International Journal of Engineering Sciences & Research Technology

(A Peer Reviewed Online Journal)
Impact Factor: 5.164

IJESRT

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

IJESRT
INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

ASSESSMENT OF THE IMPACT OF AGRICULTURAL SOLID WASTE (BAGSSE ASH) ON THE CHARACTERISTICS OF EXPANSIVE SOIL

Pankaj Kumar Singh[*1], Prof. Mohit Kumar Gupta[2]
*Department of civil Engineering, KNIT Sultanpur, India.

DOI: 10.5281/zenodo.8159285

ABSTRACT

Expansive soils expand when they are wet and contract when they are wet, resulting in a variety of issues and the potential failure of structures built on top of them. Before constructing any structure over expansive soil, an engineer must therefore evaluate and possibly modify its properties. Bagasse Ash, an industrial solid waste, is mixed with expansive soil in this study as an admixture. Most of the time, bagasse ash is deposited in an unscientific and random manner, reducing valuable space and causing numerous geo-environmental issues. The waste bagasse ash is tried to be used in this study. The properties of the soil are examined and the changes in the soil's properties are evaluated at various percentages of Bagasse Ash after the Virgin Expansive Soil is mixed with it. An effort is made to lower the soil's plasticity index and increase the expansive soil's strength.

1. INTRODUCTION

In recent A responsible engineer must assess and evaluate the properties of the soil in order to know its geotechnical and engineering characteristics prior to the construction of any structure. The properties can be modified appropriately using a variety of techniques following the evaluation. Using industrial solid waste bagasse ash, this study attempts to alter the properties of expansive soil.

Expansive soil-

The term "expansive soil" refers to soils that expand in volume when water enters the soil and contract when water is absent. In addition, numerous researchers have demonstrated that swelling and shrinkage follow two distinct mechanisms, and the shrinkage limit generally does not relate to the swelling characteristics of the soil. The variation in volume is dependent on the moisture content. This soil volume change causes significant distress in the soil and severe damage to the structure above it. These soils swell, lose their ability to hold water, and generally become softer at the beginning of the rainy season. In the seasons which are generally dry, these dirts shrivel because of vanishing of water and become more earnestly. The resulting change in volume may be the cause of cracking in the structures that are built on top of it. Based on their liquid limit and plasticity index values, the IS-1498 code has provided a fundamental understanding of the classification of various expansive soils and their expansion characteristics.

Geotechnical engineers typically encounter expansive soils when designing structures like highways, retaining walls, buildings, and backfills. Expansive soils are problematic in nature. In areas that are semi-arid, expansive soils are typically prevalent. The difference between evaporation and precipitation may be the cause.

Numerous researchers have utilized admixtures like lime, bitumen, or cement in a variety of attempts to stabilize expansive soil. Despite the fact that these admixtures are effective in stabilizing; from an economic standpoint, it does not quite fit. Stabilizing expansive soil has been attempted using a variety of inexpensive and readily available materials found in the same region as the problematic soil. To alter the properties of soils, various wastes, whose disposal presents a challenge, are utilized as admixtures.

bagasse ash-

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

When it comes to countries that produce sugar, India comes in second place worldwide. India has one-fifth of the world's sugar industries and produces nearly one-seventh of the world's supply. Bagasse is one of the most significant solid wastes produced during the sugar production process. Bagasse is the fibrous material that remains after the juice from the sugar cane is extracted. The sugar industry in India produces up to 100 MT of bagasse annually. Problems like the loss of valuable industrial space and other geo-environmental issues result from the uneven, random, and unscientific deposition of bagasse. These issues can be avoided and the valuable space of the aforementioned industry saved if solid waste is used correctly to stabilize the expansive soil. Ash, which is used in this study, is produced when the bagasse is burned. In various proportions, the Bagasse ash is used as a replacement; to determine the most significant changes in soil properties, the properties of the mixes and virgin soil are compared and the result is analyzed graphically.

2. LITERATURE REVIEW

A small number of studies have examined the use of bagasse ash as an admixture to alter expansive soil properties. In a few of the studies, in addition to using Bagasse Ash as an admixture to enhance the properties of expansive soil, other waste materials are also incorporated.

According to the findings of an investigation carried out by Akshaya Kumar Sabat (2012), the addition of bagasse ash as an admixture to expansive soil results in an increase in the value of OMC and a decrease in the MDD. The study also found that lime sludge and bagasse ash can be used in an economical way to boost the strength of flexible pavements.

K. S. Gandhi (2012) looked into how bagasse ash affected the properties of expansive soil and found that using bagasse ash decreased the values of the expansive soil's plasticity index and free swell index by 3 to 10%. The study also demonstrated that Bagasse Ash effectively reduces the moisture content of wet soils and increases initial strength, a necessary property for construction projects on unstable or excessively moist ground.

Moses, G., and Osinubi, K. J. (2013) investigated the effect of compactive effort on expansive soil samples that were compacted by Standard Proctor (SP) and treated with up to 8% Ordinary Portland cement (OPC) mixed with up to 8% Bagasse Ash (BA) by dry weight. The best combination, according to the study, was 8 percent OPC and 4 percent BA.

Dr. Prakash Chavan and M.S. Nagakumar (2014) reported that bagasse ash reduced the plasticity index of expansive soil. Additionally, the study has demonstrated that OMC decreases and MDD rises with an increase of up to 9% Bagasse Ash. The same soil's UCS values also increased when the bagasse ash content was 9 percent, according to the study.

According to C. Rajakumar, T. Meenambal, and P. D. Arumairaj (2014), the addition of Coal Ash + Bagasse Ash, Coal Ash + Groundnut Shell Ash, and Bagasse Ash + Groundnut Shell Ash in proportions that are uniform increases the strength of UCC.

The maximum dry density increased by 5.8% at an effective replacement of 6% bagasse ash, according to Amit S. Kharade, Vishal V. Suryavanshi, Bhikaji S. Gujar, and Rohankit R. Deshmukh (2014), who also suggested that the best blend for an economical strategy is the effective replacement of 6% bagasse ash.

3. EXPERIMENTAL INVESTIGATIONS

3.1 scope of work-

The objective is to compare the various geotechnical properties of Virgin Expansive Soil and Bagasse Ash mixtures. In particular, four kinds of mixes were made:

- Virgin Expansive Soil + 4% Bagasse Ash by dry weight of Soil
- Virgin Expansive Soil + 8% Bagasse Ash by dry weight of Soil
- Virgin Expansive Soil + 12% Bagasse Ash by dry weight of Soil
- Virgin Expansive Soil + 16% Bagasse Ash by dry weight of SoilThe following are the laboratory experiments that were carried out:

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

1) Determination of the expansive soil's specific gravity.
2) 2. Determination of the expansive soil grain size distribution
    a. curve.
3) Standard Procter Test determination of the soil sample's
    a. Maximum Dry Density (MDD) and Optimum Moisture Content
    b. (OMC) in various soil-bagasse ash mixtures.
4) The liquid limit of various soil sample and bagasse ash mixes
    a. was determined.
5) The plastic limit of various soil sample and bagasse ash mixes
    a. was determined.
6) Determination of the soil sample's shrinkage limit and various
    a. Soil-bagasse ash mixtures.
7) The Free Swell Index of a variety of soil sample and bagasse
    a. ash mixtures was determined.
8) Assurance of Unconfined Compressive Strength by UCS Trial of soil tests and various blends of soil test and Bagasse Debris. Because bearing capacity tests can't always be done in the field, the UCS test is done. It is more cost-effective to collect the unaffected field sample and measure its strength in the laboratory. It is easy to conduct UCS tests on both an undisturbed and remoulded sample when selecting a suitable material for embankment construction. Divide the compressive strength by 2 to determine the shear strength.

Materials

A lot of soil: A lot of soil came from Satna(MP), India. The sample was taken from the ground 150 mm below the surface. The sample was collected using manual labour. The packed soil was transported by train to the study location.

Bagasse: The bagasse came from Ambedkar Nagar(UP). The bagasse was taken from the field where layers of bagasse ash had been dumped. Roadways were used to transport the collected and packed Bagasse to the study location.

preparation of sample-

The example was first forgotten about to dry in touch with direct daylight and the hunks present were broken to accomplish consistency of the example. Small pieces of debris and other organic waste were removed from the

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

sample. After that, the sample was oven-dried for 24 hours at 105^0 C. The image below shows a sample of the expansive soil.

4. RESULTS

On Virgin Expansive Soil and various mixes described in section 3.1, various tests were carried out. The test results are listed below in the order in which they were replaced by the dry weight of soil by the percentage of bagasse ash.

VIRGIN EXPANSIVE SOIL

Specific Gravity

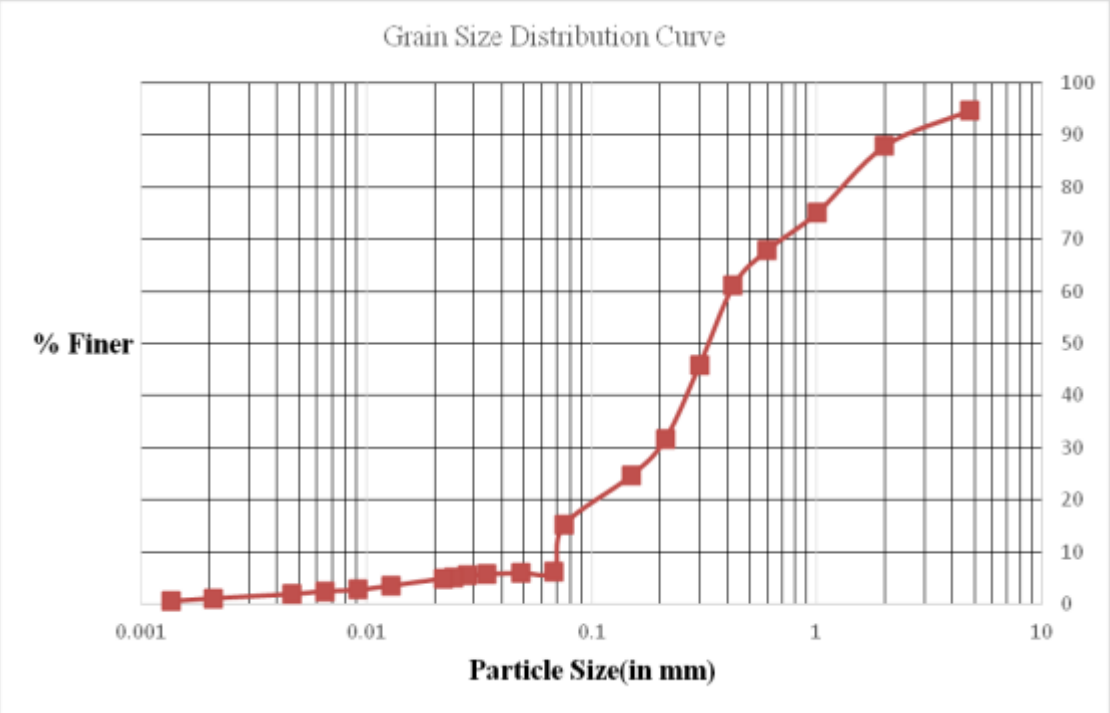
The specific gravity of the Virgin Expansive Soil was found out to be 2.61.

Free Swelling Index

The free swelling index of the soil was found out to be 33.33%.

Grain size distribution

Dry sieve analysis was done with sieves of sizes 4.75mm, 2mm, 1mm, 0.6mm, 0.425mm, 0.3mm, 0.212mm, 0.15mm, 0.075mm respectively.



Grain size distribution curve

5. CONCLUSION

Atterberg limits, plasticity index, and UCS values were examined for various changes as a result of the addition of Bagasse Ash to Expansive Soil at various replacements—4 percent, 8 percent, 12 percent, and 16 percent—for a range of properties.

The following conclusions were reached based on the current study.

The minimum plasticity index was obtained at a replacement of 16% Bagasse Ash, and the plasticity of the expansive soil was decreased by the addition of Bagasse Ash.

The minimum liquid limit was reached by replacing 8 percent of the bagasse with ash.

The maximum plastic limit value was reached by replacing 16 percent of the ash with bagasse.

The addition of Bagasse Ash as a substitute results in a decrease in the MDD value.

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

The addition of Bagasse Ash as a substitute raises the OMC value.
It was discovered that the UCS value increased up to a replacement of 8 percent of Bagasse ash and decreased thereafter.

In a broader sense, if Bagasse Ash is used as a substitute on expansive soils; It can solve a number of geo-environmental issues that are arising as a result of its deposition, save the sugar industry valuable space, and the expansive soil can also be modified appropriately.

REFERENCE

1. Gandhi, K. S. (2012): Expansive Soil Stabilization Using Bagasse Ash, International Journal of Engineering Research & Technology (IJERT), Vol.1, Issue 5.
2. Moses, G and Osinubi, K. J. (2013): Influence of Compactive Efforts on Cement- Bagasse Ash Treatment of Expansive Black Cotton Soil, World Academy of Science, Engineering and Technology, Vol. 7.
3. Sabat, A.K., Pati, S. (2014): A Review of Literature on Stabilization of Expansive Soil Using Solid Wastes, EJGE, Vol. 19 [2014], Bund. U.
4. Kharade, A. S., Suryavanshi, V. V., Gujar, B. S., Deshmukh, R. R. (2014): Waste product 'Bagasse Ash' from sugar industry can be used as stabilizing material for expansive soils, IJRET: International Journal of Research in Engineering and Technology, Volume: 03, Issue: 03.
5. C. Rajakumar, T. Meenambal, and P. D. Arumairaj (2014): California bearing ratio of expansive subgrade stabilized with waste materials, International Journal of Advanced Structures and Geotechnical Engineering ISSN 2319-5347, Vol. 03, No. 01.
6. Amit S. Kharade, Vishal V. Suryavanshi, Bhikaji S. Gujar, Rohankit R. Deshmukh (2014): Waste Product 'Bagasse Ash' From Sugar Industry can be used as Stabilizing Material for Expansive Soils, IJRET: International Journal of Research in Engineering and Technology eISSN: 2319-1163 | pISSN: 2321-7308 Volume: 03 Issue: 03.
7. Prakash Chavan and Dr.M.S.Nagakumar (2014): STUDIES ON SOIL STABILIZATION BY USING BAGASSE ASH, International Journal of Scientific Research Engineering & Technology (IJSRET) ISSN: 2278–0882.