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# "Investigation on Strength Characteristics of Black Cotton Soil and Laterite Soil Stabilization by using Corn Stalk Ash"

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**Abstract -** *Soil is important in each and every field. I'm using two types of soils which are lateritic soiland black cotton soil. Black cotton soil is more helpful in growing of agricultural crops. Itsclayey type of soil this soils swells and shrinks easily. It has low bearing capacity so, the black cotton soil are weak in structurally. The black cotton soil is collected from Marur field, Tq. Bhalki, Dist. Bidar at a depth of 1m. Laterite soil is good for structurally. This soil is collected from Kardyal field, Tq.Bhalki, Dist. Bidar at a depth of 1.5m and in this anothermaterial is used as corn stalk which is collected from Marur field and this is burnt to obtained as a corn stalk ash, it is easily available in field. It has good pozzolana and silica materials. This material is helpful for the construction work.*

*There are two types of soils are taken in an different proportions which is 50%L.S+50%B.C.Soil, 60%L.S+40%B.C.Soil, and 40%L.S+60%B.C.Soil conducted the compaction test, obtained the moisture content and dry density reading. After that prepared the UCS soil specimen without adding admixtures in that gives 60%L.S+40%B.C.Soil gives high value of compressive strength. Similarly, L.S+ 6%CSA, L.S+ 12%CSA, B.C+ 6%CSA, B.C+ 12%CSA, 50%L.S+ 50%B.C+ 6%CSA, 50%L.S+ 50%B.C+ 12%CSA, 60%L.S+ 40%B.C+ 6%CSA, 60%L.S+ 40%B.C+ 12%CSA, 40%L.S+ 60%B.C+ 6%CSA, 40%L.S+ 60%B.C+ 12%CSA, taken all these proportions an compaction test from this obtained moisture content and dry density values prepared the UCS specimens without period of curing and also prepared with aperiod of curing such as 3, 7, & 14days. In this 60%L.S+40%B.C.Soil+12%CSA with 7th day period of curing is obtained high value of compressive strength compare to the other addition of corn stalk ash content and also the moisture content is decreased, dry density values Increased.*

***Key Words*: Laterite soil, Black cotton soil, CSA-Corn Stalk Ash, pozzolana &UCS etc,.**

## 1. INTRODUCTION

The black soil is more often found in India. This soil contains more minerals, so it is helpful for growing of agricultural crops. The black cotton soil is rich in carbonates of calcium and magnesium. It`s a clayey type of soil and this soil swells when it got moisture and shrinks when it dries. The black soils are weak structurally so, this soil is improved by adding the some useful stabilizers to increase the strength property of the soil.

Laterite soils are highly weathered soils, commonly found in hot and wet tropical regions and these are porous, red or rusty in appearance, clay type of soil. This soil is rich in aluminum and iron. These soils are acidic in nature, poor in nitrogen and lime and have low water retention capacity so therefore it is not suitable for cultivation. But structurally it is good.

Maize/corn is one of the most important cereal crop & having wider adaptability to varying climatic condition, it posses highest yield potential. The byproduct of maize like corn stalks can be taken and burnt to get ash and this ash has high retention capacity of nutrients, so it makes better raw material by addition of corn stalk ash to the soil, geotechnical properties can be improved by stabilizing the soil.

We have taken two types of soil for my experimental purpose that is black cotton soil and laterite soil in different proportions and addition of corn stalk ash to that in varying concentrations for stabilizing the soil. Lab tests like water/moisture content, Atterberg limits, compressive strength, specific gravity test & compaction tests has been performed for the improvement of bearing stability and strength of both the soils.

### OBJECTIVES OF THESTUDY

- Knowing the physical property of black cotton soil.
- To assess physical property of the laterite soil.

- Determining change in compressive strength properties of Black cotton soil & lateritic soil by the addition of different percent's of corn stalk ash as 3%, 6%, 9%, and 12% respectively.

- Assessing the optimum/appropriate content of corn stalk ash (CSA) for achieving the more strength of stabilized soil.

## 2. MATERIALS

In these experimental study materials like black cotton soil, lateritic soil and corn stalk ash were used. The samples are collected from Marur field, Bhalki (TQ), Bidar (Dist.) at the depth of 1 meter

Fig -1: Black cotton soil Fig -2: Laterite soil

Fig -3: corn Stalk Ash

## 3. METHODS

### Sample preparation

In this experimental work there are three kinds of soil samples has taken as 50% of B.C.Soil+50% L.S, 60% of B.C.Soil+40%L.S, 40%B.C.Soil+60%L.Sare

And preparing UCS specimen and kept for a period of curing 3, 7,14days respectively. Likewise for the addition of corn stalk ash to the soil by varying percent's as 3,6,9,12 and preparing the UCS specimens and kept for a curing period of 3,7,14days respectively.

## 4. RESULTS ANDDISCUSSION

To determine the compaction and compressive strength of soil with different % of corn stalk ash. The following test to be conducted

Table -1 Properties of soil samples

| Sl. No | Properties | Black cotton soil | Laterite soil |
|---|---|---|---|
| 1 | Specific gravity | 2.58 | 2.52 |
| 2 | Moisture content (%) | 24.2 | 15.0 |
| 3 | Atterbergs limits<br>Liquid limit (%) Plastic limit (%) Plasticity index(%)<br>Shrinkage limit(%) | <br>65<br>36.5<br>27.2<br>8.16 | <br>33.8<br>14.5<br>18.2<br>21.2 |
| 4 | Color | Black | Red |
| 5 | Classification | CH | MH |
| 6 | MDD (g/cc) | 1.45 | 1.52 |
| 7 | OMC (%) | 24 | 18 |
| 8 | UCS (Kg/sq.cm) | 0.64 | 2.8 |

**Compaction test results of Black cotton soil, Laterite soil and Corn stalk ash.**

Table-2 Compaction values of soil

| S.No. | Combination of soils | OMC(%) | MDD(g/cc) |
|---|---|---|---|
| 1 | Black cotton soil | 23 | 1.48 |
| 2 | Laterite soil | 18 | 1.54 |
| 3 | 50% B.C.Soil + 50% L.S | 25 | 1.55 |
| 4 | 60% B.C.Soil +40% L.S | 24 | 1.52 |
| 5 | 40% B.C Soil +60% L.S | 26 | 1.57 |

Table -3: compaction value of soils with Corn stalk ash

| Combination of soils with corn stalk ash | OMC(%) | MDD(%) |
|---|---|---|
| L.S.Soil+3%CSA | 18 | 1.54 |
| L.S.Soil+6%CSA | 19 | 1.56 |
| L.S.Soil+9%CSA | 17 | 1.58 |
| L.S.Soil+12%CSA | 20 | 1.55 |
| B.C.Soil+3%CSA | 26 | 1.50 |
| B.C.Soil+6%CSA | 21 | 1.56 |
| B.C.Soil+9%CSA | 24.2 | 1.47 |
| B.C.Soil+12%CSA | 23 | 1.44 |
| 50%L.S.Soil+50%B.C.Soil+3%CSA | 21 | 1.52 |
| 50%L.S.Soil+50%B.C.Soil+6%CSA | 23.2 | 1.54 |
| 50%L.S.Soil+50%B.C.Soil+9%CSA | 15 | 1.58 |
| 50%L.S.Soil+50%B.C.Soil+12%CSA | 24 | 1.48 |
| 60%L.S.Soil+40%B.C.Soil+3%CSA | 23.4 | 1.59 |
| 60%L.S.Soil+40%B.C.Soil+6%CSA | 20 | 1.50 |
| 60%L.S.Soil+40%B.C.Soil+9%CSA | 14 | 1.65 |
| 60%L.S.Soil+40%B.C.Soil+12%CSA | 22 | 1.56 |
| 40%L.S.Soil+60%B.C.Soil+3%CSA | 25.2 | 1.58 |
| 40%L.S.Soil+60%B.C.Soil+6%CSA | 20 | 1.64 |
| 40%L.S.Soil+60%B.C.Soil+9%CSA | 23 | 1.54 |
| 40%L.S.Soil+60%B.C.Soil+12%CSA | 27 | 1.52 |

**Compressive Strength test results of Laterite soil and Black cotton soil without period of curing.**

Table-4 Compressive strength values of soils

| Properties of soils | UCS(kg/cm$^2$) |
|---|---|
| Laterite soil | 2.6 |
| Black cotton soil | 0.68 |
| 50%L.S+50%B.C.Soil | 1.25 |
| 60%L.S+40%B.C.Soil | 1.62 |
| 40%L.S+60%B.C.Soil | 1.35 |

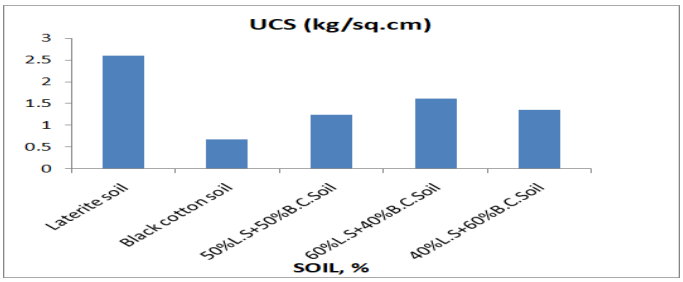


Figure -4 Compressive strength graph for L.S, B.C. Soil, 50%L.S+50%B.C. Soil, 60%L.S+40%B.C. Soil, 40%L.S+60%B.C. Soil.

Above fig. shows the compressive strength for L.S, B.C.S, 50%L.S+50%B.C.S, 60%L.S+40%B.C,

40%L.S+60%B.C.Soil, in this laterite soil is showing high value of compressive strength compared to the other soil.

**Compressive strength test results of Back cotton soil, laterite soil and corn stalk ash with period of curing 14days.**

Table-4 Compressive strength values of soil with corn stalk ash

| Proportions of soil with CSA | UCS(kg/cm$^2$) |
|---|---|
| L.S+3%CSA | 6.0 |
| L.S+6%CSA | 6.5 |
| L.S+9%CSA | 13.1 |
| L.S+12%CSA | 12.8 |
| B.C+3%CSA | 2.44 |
| B.C+6%CSA | 4.60 |
| B.C+9%CSA | 3.80 |
| B.C+12%CSA | 3.60 |
| 50%L.S+50%B.C+3%CSA | 4.84 |
| 50%L.S+50%B.C+6%CSA | 5.4 |
| 50%L.S+50%B.C+9%CSA | 8.8 |
| 50%L.S+50%B.C+12%CSA | 8.4 |
| 60%L.S+40%B.C+3%CSA | 9.2 |
| 60%L.S+40%B.C+6%CSA | 9.6 |
| 60%L.S+40%B.C+9%CSA | 9.8 |
| 60%L.S+40%B.C+12%CSA | 8.5 |
| 40%L.S+60%B.C+3%CSA | 6.5 |
| 40%L.S+60%B.C+6%CSA | 7.6 |
| 40%L.S+60%B.C+9%CSA | 7.2 |
| 40%L.S+60%B.C+12%CSA | 6.8 |

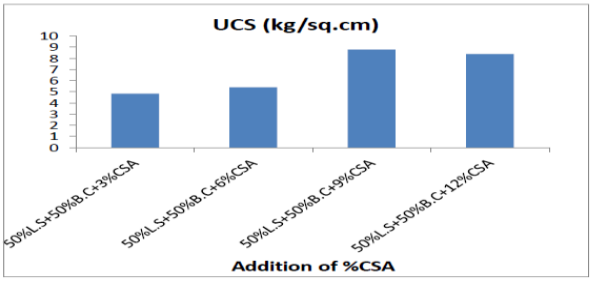


Fig-5 Compressive strength of soil L.S with (3%,6%,9%,12%)CSA

In above fig. compressive strength of soil is increased at L.S+9%CSA and then decreased as increasing CSA value

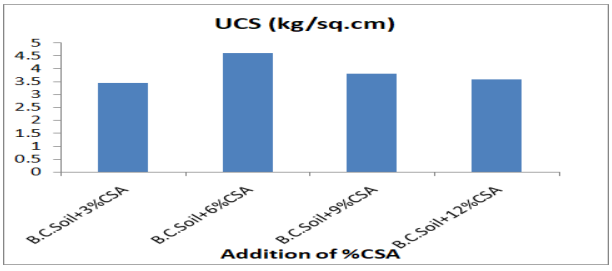


Fig-6 Compressive strength of soil B.C. Soil with (3%,6%,9%,12%)CSA.

In above fig. shows compressive strength of soil is increased at B.C+6%CSA and then decrease by increasing value of CSA.

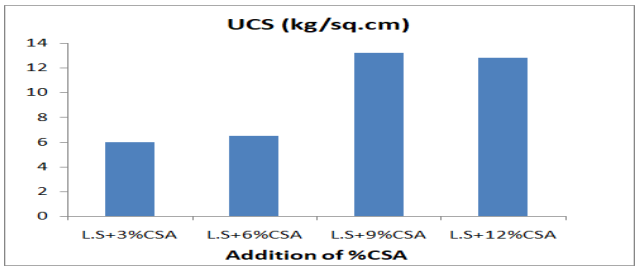


Fig-7 Compressive strength of soil 50%L.S+50%B.C with (3%,6%,9%,12)CSA.

In above fig. shows compressive strength of soil is increased at 50%L.S+50%B.C+9%CSA and then decreased.

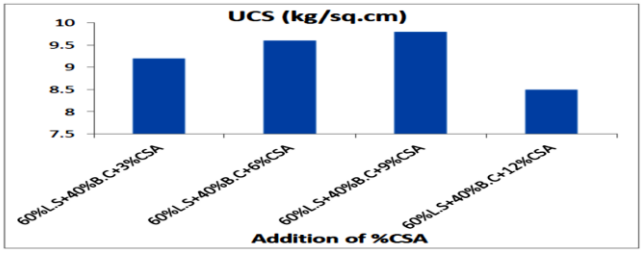


Fig.-8Compressive strength of soil 60%L.S+40%B.C with (3%,6%,9%,12)CSA.

In above fig. shows compressive strength of soil is increased at 60%L.S+40%B.C+9%CSA and then decrease

## 5. CONCLUSIONS

1. For treating the laterite soil with corn stalk ash, for the 9% corn stalk ash, reduced the moisture/water content & increase in dry density by comparing with lateritic soil.

2. For Black cotton soil is treated with corn stalk ash(CSA), for about 6% corn stalk ash, the water/moisture content is reduced and increasing in dry density as comparing with the black cotton soil.

3. For combination of 50% laterite soil, 50% black cotton soil and the 9% corn stalk ash, the moisture/water content is reduced and increase in maximum dry density (MDD).

4. By combining of 60% laterite soil, 40% Black cotton soil (BCS) and 9% corn stalk ash (CSA), the optimum moisture content is reduced and max.dry density (MDD) increased.

5. For combination of 40% laterite soil, 60% black cottony soil and 6% corn stalk ash (CSA), the optimum moisture content (OMC) is reduced and max.dry density(MDD)

6. In addition of laterite soil with % of corn stalk ash content increasing as increased the LL, PL, and PI of the soil, from a corn stalk ash value of o to9%.

7. For a combination of 60% laterite soil, 40% black cotton soil with 9% corn stalk ash, the compressive strength is high value compared to other combination for without period of curing.

8. Increasing the % of corn stalk ash to the soil which increased in the compressive strength of soil for a period of curing 7days compared to 3days and 14day.

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