**National Journal of Multidisciplinary Research and Development**
**ISSN: 2455-9040**
**Impact Factor: RJIF 5.22**
**www.nationaljournals.com**
**Volume 3; Issue 1; January 2018; Page No. 1048-1052**

# Misuse product 'bagasse ash' from sugar industry can be utilized as stabilizing material for expansive soils

**Er. Sumit Sharingi, Er. Pooja Rajora, Er. Manik Badhwar**
Assistant Professor Department of Civil Engineering, Vedant College of Engineering & Technology, Bundi, Rajasthan, India

**Abstract**
Soil is a base of structure, which really underpins the structure from underneath and disseminates the heap successfully. In the event that the strength of the dirt isn't satisfactory then disappointment of structure happens in type of settlement, splits and so forth. Far reaching soil otherwise called dark cotton soil is more in charge of such circumstances and this is because of quality of montmorillonite mineral in it, which has capacity to experience extensive swelling and shrinkage. To beat this, properties of soil must be enhanced by simulated means known as 'Soil Stabilization'. It is a system which extemporizes at least one soil properties by mechanical, establishing and compound utilize. Numerous examination has been led for adjustment of soil by utilizing establishing, concoction materials e.g. Fly powder, bond, Calcium chloride, Sodium chloride and so on. Lackey world is confronting major issue of transfer of horticultural waste. Western Maharashtra is well known for creation of sugar stick in extensive amount. Sugar manufacturing plants produces squander after extraction of sugar stick in machines that waste when consumed, the resultant fiery debris is known as 'Bagasse Ash'. It is a sinewy material with nearness of silica (SiO2) and can be utilized to enhance the current properties of dark cotton soil. In this investigation research facility tests were led on dark cotton soil with incomplete substitution by Bagasse Ash (3%, 6%, 9% and 12%). This paper features huge increment in properties of dark cotton soil got at 6% substitution of Bagasse Ash with no compound or establishing material.

**Keywords:** bagasse ash, black cotton soil, unconfined compressive strength, MDD, soil stabilization, CBR

## 1. Introduction
The establishment of a building or street is a fundamental part for compelling transmission of load to the subsoil display underneath it. The nature of soil has huge effect on sort of structure and its outline. The extensive soils are cases of feeble soils, which experienced in establishment designing for spans, roadways, structures, banks and so forth. Far reaching soil experiences volume changes when they interact with water. They indicate substitute swelling and shrinkage properties. It extends amid stormy season and psychologists amid summer season. Broad soil covers almost 20% of the land mass in Indian. In Maharashtra area the extensive soils are recognized by name „Black Cotton‟ soil. These dirts have frail properties because of quality of mud minerals known as “Montmorillonite”. Run of the mill conduct of soil comes about into disappointment of structure in type of settlements breaks and so on. Thusly it is vital to evacuate the current weal soil and supplanted it with a non sweeping soil or enhances the properties of frail soil by adjustment. Soil adjustment is a strategy in which existing properties of soil are enhanced by methods for expansion of establishing materials or chemicals. One of the more typical strategies for adjustment incorporates the blending of normal coarse grained soil and fine grained soil to get a blend that creates satisfactory inner erosion and attachment and in this manner gives a material that is workable amid situation. Adjustment of soil can be done by utilizing mechanical adjustment, solidifying adjustment and concoction adjustment. Reworking of soil particles by some of mechanical compaction is alluded as„ Mechanical Stabilization‟, utilization of solidifying material, for example, concrete, lime, bitumen/black-top and so forth is added to soil is „Cementing Stabilization‟ and utilization of chemicals in soil, for example, calcium chloride; sodium chloride and so on is „Chemical Stabilization‟. Today, world faces a major issue in arranging the extensive amount of agrarian waste. The transfer of rural waste without legitimate consideration makes affect on natural wellbeing. It exasperates biological community, causes air contamination, water contamination and so forth. The designers need to take challenge for safe transfer of horticultural waste. This examination embraces utilization of horticultural waste in balancing out dark cotton soil, different endeavors have been made to enhance the quality of soil utilizing distinctive compound added substances in mix with lime and concrete, yet explore work needs to concentrate more on utilization of less expensive and locally accessible material.

Bagasse fiery remains is a stringy material acquired from sugar stick plant after the extraction of sugar stick juice. Sugar production line squander bagasse is utilized as bio fuel and in assembling of paper. Sugar industry produces 30% bagasse for each part of pounded sugar stick, when this bagasse is singed the resultant fiery remains is known as „Bagasse Ash‟. Bagasse demonstrates the nearness of shapeless silica, which means that pozolonic properties, mindful in holding the dirt grains together for better shear quality. The utilization of bagasse fiery debris as balancing out material for dark cotton soil can be checked under different tests, for example, standard delegate test, unconfined pressure test, California bearing proportion, aterbergs confine etc.

### 1.1 Objectives of study

1. To use agricultural waste bagasse ash as a stabilizing material and to solve the problem of waste disposal.
2. To evaluate the strength characteristics of black cotton soil for different proportions of bagasse ash in replacement of 3%, 6%, 9% and 12%.
3. To study the results of replacement and concentration on future use.

### 1.2 Requirement of soil stabilization

The primary prerequisite of soil adjustment is satisfactory quality and it relies upon character of soil. If there should arise an occurrence of cohessionless soils the quality could be enhanced by furnishing repression or by including union with an establishing or restricting operator. If there should arise an occurrence of firm soil the quality could be expanded by drying, making soil dampness safe, changing the earth electrolyte focus, expanding union with a solidifying operator and including frictional properties. Dark cotton soil swells amid stormy season and therapists amid summer season. This substitute swelling and shrinkage makes breaks operating at a profit cotton soil. These shrinkage breaks are 100 mm to 150 mm wide and 0.5 to 2 m profound. Swelling makes upward weight on structure and shrinkage makes descending draw. It comes about into breaks or harm in the establishments.

#### 1.2.1 Black Cotton Soil

Dark cotton soil is the Indian name given to the broad soil store in the focal piece of the nation. Dark cotton Soil is a leftover soil, which have been shaped from basalt or trap and contain the earth mineral montmorillonite that causes extreme swelling and shrinkage qualities of the dirt. The swelling conduct of the dirt would depend to a great extent on the sort of mud minerals that are available in these dirts and extents in which they are available. The swelling and shrinkage of the dark cotton soil can prompt harm the establishments of the structures and street asphalts. This outcomes in trouble of develop of establishment on such soil, so this dirt needs exceptional care. This dirt produces inordinate settlement of the establishment because of high compressibility. So it is essential to enhance the geotechnical properties of the dark cotton soil.

#### 1.2.2 Bagasse Ash

Bagasse is a buildup got from the consuming of bagasse in sugar delivering production lines. Bagasse is the cell sinewy waste item after the extraction of the sugar juice from stick factories. It is as of now utilized as a bio fuel and in the make of mash and paper items and building materials. For every 10 tons of sugarcane smashed, a sugar industrial facility delivers almost 3 tons of wet bagasse which is a result of the sugar stick industry. At the point when this bagasse is singed the resultant slag is bagasse fiery remains. Western Maharashtra is having greatest number of sugar industrial facilities, these production lines faces a transfer issue of huge amount bagasse. The powerful use of these waste items is a testing assignment for a specialist through prudent and ecological effect. This material contains indistinct silica which is sign of establishing properties, which can grow great holding between soil grains in the event of powerless soil.

## 2. Literature Review

Numerous analysts endeavor to balance out the dark cotton soil with utilization of cementious materials and farming waste as a blend; here we talk about some of works in view of utilization of bagasse Ash which utilized as a part of mix with bond or some other material. M. Chittaranjan, M. Vijay, D. Keerthi contemplated the 'Horticultural squanders as soil stabilizers'. In this investigation Agricultural squanders, for example, sugar stick bagasse fiery debris, rice husk cinder and groundnut shell powder are utilized to settle the powerless sub review soil. The feeble sub review soil is treated with the over three squanders independently at 0%, 3%, 6%, 9%,12%and 15% and CBR test is completed for each per penny. The consequences of these tests demonstrated change in CBR esteem with the expansion in level of waste.

## 3. Laboratory set up

### 3.1 Material Collection

#### 3.1.1 Black Cotton Soil

The black cotton soil was gathered from East zone of Kodoli, Tal-Hatkanangle, Dist-Kolhapur, Maharashtra (INDIA), close,, Patil Mala", by utilizing system of bothered testing. Fig. 1 demonstrates the area and Fig. 2 indicates test of gathered dark cotton soil. The research facility tests are directed on unadulterated dark cotton soil in semi strong state and there comes about are appeared in Fig 1.

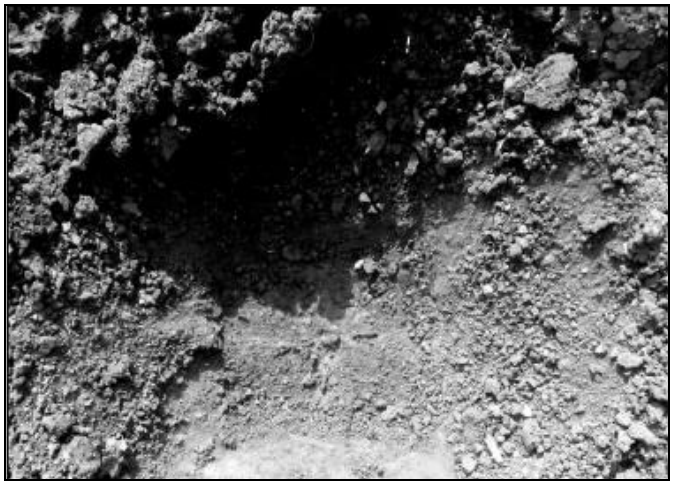

**Fig 1:** Sampling of BC soil on location

#### 3.1.2 Bagasse Ash

The bagasse fiery debris was gathered from,, Tatyasaheb Kore Sugar Factory Pvt. Ltd, Warananagar, Tal – Panhala, Dist – Kolhapur, close TKIET College. The Fig. 3 demonstrates the bagasse test. The synthetic properties of bagasse powder were acquired and appeared in table 2. The research center test comes about on bagasse fiery debris are as take after, Color – Black Specific gravity – 1.306.

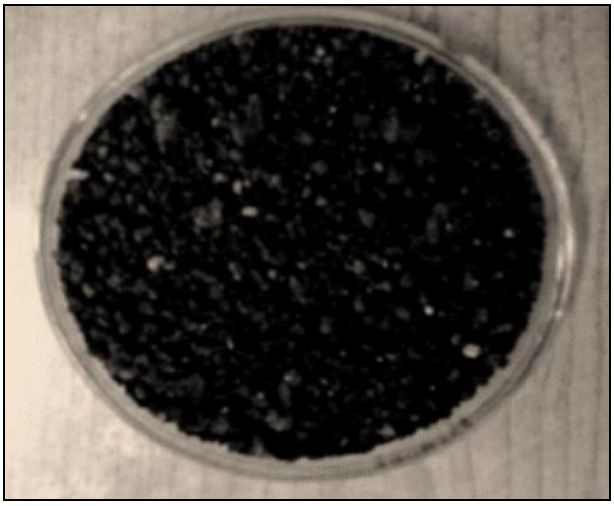

**Fig 2:** Collected black cotton soil sample

**Table 1:** Laboratory evaluated properties of pure black cotton soil

| Sr. No | Description of Properties | Obtained Results in Laboratory |
|---|---|---|
| 1. | Colour | Grey-Black |
| 2. | Specific gravity | 2.57 |
| 3. | Water content (w) | 28.35% |
| 4. | Liquid Limit (WL) | 75% |
| 5. | Plastic Limit (Wp) | 30.58% |
| 6. | Shrinkage Limit (Ws) | 19.25% |
| 7. | Plasticity Index (Ip) | 44.42% |
| 8. | Consistency Index (Ic) | 1.05 |
| 9. | Liquidity Index (IL) | -0.05 |
| 10. | Maximum dry density (KN/m3) | 1.305 |
| 11. | Optimum moisture content (OMC) | 30.50% |
| 12. | Unconfined compressive strength (KN/m2) | 138.58 |
| 13. | California bearing ratio (CBR) | 12.88 |

**Table 2:** Chemical properties of bagasse ash

| Sr. No | Description of Properties | Percentage (%) |
|---|---|---|
| 1. | Silica (SiO2) | 64.38 |
| 2. | Magnesium (MgO) | 0.85 |
| 3. | Calcium (CaO) | 10.26 |
| 4. | Iron (Fe2O3) | 4.56 |
| 5. | Sodium (Na2O) | 1.05 |
| 6. | Potassium (K2O) | 3.57 |
| 7. | Alumina (Al2O3) | 11.67 |

## 4. Methodology

Fundamental research center tests (Attenberg‟s restrict, compaction, CBR, UCC) were completed on dark cotton soil test, and on blend of soil and bagasse fiery remains to decide the essential properties of soil test.

- Then the adjustment of dark cotton soil with bagasse is completed by mixing the dirt with various rates of bagasse fiery remains (3%, 6%, 9% and 12%) and after that ideal level of bagasse Ash can be included have decided.
- To decide the quality conduct of dark cotton soil with bagasse slag squander, the lab tests (compaction, California bearing proportion, unconfined compressive quality) are conveyed.
- The quality tests are done on every level of mixes. By getting the aftereffects of every one of these mixes the correlation of the best appropriate added substance blend will be completed.

### 4.1 Sample Preparation

Gathered soil test is first dried in coordinate daylight; the hunks are broken to get a uniform example. The natural issues, little totals, broken wooden material, bits of glasses are expelled precisely from soil test. Test is kept in broiler for drying to use in test at temperature 105 C for 24 hrs. The readied test is then utilized for the test determined in 3.2. The heaviness of soil test taken for test is supplanted by level of weight of bagasse fiery remains. Four unique mixes are set up for substitution of soil in changing extent of (3%, 6%, 9% and 12%)

## 5. Results and Discussions

1. The underlying research center aftereffects of dark cotton soil test appeared, soil is a strong or solid (as consistency record is more than 1 and Liquidity file is under zero), Ic = 1.05 and IL = - 0.05
2. Gathered dark cotton soil is exceedingly plastic (as pliancy file more than 17), Ip=44.42
3. The consequences of Attenberg‟s confine, standard delegate test, unconfined pressure test and California bearing proportion test are arranged in table 1with reference to IS
4. Particular gravity of bagasse powder is observed to be less (1.306), this might be because of its stringy nature and light in weight.

   Consequences of mix in chose extents are organized in graphical introduction

### 5.1 Results of MDD and OMC for black cotton soil stabilized with bagasse ash

**Table 3:** Results of MDD and OMC

| % Replacement | Pure Black Cotton Soil | | Black cotton soil + % Bagasse ash | |
|---|---|---|---|---|
| | MDD | OMC | MDD | OMC |
| 0 | 1.305 | 30.50% | Nil | Nil |
| 3 | - | - | 1.34 | 35.05% |
| 6 | - | - | 1.38 | 34.50% |
| 9 | - | - | 1.29 | 28.10% |
| 12 | - | - | 1.23 | 27.40& |

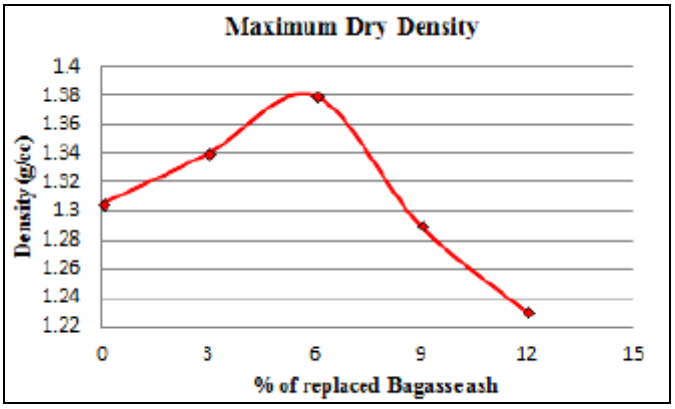


**Fig 4:** Maximum dry density variations with % replacement of Bagasse ash

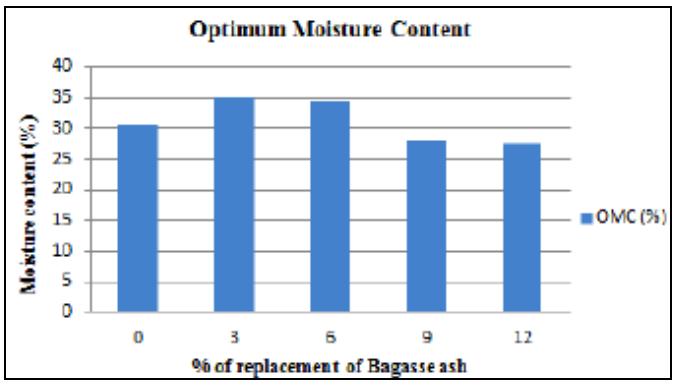


**Fig 5:** Variation in optimum moisture content

Change in the greatest dry thickness was watched gradually for 3% and 6% substitution of bagasse slag, yet then after further increment in mix MDD diminishes. This reduction might be because of low particular gravity bagasse fiery debris replaces higher particular gravity soil and it is sinewy in nature. It was watched that as % of bagasse slag builds the ideal dampness content abatements.

## 6. Conclusions

The utilization of rural waste somewhat enhances the properties of broad soils, bagasse can be utilized as substitution in dark cotton soil up as far as possible. The properties which enhances are talked about here,

1. The underlying research facility test demonstrated that gathered dark cotton soil is strong and hardened. It has low penetrability, high compressibility and low bearing limit.
2. The viable rate substitution of bagasse slag was observed to be 6%
3. The outcomes enhanced at 6% substitution are as per the following – The most extreme dry thickness expanded by 5.8%, California bearing proportion (CBR) expanded by 41.52% and Compressive quality increment by 43.58%
4. The perceptions demonstrated that, because of expansion of bagasse fiery remains CBR and Compressive quality increments nearly by 40%, however thickness indicates just noteworthy change.
5. The mix proposed from this exploration is Black cotton soil + 6% substitution by bagasse cinder, with no expansion of establishing or compound material, this would be a monetary approach
6. Assist progressively if any solidifying material is included recommended mix, at that point there will be certainly more act of spontaneity in properties of extensive soils.

## 7. References


1. Suksun Horpibulsuk, Chayakrit Phetchuay, Avirut Chinkulkijniwat. Soil Stabilization by Calcium carbide Residue and Fly Ash Journal of materials in civil engineering February, at ASCE. 2012, 184-193.
2. Amaia Lisbona, Inigo Vegas, Javier Ainchil3 and Carolina Ríos, Soil Stabilization with Calcined Paper Sludge: Laboratory and Field Tests Journal of Materials in civil engineering at ASCE, 2012, 666- 673.
3. Ramesh HN, Manoj Krishna KV, Mamatha HV. Compaction and strength behavior of limecoir fiber treated Black Cotton soil Geomechanics and Engineering. 2010; 2(1):19-28.
4. Mgangira MB. Evaluation of the effects of enzyme-based liquid chemical stabilizers on subgrade soils, CSIR, 2009.
5. Shenbaga Kaniraj R, Gayathri V. Permeability and Consolidation Characteristics of Compacted Fly Ash, J Eenery Engineering at ASCE. 2004; 130:18-43.
6. Kiran RG, Kiran L. Analysis of strength characteristics of Black cotton soil using Bagasse ash and additives as stabilizer, IJERT, Laboratory Study, Unpublished MSc. Thesis, Virginia: Virginia Polytechnic Institute and State University, 2013, 7.
7. Chusilp N, Likhitsripaiboon N, Jaturapitakkul C. Development of bagasse ash as a pozzolanic material in concrete. Asian Journal on Energy and Environment, 2009, 10(3).
8. Ken Onyelowe C. Cement Stabilized Akwuete Lateritic Soil and the Use of Bagasse Ash as Admixture International Journal of Science and Engineering Investigations, 2012, 1(2).
9. Kiran RG, Kiran L. Analysis of Strength Characteristics of Black Cotton Soil Using Bagasse Ash and Additives as Stabilizer International Journal of Engineering Research & Technology, 2013, 7.
10. Kolawole Juwunlo Osinubi. Influence of Compactive Efforts on Lime-Slag Treated Tropical Black Clay Journal of Materials in Civil Engineering. 2006; 18(2):175-181.
11. Chittaranjan M, Vijay M, Keerthi D. Agricultural wastes as soil stabilizers International Journal of Earth Sciences and Engineering. 2011; 04(06):50-51.
12. Manasseh Joel, Isaac O Agbede. Mechanical Cement Stabilization of Laterite for Use as Flexible Pavement Material, Journal of Materials in Civil Engineering. 2011; 23(2):146-152.
13. Udayashankar D, Hakari SC, Puranik. Stabilization of Black Cotton Soils Using Fly Ash, Hubballi-Dharwad Municipal Corporation Area, Karnataka, India, 2012, 12(2).
14. Ramana Murty V, Praveen GV. Use of Chemically Stabilized Soil as Cushion Material below Light Weight Structures Founded on Expansive Soils American Society

for Civil Engineering. 2008; 20(5):392-400.
15. William Orts J, Aicardo Roa-Espinosa, Robert Sojka E, *et al*. Use of Synthetic Polymers and Biopolymers for Soil Stabilization in Agricultural, Construction, and Military Applications, American Society for Civil Engineering. 2007; 19(1):58-66.
16. Dr. Purushothamaraj P. Ground Improvement Techniques 2nd edition, University Science Press Publication, Imprint of Laxmi Publication Pvt. Ltd, Delhi, 1999.
17. Gopal Ranjan, Rao ASR. Basic and Applied Soil mechanics 2nd edition, New Age International (P) Ltd Publisher, Delhi, 2000.
18. Dr. Punmia BC, Ashok Kumar Jain, Dr. Arun Kumar Jain. Soil Mechanics and Foundation Engineering 16th edition, Laxmi Publication Pvt. Ltd, Delhi [22]. IS 2720, 1999, III-IV-V-VI-VII-X).