INVESTIGATION ON UTILIZATION OF SUGARCANE FIBRE ON SOIL SAMPLE

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ABSTRACT

In this Research the effect of sugarcane bagasse fibres on strength properties of soil sample have been investigating. This study is oriented towards improving the strength of soil by using locally available agricultural fibers to reduce the construction cost.

In generally sugarcane fibres are waste material hence by this project we are utilizing these fibres inside the soil sample to improve bearing capacity of soil sample. In our study an attempt is made to stabilize lateratic soil with addition of sugarcane fibre. The strength parameters like CBR, is determined to know the suitability of material.

Keywords: CBR, Index Properties, Lateratic Soil, Sugarcane.

I. INTRODUCTION

Soil is very important in civil engineering construction. The poor engineering property of local soil provides difficulties for construction and therefore its need to improve their engineering properties. These include soil replacement, preloading, and chemical stabilization. Soils are may classify different types (sandy, silty, loamy, and peaty, clay, chalky) in this present study, we considered lateratic soil; and by using sugarcane fibers to improve the strength of soil. This study was oriented towards improving the strength of soil by using locally available agricultural fibers to reduce the construction cost.

1.1 Objectives

1) To use agricultural waste, sugarcane fibre as a stabilizing material and to solve the problem of waste disposal.
2) Utilizing sugarcane fibre inside soil sample to improve bearing capacity of soil sample.
3) Improving the CBR value of stabilized soil sample.

II. LITERATURE REVIEW


In this paper, the fibres are extracted from the bagasse. Bagasse is mainly composed of an outer rind and inner pith. Rind, which mainly consists of fibres, can be separated lignin by alkali treatment. In this process the samples were kept in hot water at around 90°C for the removal of colouring materials and sugar traces. The sample were then dried under the sunlight. Finally samples were subjected to chemical extraction. In this process samples were treated with 0.1N NaOH solution at boiling water temperature for 4 hrs. This may leads to effective separation of fibres. The well separated fibres were then dried.


In this paper the effects of sugarcane bagasse fibres on the strength properties of soil blocks have been investigated. The addition of fibre to the soil blocks, which could be attributed to the low density of fibre. This means that blocks are used for building houses.

In this paper, sugarcane straw ash is used at varying percentage and at varying curing periods to stabilize the soil. The maximum CBR value is obtain for 10% addition of SA and decreases with the further increases in percentages of SA. The swelling index found to be zero 10% addition of SA. The optimum percentage of straw ash (SA) to be used as soil stabilizer is found to be 10 % having a curing period of 7 days.

III. MATERIALS & METHODS

For every research in civil engineering it is important to study materials and methodology required for research. Following are the materials which are briefly explained below.

3.1 Lateratic soil

![Fig.3.1 Lateratic soil](image)

Lateratic soil is used in this projects. Lateratic soils rusty colour iron and aluminium rich rock like appearing soil that gets formed due to prolonged weathering of the parent rocks mainly in humid and hot tropical areas.

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Laterite has commonly been referred to as a soil type as well as being a rock type. This and further variation in the modes of conceptualizing about laterite (e.g. also as a complete weathering profile or theory about weathering) has led to calls for the term to be abandoned altogether. At least a few researchers specializing in regolith development have considered that hopeless confusion has evolved around the name.

Characteristics:
- Lateratic soil is rich in iron and aluminium content.
- Formed in hot and wet tropical areas of the country.
- Is formed under the chemical weathering due to weather changes.
- Usually poor in line, potash and magnesium contents.

3.2 Sugarcane fibre

The sugarcane fibre is major by-product of sugarcane industry. Sugarcane fibre one of the largest cellulose based on agro-industrial by-products and fibrous residue left after the sugarcane is crushed in the factories of the sugar and alcohol industry, and is widely available renewable source. About 54 million tonnes of dry sugarcane fibre (bagasse) is produce annually through out the world. Sugarcane is natural plant fibre, which is collect from the sugarcane plant. Mainly sugarcane fibre is called "bagasse Bagasse is the fibrous material that remains after sugarcane are crushed to extract their juice from sugarcane. It is dry pulp residue left after the extraction of juice from sugarcane.

![Fig.3.2 Sugarcane fibre](image)
Characteristics of sugarcane fibres

- **Crystallinity**: between 63% - 68%
- **Fibrefineness**: according to maturity level
- **Moisture absorption**: 13% - 18%
- **Elastic recovery**: 50% - 60%
- **Torsional rigidity**: varies between maturity level
- **Flexural rigidity**: 0.015 gm/cm² – 0.032 gm/cm²

**Advantages**:

1. Made from agricultural waste.
2. Low cost.
3. Biodegradable
4. Comparatively high tensile strength.
5. High impact strength
6. Weight is low.
7. Easily available.

### 3.3 Pre-treatment process

The sample were subjected to hot water treatment. In this process the samples were kept in hot water at around 90°C for the removal of colouring materials and sugar traces.

The sample were then dried under the sunlight. Finally samples were subjected to chemical extraction. In this process samples were treated with 0.1N NaOH solution at boiling water temperature for 4 hrs. This may leads to effective separation of fibres. The well separated fibres were then dried.

### 3.4 Compaction test

This method covers the determination of the relationship between the moisture content and density of soils compacted in a mould of a given size with a 2.5kg rammer dropped from a height of 30cm.

**Apparatus**

- Proctor mould having a capacity of 944cc with an internal diameter of 10.2 cm and a height of 11.6 cm. The mould shall have a detachable collar assembly and a detachable base plate. A rammer having a 5.08 cm diameter face and a weight of 2.5 kg. The rammershall be equipped with a suitable arrangement to control the height of drop to a free fall of 30 cm.

### 3.5 CBR test

CBR test done on the lateritic soil with adding sugarcane fibre and without sugarcane fibre.

The apparatus consist of cylindrical mould of 150 mm inside diameter and 175 mm in height. Itis provided with a detachable metal extension collar 50 mm in height and a detachable perforated base plate 10 mm thick. A circular metal spacer disc 148 mm in diameter and 47.7 mm in height is also provided. A standard metal rammer (IS:9198-1979) is used for compaction for preparing remoulded specimens. One annular metal weight and several slotted weights weighing 24.5 N (2.5kg) each (147 mm in diameter with a central hole 53 mm in diameter) are used for providing the necessary surcharge pressure.

A metal penetration plunger, 50 mm in diameter and not less than 100 mm long, is used for penetrating the specimen in the mould. If it is necessary to use a plunger of greater length, a suitable extension rod may be used. Dial gauges reading to 0.01 mm are used to record the penetration.
Preparation of sample

![Fig.3.3 Soil sample with addition of Sugarcane fibre](image)

Take about 4 kg of soil and mix with the 15% of water. Fix the extension collar and the base plate to the mould. Insert the spacer disc over the base. Place the filter paper on the top the spacer disc. Compact the mix soil in the mould using light compaction. For light compaction, compact the soil in 3 equal layers, each layers being given 56 blows by the 2.6 kg rammer remove the collar and trim off soil. Turn the mould upside down and remove the base plate and the displacer disc. Weight the mould with compacted soil (collar side) and clamp the perforated base plate on to it.

3.6 Procedure for test

Place the mould assembly with the surcharge weights on the penetration test machine. Seat the penetration piston at the center of the specimen with full contact of the piston on the sample is established. Set the stress and strain dial gauge to read zero. Apply the load on the piston so that the penetration rate is about 1.25 mm/min. Records the load readings at penetrations of 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 7.5,10 and 12.5mm. Note the maximum load and corresponding penetration if it occurs for a penetration less than 12.5 mm.

The California bearing Ratio Test is presentation test ment for the evaluation of subgrade strength of road and pavements. C.B.R Test may conducted in remoulded or undisturbed sample. Test consist of causing cylindrical plunger of 50 mm diameter. To penetrate a pavement component material at 1.25 mm/min. The load for 2.5 mm and 5 mm are recorded. This load expressed as a percentage of standard load value at respective deformation level to obtain C.B.R value.

IV. RESULT & DISCUSSION

4.1 Compaction test

Observation:
Diameter of mould- 10cm
Height of mould- 12.7cm
Volume of mould- 1000cc
Weight of mould- 1.952kg

Observation table

<table>
<thead>
<tr>
<th>Trail No</th>
<th>Water content</th>
<th>Wt. of mould + soil</th>
<th>Bulk density</th>
<th>Dry density</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8%</td>
<td>3.21</td>
<td>1.25</td>
<td>1.16</td>
</tr>
<tr>
<td>2</td>
<td>10%</td>
<td>3.29</td>
<td>1.33</td>
<td>1.22</td>
</tr>
<tr>
<td>3</td>
<td>12%</td>
<td>3.334</td>
<td>1.38</td>
<td>1.23</td>
</tr>
<tr>
<td>4</td>
<td>14%</td>
<td>3.45</td>
<td>1.49</td>
<td>1.31</td>
</tr>
<tr>
<td>5</td>
<td>16%</td>
<td>3.5</td>
<td>1.54</td>
<td>1.33</td>
</tr>
</tbody>
</table>
From Graph

Result:

OMC=18%
MDD=1.5 gm/cc

- Graph showing Compaction test with addition of sugarcane fibre

Fig. 4.1 MDD-OMC Compaction graph

Fig. 4.2 Graph showing Compaction test with addition of sugarcane fibre
Table 4.2 CBR value without sugarcane fibre

<table>
<thead>
<tr>
<th>Sr.No</th>
<th>2.5 mm penetration</th>
<th>5 mm penetration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>28.11%</td>
<td>28.16%</td>
</tr>
<tr>
<td>2</td>
<td>27.55%</td>
<td>27.80%</td>
</tr>
<tr>
<td>3</td>
<td>28.08%</td>
<td>28.12%</td>
</tr>
</tbody>
</table>

Table 4.3 CBR value with adding sugarcane fibre

<table>
<thead>
<tr>
<th>Dosages of sugarcane fibre</th>
<th>2.5mm penetration</th>
<th>5mm penetration</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.50%</td>
<td>33.27%</td>
<td>29.06%</td>
</tr>
<tr>
<td>1.00%</td>
<td>33.85%</td>
<td>36.33%</td>
</tr>
<tr>
<td>1.50%</td>
<td>32.12%</td>
<td>32.12%</td>
</tr>
<tr>
<td>2.00%</td>
<td>25.24%</td>
<td>26.39%</td>
</tr>
</tbody>
</table>

4.2 Discussion

With the addition of sugarcane fibers with different proportions i.e. 0.5%, 1.0%, 1.5%, 2.0%. Here we are mixing sugarcane fibers to strengthen the soil. In this project we are showing comparison of natural sandy soil strength and also sandy red soil were mixed with sugarcane fibers in different proportion soil strength, soil properties increases.

CBR Test The addition of sugarcane fibers increases the CBR test consistently from 28.11% to 36.33%. The maximum CBR test value is obtained at 1.0% sugarcane fiber and the highest value is 36.33%.

From the results we have found that addition of sugarcane fibre as binding material which imparts properties on soil. Majorly sugarcane fibre plays important role in the bearing capacity of soil.

V. CONCLUSION

Therefore the maximum CBR test value is obtained at 1.0% sugarcane fiber with highest value 36.33% at 5mm penetration and this value is greater than normal CBR test value without addition of sugarcane fibre. So it was concluded that with addition of 1% sugarcane fibre we can achieve our objective.
VI. REFERENCES


