JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

STABILISATION OF BLACK COTTON SOIL USING 20% MARBLE STONE SLURRY WITH WOODEN SAW DUST ASH

[1]Muske Sai Krishna, [2]A. Naresh, [3]K. Keerthana, [4]M. Sagar, [5] M. Rani

[1]Asst. Professor, [2345]Student
[1]Department of Civil Engineering
[1]Jyothishmathi Institute of Technology and Science (Autonomous), Karimnagar, India

Abstract: *Black Cotton soil is expansive soil which expands when it contacts with water. This is the major reason of failure of black cotton soil strata and soil strata may be improved by different types of admixtures. The different areas having different types of black cotton soil and its engineering properties. In this research paper, the engineering properties of black cotton soil is tried to improve by using wooden saw dust with 20% Marble stone slurry in this research, the 20% Marble stone slurry is mixed with different percentage of wooden saw dust in black cotton soil. The engineering parameters are also determined by conducting tests for 20% Marble stone slurry with black cotton soil mix specimen. For stabilization of black cotton soil with 20% Marble stone slurry, the Atterberg's limits (Liquid Limit, Plastic Limit, Plasticity Index), standard proctor test and unconfined compressive strength test are conducted but with different percentage of wooden saw dust.*

Index Tems – Atterberg Limits, Maximum Dry Density, Optimum Moisture Content, Unified Compressive strength,Saw Dust Ash, Marble Stone Slurry.

I.INTRODUCTION

Expansive soil is one of the most prevalent and problematic soil deposits in India, which poses significant challenges in nature. It shows either an enormous increase or decrease in volume, attributing to severe damages on structures built on such soils. The idea of strengthening soil masses through the incorporation of certain types Fiber utilization has been a common practice among ancient societies, where they would incorporate soil blended with straw or other accessible fiber to enhance its quality. In terms of building materials, the endurance and robustness of the dried brick have been observed over the years. Slurry waste, which results from stone production plants, has been created and poses considerable environmental consequences. The wooden sawdust can be utilized with varying proportions, ranging from 2.5% to 12.5%.

The laboratory tests are conducted for determining the engineering properties of black cotton soil with fibre and Marble stone slurry. The main objective of this work is to investigate the possibility of improving engineering properties of black cotton soil by using Marble stone slurry.

II. LITERATURE REVIEW

Numerous researchers have conducted investigations on black cotton soil to explore approaches for its stabilization. Previously, numerous researchers have conducted research to address the stabilization of black cotton soil. Stone dust and wooden sawdust are used as various types of admixtures. Numerous informative sources have discussed this in detail. The research conducted on the subject matter, specifically focusing on stabilizing black cotton soil, has been thoroughly reviewed. This review encompasses various aspects and findings related to the stability of the soil. The paragraphs that follow present various literary works.

Sukanya Sharma et.al. (2021) examined the stabilization of expansive soil through an experimental study.

Highly expansive soils possess a significant capacity for expansion due to the presence of a mixture of sawdust and marble dust. Surface cracks can occur as a result of the phenomenon of shrinking or swelling.

Openings that occur in the dry season are primarily influenced by the varying strength of expansive soils.

Moisture content and significant volume changes make it unsuitable for construction purposes. The soil sample underwent CBR, UCS, and standard proctor tests to fulfil its purpose. the soil sample mixed with 2-10% sawdust and 2-15% marble dust powder. The UCS value is increased by 2.12% on the addition of 10% marble dust and 4.78% at 20% of marble dust. OMC was decreased by addition SDA in varying percentages. MDD was

decreased with addition of SDA. The C.B.R. value of black cotton soil improves considerably to 10.16% on 6% Sawdust content. Based on the inquiry, it is possible to conclude. After careful investigation, it was determined that sawdust possesses the ability to alter the properties of expansive materials. The black-cotton soil with clay-like properties can be modified to make it suitable for various geotechnical applications. The addition of marble dust will result in an increase in both durability and strength.

Vignesh et.al (2019) Stabilization of Clay Soil using Polypropylene and Saw Dust Ash. This paper explains about a stabilization of clay soil using polypropylene and saw dust. The ratio of the mix will be on adding polypropylene as (0%, 10%, 15%) and saw dust ash as (0%, 10%, 15%) and CBR is done with the un-soaked conditions test was performed based on the addition of (10% 15%) of polypropylene andthe sawdust ash also. When the additive polypropylene is added to it the CBR value increased. So based on the respective results, quality of soil is increasing from bad condition to excellent condition based on CBR test values.

Er. Jitendra khatti, et al. (2018) designed the flexible pavement by black Cotton soil and 15% Kota stone slurry with wooden saw dust. Their main objective was to study the behavior of strength gain in BC soil using process of 15% Kota stone slurry with wooden saw dust stabilization. The different tests they conducted were specific gravity, sieve analysis, Atterberg limits, standard proctor test, California bearing ratio(soaked) for natural soil as well as soil admixed with stabilizers at different percentages.

III. EXPERIMENTAL INVESTIGATIONS

Various such as Atterberg's limit (liquid limit and plastic limit), OMC and MDD, UCS, etc tests have been performed to find out the engineering properties of black cotton soil as well as soil with 20% Marble stone slurry and varied percentage of saw dust ash. The percentage of Marble stone slurry is 20% and saw dust ash may have varied from 5% to 15% at 5% interval.

3.1 Material Used

- Black Cotton Soil – About 100 kg of soil sample for the present work was collected from saidapur, Karimnagar.
- Marble Stone Slurry –stone slurry for the present work was obtained from Marble stone industry, Karimnagar.
- Wooden Saw Dust – Wooden industry, Karimnagar.

Engineering Properties of Soil, Marble Stone Slurry and Saw dust ash

The following engineering properties are determined for black cotton soil and 20% Marble stone slurry and varied per. of SDA by the laboratory experiments as shown in Table 3.1.

3.2 Atterberg Limits:

Table 3.1 Consistency Limits of Black Cotton Soil and Marble Stone Slurry and Saw Dust ash

Test Specimen	Liquid Limit (%)	Plastic Limit (%)	Shrinkage Limit (%)
Black Cotton Soil (BCS)	37.6%	24.62%	18.72%
BCS+20% MSS+5% SDA	48.3%	15.26%	8.68%
BCS+20% MSS+10% SDA	56%	19.54%	15.31%
BCS+20% MSS+15% SDA	49.5%	21.3%	2.53%

3.3 Standard Proctor Test

The purpose of conducting tests is to determine the highest level of dry density and the ideal moisture content for a mixture specimen. The mix specimen is prepared by different percentage of wooden saw dust with 20% Marble stone slurry in black cotton soil. The analysis outcomes of the blended sample are presented in Table 3.2, demonstrating the properties of cotton soil.

Table 3.2 MDD and OMC for Black Cotton Soil and Marble Stone Slurry and Saw Dust ash

Test Specimen	MDD (g/cm^3)	OMC (%)
Black Cotton Soil (BCS)	1.73	17.3
BCS+20% MSS+5% SDA	1.84	9
BCS+20% MSS+10% SDA	1.76	15
BCS+20% MSS+15% SDA	1.69	17.5

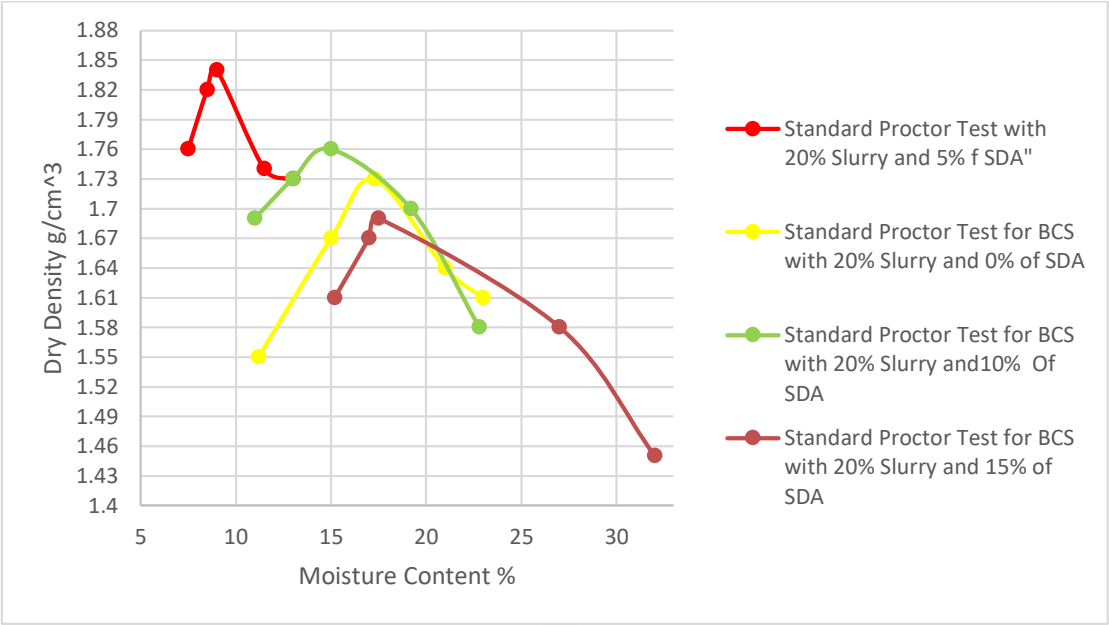

Fig. 3.1 Standard proctor test results of black cotton soil with 20% of MSS and varied percentage of SDA

From fig. 3.1, it shows that the red curve is having MDD and OMC, 1.84 g/cm3 and 9.0% respectively for 20% Marble stone slurry with 5% SDA black cotton soil mix specimen. When 10% dust is added in black cotton soil and 20% Marble stone slurry mix specimen, the maximum dry density decreases from 1.84 g/cm3 to 1.76 g/cm3 shown in yellow curve. But when the percentage of dust further increases from 10.0% to 15.0%, the MDD decreases 1.76 g/cm3. Same as in case of OMC, the OMC increases with increasing the percentage of dust in mix specimen from 9.0% to 15.0% with 5% and 10% SDA.

3.4 Unconfined Compressive Strength

The purpose of conducting this test is to ascertain the shear strength characteristic of clay and a slurry composed of 20% Marble stone slurry & Varied per. of SDA. The proportion of sawdust derived from wood in cylindrical specimens was measured and calculated to determine the axial loading of the unconfined compressive strength (UCS). The test findings are displayed in Table 3.3.

Table 3.3: Unconfined compressive test on black cotton soil with varying per. of SDA and 20% Marble stone slurry

Particulars	UCS Test Values (KPa)
Black Cotton Soil (BCS)	87
BCS+20% MSS+5% SDA	103
BCS+20% MSS+10% SDA	126
BCS+20% MSS+15% SDA	169

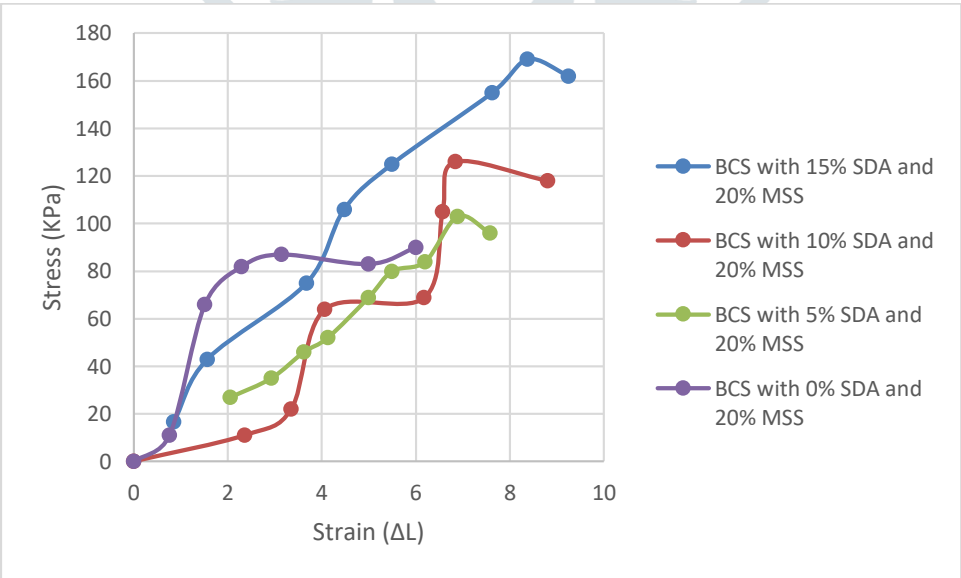

Fig. 3.1 Unconfined Compressive Strength of test black cotton soil with 20% of MSS and varied percentage of SDA.

- The soil's shear strength was determined to be 82 kilopascals when tested in isolation.
- The soil's shear strength was determined to be 103 Kpa, 126 Kpa, and 169 Kpa when 5%, 10%, and 15% SDA + 20% stone slurry were added by weight, respectively.

- The highest UCS (Unconfined Compressive Strength) is attained when using a combination of 15% SDA (Stone Dust Ash) and 20% stone slurry. This value increases by approximately 34.12%, 64%, and 106.09% when no SDA is used, 5% SDA is used, and 10% SDA is used, respectively.

IV. DISCUSSIONS ON TEST RESULTS

The behavior of black cotton soil undergoes changes as a result of the addition of Marble stone slurry and wooden sawdust. The influence of Marble stone slurry on the soil is significant. The medium plasticity of black cotton soil can be attributed to it being an inorganic clay with low plasticity material. The dry density and optimal moisture content of Marble stone slurry & SDA increases with increase of 5% of SDA.But decreases with increase of 10% and 15% of SDA.

The density of the 20% Marble stone slurry & 5% SDA is determined to be 1.84 g/cm3, with an Adde. Hence the maximum dry density and optimum moisture content of a composite sample consisting of 20% MSS with 5% SDA BCS.

The shear strength is also increased with increasing the percentage of wooden saw dust in 20% MSS and black cotton soil mix specimen. The maximum shear strength is observed for black cotton soil with 20% Marble stone slurry and 15 % dust mix specimen, which is 169 KPa. When 5% dust is added in 20% MSS with black cotton soil mix specimen, the value is 39% decreased form 20% Marble stone slurry mix specimen.

V. CONCLUSIONS

- Black cotton soil experiences a transition from the Intermediate Compressibility (CI) state to the Low Compressibility (CL) state when exposed to Marble stone slurry, which is a low plasticity material.
- The highest level of MDD achieved is 1.84 g/cm3, which was obtained using 5.0% SDA and 20% Marble stone slurry at 9.0% optimal water content.
- The percentage increase in maximum dry density is 6.35%, 4.53%, and 8.37% for different combinations of SDA and Marble stone slurry, compared to the reference values of 0.0% SDA & 20% Marble stone slurry, 10% SDA & 20% Marble stone slurry, and 15.0% SDA &20% Marble stone slurry, respectively.
- The highest level of shear strength recorded was 169 Kpa, which was achieved with a combination of 15% SDA and 20% Marble stone slurry. This represents an increase of 106.9%, 64%, and 34.12% compared to 0.0% SDA and 20% Marble stone slurry, 5.0% SDA and 20% Marble stone slurry, and 10% SDA and 20% Marble stone slurry, respectively.

REFERENCES

[1] Sukanya Sharma, Kalpana Verma & J. K. Sharma, Experimental Study of Stabilization of Expansive Soil Mixed with Sawdust and Marble Dust.
[2] S. Bharathi, B. Hari prasad, S.N. Gautham, A. Farzi Arafat, Stabilization of Black Cotton Soil Using Polypropylene Fibre, 2018 IJCRT, Volume 6, Issue 2 April 2018, ISSN: 2320-2882.
[3] Er. Amit Kumar Jangid, Er. Jitendra Khatti, Dr. Ajay Bindlish, Stabilization of Black Cotton Soil By 15% Kota Stone Slurry With Wooden Saw Dust, IJARSE, Volume 7, Issue 2 January 2018, ISSN:2319-8354.
[4] Dr. K. R. Arora, Soil Mechanics and Foundation Engineering, Standard Publications, New Delhi.
[5] Indian Standard Code: IS 1498 – 1970, Classification and identification of soils for general engineering purposes (first revision).
[6] Indian Standard Code: IS 2720 (Part 5) – 1985, Determination of liquid limit and plastic limit (second revision).
[7] Indian Standard Code: IS 2720 (Part 7) – 1980, Determination of water content, dry density relation using light compaction (second revision).
[8] Indian Standard Code: IS 2720 (Part 10) – 1973, Determination of unconfined compressive strength (first revision).