soil gradually decreased.

Keywords: Expansive soil, Specific gravity, Atterberg's, Dry density, Plasticity index.

Introduction

When building on expansive soils, which are frequently fragile and lack sufficient stability under heavy loading, geotechnical engineers must deal with a number of challenges. Stabilizing the soil is necessary in this respect because doing so enhances its engineering properties. Limited funds are accessible in developing nations like India for network planning and development. To reinforce road surfaces, it is possible to use soil stabilisation to increase the weight-bearing capacity and performance of in situ subsoils, sands, and other waste materials. The main goals of soil stabilisation are to increase the in situ soils' California Bearing Ratio, to enhance on-site materials in order to produce a solid and durable sub base and base courses, and to partially or entirely substitute rare and expensive virgin construction materials that are non-renewable materials. The quantity of waste produced by thermal power plants is increasing. Pondash is the refuse that they generate. They employed landfills known as ponds to stop the discharge of ash into the atmosphere. Wet scrubbers and ash ponds are two air pollution control methods that are used to reduce the amount of airborne pollutants that enter the atmosphere and pose significant health risks to the area around them. In order to lessen its effect on the environment, pond ash produced by ash ponds can be used in geo-technical aspects.

Literature

COAL ASHES IN GEOTECHNICAL ENGINEERING PRACTISE: BENIFICIAL ASPECTS BY A. SRIDHARAN (2012) He covered a number of coal ash properties that can be advantageously used in a variety of geotechnical engineering uses. They consolidate more rapidly, have a higher frictional strength and a higher CBR, are pozzolanic reactive, have a low specific gravity, are compressible, and are water insensitive in terms of compaction traits. They also have a very low possibility for swell and shrink.

INFLUENCE OF POND ASH ON THE BEHAVIOUR OF SOIL: A REVIEW BY GOURAV DHANE, ARVIND KUMAR AGHNIHOTRI, AKASH PRIYADHARSHEE, MANISH YADAV(2014) A short discussion of the effect of pond ash on the behaviour of soil mixed with pond ash was conducted to better utilise industrial waste materials for geotechnical purposes while preserving the ecosystem. Understanding how it affects how the earth functions is essential. It is found that the form and size of the pond ash, particle size distribution, physical properties, chemical constituents, etc. have a significant impact on the mix's geotechnical characteristics.

EFFECT OF COAL ASH IN THE STABILIZATION OF THE EXAPNSIVE SOIL FOR THE PAVEMENT: BY C. RAJ KUMAR, T. MEENAMBAL(2015) Coal ash stabilisation can enhance an extremely expansive soil's properties and toughness. Our research's primary purpose is to find effective ways to use coal ash to reduce the cost of building roads and accomplish research objectives. The amount of coal ash applied reduces the liquid limit and plasticity index. Approximately 1.34 times the original strength of the soil can be added to the CBR. According to the test results, the expansive soil and coal ash mixture reached high strengths at the ideal moisture level and plastic limits. The expansive soil and coal ash mixture becomes strong and non-swelling when 10 to 40 percent of coal ash is added. This mixture can be used as subgrade and in other geotechnical uses.

STABILIZATION OF SOFT CLAY SOIL BY USING POND ASH AND WOVEN GEOTEXTILE: BY K. SANDEEP, P. PARDHASARADHI, ABHAS HUSSAIN, P. SAI TEJA, R. JITHENDRA(2020) The fundamental building characteristics of pond ash and expansive soil are investigated. As the percentage of pond ash rises, the differential free swell indicator falls. The value of the earth is 50% and it has a high degree of expansiveness. From 50% to 17.64%, this level of expansiveness diminishes. This is for clay whose expansiveness diminishes by about 32.36% when 50% pond ash is added to it. It is obvious that adding pond ash causes the dry density to rise and ultimately causes the moisture content to fall. The percentage of pond ash rises from 5.52% to 25.12%, increasing the saturated CBR values of expansive soil.The unsoaked CBR values of expanding soil rise from 7.54% to 25.63% with an increase in pond ash content. The addition of a geo-textile layer can therefore reduce the thickness of the pavement based on this relationship.

A REVIEW ON STUDY OF X RAY DIFFRACTION ON A MIXTURE OF BLACK COTTON SOIL AND POND ASH: BY JAIN VIRAG, PROF. MRS. SV.PAWAR(2021) Black cotton soil currently is an expansive soil that expands when it comes into touch with water. This is the primary cause of the black cotton soil strata's collapse. a distinct region with various black cotton soil varieties and their engineering characteristics. The addition or blending of various admixtures, fibers or stabilising materials can enhance these characteristics. Synthetic and natural fibres are typically used to stabilise the black cotton soil. Jute is a natural fabric, while polyester and polypropylene are synthetic. The goal of this research endeavour is to find ways to enhance the engineering qualities of expansive soil that contains varying amounts of pond ash.

III. Methodology

MATERIALS USED

1. Expansive soil
2. Pond ash

EXPANSIVE SOIL:

Extensive soils are found in many parts of the world, including the USA, South Africa, Australia, Spain, Israel, Myanmar, and India. India refers to these wide soils by their regional names, including Kashmir, Mar, or kabar in Uttar Pradesh and black cotton soils (BC Soil) in Rajasthan. These soils make up between 30 and 40 percent of India's total geographical area.

We currently collected a soil sample from a farmland adjacent to the NAAC building in Pulivendula, which is located 5 kilometres from our institution.

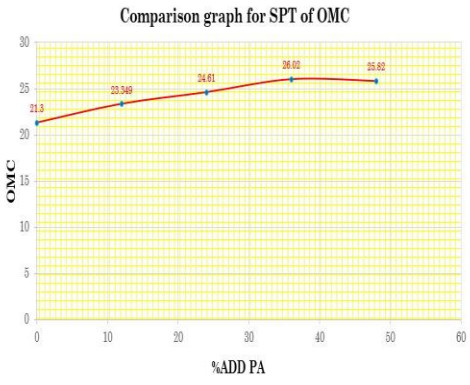
POND ASH:

Pond ash was chosen as an additive to improve the engineering characteristics of the problematic clay. Pond ash may also be referred to as coal ash or surface pond. Fly ash, bottom ash, or both combined in any ratio, transported as a water slurry, and deposited in ponds or lagoons are referred to as pond ash. The size of ash particulates varies from 1 micron to 600 microns. India generated 227 million tonnes of coal ash between 2019 and 2020. (Central Electricity Authority 2020). This massive quantity of industrial waste poses serious risks to the entire world. To be disposed of, these contaminants require a lot of space. We observed that production is considerable compared to its

utilisation. This can be used to balance the debris in geotechnical components like road embankments, subgrades, backfill, and structural material.Currently, we have a sample of pond ash from the Rayalaseema Thermal Power Plant in Yerraguntla, Andhra Pradesh, which is 47 kilometres away from our institution.

Table: 1 PROPERTIES OF EXPANSIVE SOIL:

PARTICULARS	VALUES
Liquid limit	58 %
Plastic limit	35.41%
Plasticity index	22.59%
Specific gravity: Expansive soil Pond ash	 2.48 2..25
Optimum moisture content	21.3%
Maximum dry density	1.46g/cc
CBR @2.5mm	6.1
CBR@ 5.00 mm	5.6
UCS	84.60kN/m^2



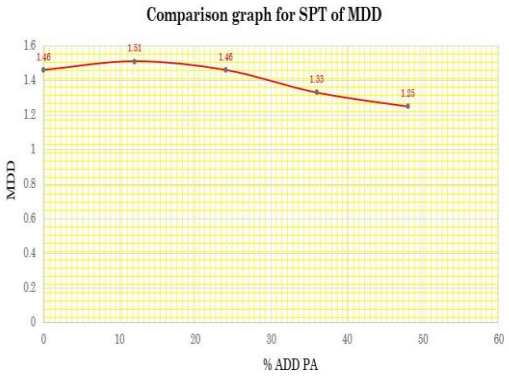


Fig: 1Comparasion of SPT of OMC

Fig: 2Comparasion of SPT of MDD

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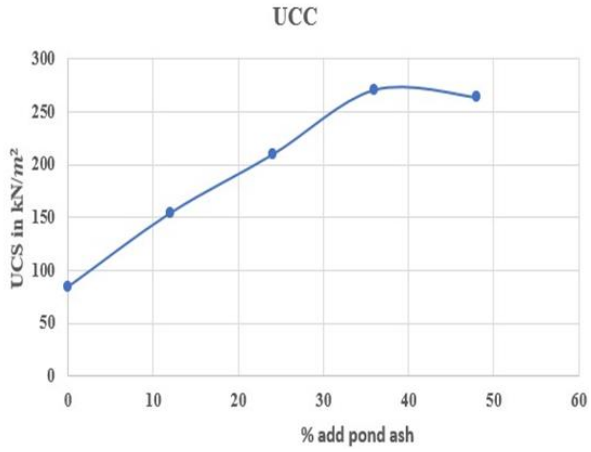

Fig: 3Comparasion of SPT of OMC

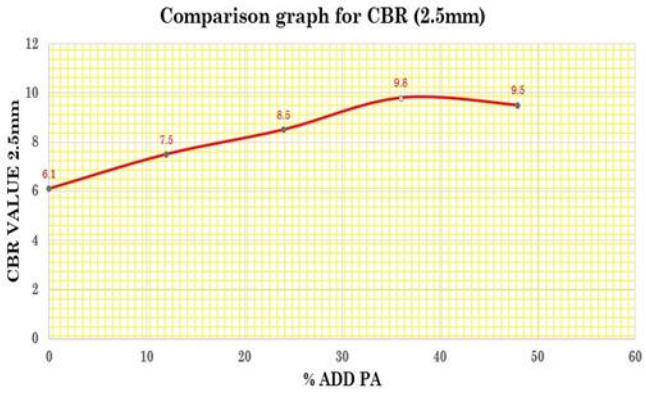

Fig: 4Comparasion of CBR

Table: 2 RESULTS:

S.NO	MATERIAL	OMC%	MDD g/cc	CBR	UCS kN/m^2
1	ES+ 0% pond ash	21.3	1.46	6.1	84.60
2	ES+ 12% pond ash	23.36	1.51	7.5	154.37
3	ES+ 24% pond ash	24.61	1.46	8.5	209.60
4	ES+ 36% pond ash	26.02	1.33	9.8	270.98
5	ES+ 48% pond ash	25.82	1.25	9.5	263.91

IV. Conclusion

The following conclusions were drawn from comparing the results:

- CBR value has risen by 60.6% in comparison to natural soil value.
- The value of UCS has grown by 220% over the value of natural soil.

After doing all these experiments we observed that OMC, CBR and UCS values of expansive soil treated with pond ash up to 36% gives good results and fit for use in our daily life. Any additional pond ash added to expansive soil causes a loss in strength, making it unsuitable for field building.The aforementioned conclusions can be extrapolated to the conclusion that stabilised expansive clay is suitable for use as a subgrade substance for the construction of pavements as well as a variety of building foundations.

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