Stabilization of Blackcotton Soils by using Groundnut Shell Ash

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Abstract— Due to rapid increase in the world’s population there is increased demand for food, and this has resulted in the production of different types of crops and consequently large amounts of agricultural wastes are generated. Hence it is necessary to dispose these agricultural wastes safely on to the environment. On other hand BC soils expands and contracts due to changes in the moisture content of the soil, causing structural problems through differential movement of the structure. This isolated movement of sections of the structure can cause damage to building foundations and cracking in the exterior or interior wall covering leads to uneven floors etc. Also cause severe cracking in pavements, swimming pools, pipelines, sidewalks, highways etc. Hence there is need to stabilize expansive soil. From these discussion we should find out the solution for the above two problems. After studying several research papers it is concluded that agricultural wastes can be used effectively in stabilization of BC soils. This project presents stabilization of BC soils using groundnut shell ash since its production increased to large extent. On addition of groundnut shell ash in increment of 15% from 0 to 60% to BC soils different experiments on plasticity characteristics, compaction characteristics, shear strength characteristics are conducted .And found gradual improvement in geotechnical properties of black cotton soils.

Key words: Blackcotton Soils, Groundnut Shell Ash

I. INTRODUCTION

Expansive soils are being distributed widely over all geographical locations in the world. These soils cause distress to the structures founded on them because of their high swelling potential due to the presence of various clay minerals like montmorillonite, bentonite, smectite, vermiculite, illite and beidellite etc. When soil gets wet these clay minerals absorb water molecules and expand or when they dry they shrink leaving large voids in the soil. This shrinkage can remove support from buildings or other structures and result in damaging. Fissures in the soil can also develop. These Fissures can facilitate the deep penetration of water when moist conditions or runoff occurs. These swelling clays derived from residual soils also exert uplift pressures.

Expansive soils can typically be recognized in the lab by their plastic properties criteria are available to identify and characterize expansive soils, such as liquid limit, plasticity index, shrinkage limit, shrinkage index. These swelling clays can control the behavior of any type of Soil if the percentage of clay is more than about 5 percent by weight. Expansion of soils can also be measured in the lab directly Shrink swell soils also called heaveable soils can produce more damage to buildings than hurricanes, floods, earthquakes that combiney cause.

Fig. 1: Expansive Soils

Fig. 2: (a) Ground nuts (b) shell ash

<table>
<thead>
<tr>
<th>Degree of expansiveness</th>
<th>DFSI (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Less than 20</td>
</tr>
<tr>
<td>Moderate</td>
<td>20 to 35</td>
</tr>
<tr>
<td>High</td>
<td>35 to 50</td>
</tr>
<tr>
<td>Very high</td>
<td>Greater than 50</td>
</tr>
</tbody>
</table>

Table 1: Degree of expansiveness and possible damage

II. RESEARCH SIGNIFICANCE

From the literature, it is found that, In this investigation an attempt has been made to study the effect of groundnut shell ash on the geotechnical properties of BC soils. The addition of ash in different percentages to with soil is done in laboratory.

III. EXPERIMENTAL PROGRAM

The experimental program carried out for sieve analysis, specific gravity of materials, plasticity characteristics, compaction characteristics, direct shear test, unconfined compressive strength these tests are conducted as per standards.
Stabilization of Blackcotton Soils by using Groundnut Shell Ash
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IV. RESULTS AND DISCUSSION

From the above table and graph it is observed that specific gravity is decreased.

Fig. 3: Test setup

Fig. 4: LL, PL, PI and %Ash Content from the table and graph it observed that liquid limit, plastic limit and plasticity index values are decreases.

Fig. 5: OMC Vs %Ash Content

Fig. 6: MDD VS %ASH GRAPH From the tables and graphs it is observed that OMC is decreases and MDD is increases.

Fig. 7: CBR VS %ASH GRAPH

Fig. 8: SG VS %ASH GRAPH

From the above table and graph it is observed that there is decrease in results and the percentage of decrease is 60%.

Fig. 9: DFSI VS %ASH

Fig. 10: UCC VALUES VS %ASH GRAPH

Fig. 11: Cohesion vs %ash content

Fig. 12: Angle of friction vs %ash graph

A. Discussion:
From the table and graphs it is observed that cohesion values are decreases and angle of friction values are increases.

V. CONCLUSIONS
From the investigation we can say that there is decrement as well as increment in a few cases in the experiments which we have done. In experiment CBR have an incerase in the results. This increment varies between 40 to 150. The plasticity characteristics have decrement in the results. The increment or decrement of results depends upon the percentage of ground nut shell ash added to black cotton soil.

The below table gives brief description about increment or decrement of soil properties.
<table>
<thead>
<tr>
<th>Name Of the experiment</th>
<th>Increase or decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid limit</td>
<td>decrease</td>
</tr>
<tr>
<td>Plastic limit</td>
<td>decrease</td>
</tr>
<tr>
<td>Plasticity index</td>
<td>decrease</td>
</tr>
<tr>
<td>Shrinkage limit</td>
<td>decrease</td>
</tr>
<tr>
<td>Differential free swell</td>
<td>decrease</td>
</tr>
<tr>
<td>Unconfined compression test</td>
<td>decrease</td>
</tr>
<tr>
<td>OMC</td>
<td>decrease</td>
</tr>
<tr>
<td>Dry density</td>
<td>increases</td>
</tr>
<tr>
<td>California bearing ratio</td>
<td></td>
</tr>
<tr>
<td>At 2.5mm</td>
<td>increases</td>
</tr>
<tr>
<td>At 5.0mm</td>
<td>increases</td>
</tr>
<tr>
<td>Shear box</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>decrease</td>
</tr>
<tr>
<td>$\theta$</td>
<td>increases</td>
</tr>
</tbody>
</table>

Table 2: Increment or decrement of soil properties

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