

A Review Paper on Stabilization of Clayey Soil Using Sugarcane Bagasse Ash

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Abstract- A large part of our country covers the area (about 1/5th) by expansive soil which lacks enough geotechnical properties which results in sudden failure of structures in conditions like heavy rainfall drought or any change in water level in the form of settlement, cracks, etc. So it is required to make some kind of material which is effective and easily available from any industrial or agricultural waste as a stabilizer to improve the properties of soil and also reduce the construction cost. A solid waste product of sugar mills sugarcane bagasse when burnt, results in bagasse ash which has silica (SiO₂) which can be used for improving the geotechnical properties. We can decrease the cost of construction by choosing local material.

The aim of this study is to investigate reliability of using sugarcane bagasse ash to improve the geotechnical properties with different percentages (5%, 10%, 15%, 20%, 25% and 30%) and with all the required tests like Atterberg's limit Standard Proctor Test, CBR Test, have been performed. SPT results indicate OMC increment with increase in ash percentage and maximum dry density decreases with increase in percentage of ash. CBR indicates that CBR value increases up to 20% of bagasse ash which shows that the sugarcane bagasse ash acts as a stabilizer with its optimum moisture content percentage that is 20% SCBA and 80% clayey soil

Keywords- Clayey soil, SCBA, CBR, Shear strength

I. INTRODUCTION

India has different types of soil and the soils have different characteristics due to their structural composition and minerals in it. About 35 % of land is agricultural and approximately 65% of states produce sugarcane in India. These resources produced huge amount of waste product in the form of ash, on the other hand India is a developing country and it has a need of stable and reliable roadway network like National Highways, Expressways and also state highways which is a challenge to make this network efficient and cost effective in a country like India where every step has different soil with different characteristics.

Expansive soil is nearly all over India except some areas and dealing with its strength properties is quite difficult

and making it cost effective also is a herculean task. Using waste materials of good stabilization properties meet the needs.

Now a day's research are based on the economical use of resources and hence the scientists are more attracted towards the cost effective and locally available materials from different kind of industries, agricultural waste or any kinds of waste for improving the soil properties.

The SCBA is a waste material which is generally in powder form, derived from sugarcane mills. The industries and agricultural areas produce large amount of waste as ash which is a serious problem and headache for farmers and also it is harmful for environment. This ash has fibrous structure of SiO₂; it is the amorphous silica present in it which is pozzolanic ingredient responsible for strength of required soil. This ash is going through the different kinds of strength tests such as SPT, CBR and Atterberg's limit before using it as a stabilizing material in the soil.

The stabilization soils are not latest technique but it is used from Christian area. Since expansive soil has swelling and shrinkage property which result different types of failure like as settlement in foundation pavement and building structure.

Here, in his project stabilization is done with the help of SCBA, because SCBA is cheap material and easily available. This additive can change the strength of soil by increase of bagasse ash CBR value are increase. This is an effective method of stabilization of soil.

1.1 Methods of soil stabilization

In soil stabilization we use different types of additives like lime, coir; stone dust etc. and the types of soil stabilization are given below

- Mechanical stabilization
- Cement stabilization
- Lime stabilization
- Chemical stabilization
- Thermal stabilization

1.2 Use of soil stabilization

Use of soil stabilization listed below

- To enhance characteristics strength of soil
- To enhance the bearing capacity of soil
- To enhance CBR value
- To minimize the shrinkage and swelling in soil
- To minimize the permeability and compressibility of soil

II. LITERATURE REVIEW

Soil stabilization is not a new concept, in the ancient Christian era, it was performed for millennia. In ancient time many cultures like Chinese and Romans use different techniques to enhance the engineering properties of soil. It included foundations of buildings and roadways and their construction. Ancient buildings were so strong and stable that some of these are even being used in present day. Limestone and calcium were used as stabilizing agent in the period of Mesopotamians and Harappan were the first chemical stabilizer to enhance the bearing capacity of soil.

During the war in Vietnam, US army wanted methods of stabilizing the soil to support their missions worldwide and they were looking for various methods for fast stabilization of poor soil. They were able to build roadways and air traffic also to landing and takeoff. Now from previous 65 years, we used cement and lime as stabilizer just because of its effective performance but it has cost increment factors. Since these materials were not present easily all over world, so its transportation cost was going to increase day by day. Then we needed some other stabilizers which would available in local area and after that various types of stabilizers came into practice in previous decades.

Now a days we have discovered many additives which are broadly used in improvement of geotechnical properties of soil like as coir, stone dust, bagasse ash, fly ash, lime and also different combinations of above additives.

2.1 STABILIZATION USING ADDITIVES

Dr. Suhail A. A Khattab, Khawla A.K. Al-Juari, Ibrahim M. A. Al-Kiki. The main aim of these researchers was to use the industrial waste like byproducts of factories and mills. They were using lime and bsgasse ash by the percentages of 2%, 4%, and 6% by the replacement of soil by weight. Result of this research was going about decrease in plasticity and other harmful parameter like swelling potential. Compressive strength of soil was increasing on increasing the curing time and quantity of additives. Their result analysis shows that the water holding capacity of soil was increasing with increase in lime content.

2.2 STABILIZATION USING SUGARCANE BAGASSE ASH

M. Chittaranjan, M. Vijay, D. Keerthi Earlier they had studied about waste as soil stabilizer in many other ways like rice husk, groundnut shell etc., to improve soil properties at different percentages of. The soil behaves accordingly and CBR increases with increase in percentage of waste.

K.S. Gandhi studied the change in volume of soil with respect to the water content. It can cause very disastrous results. As of NDMA reports, billions of wealth is lost annually as well as it has a psychological effect on mind set in farmers, residents etc., that's why it becomes necessary to make soil well effective against these kinds of destructions with cost effective measures and here this study comes in role. This paper was based on some of the advances developed in past 60 years for improvement in our understanding the nature and methods of expansive clayey soil stabilization. They studied on expansive soil of Surat region with addition of bagasse ash and additives which results in the increase in stability of soil and decrease in swelling potential. As the sugarcane bagasse ash contains silica and other calcium minerals, it increases the required cementing property and homogeneity.

Alavez- Ramirez et al. Another study by Alavez- Ramirez et al was presented on the use of SCBA and lime to enhance stability and engineering properties of compacted soil blocks which studied the mixture of lime and sugarcane as chemical stabilizer in compaction test for fracture and compression in dry and saturated state of soil which had been done for different time durations as 7, 14, 28 days to evaluate the effects. The result indicated that 10% lime with 10% SCBA gives better performance instead of only lime. In the SEM and DRX study, improvement was observed due to strong phase formation like CSH and CAH for additives. Also the combination of SCBA and lime instead of cement in compacted soil block stabilization gave promising results considering the energy consumption issues and pollution.

Kiran R. G. Kiran L Kiran had studied on stabilization of B.C. soil with SCBA as well as cement. Kiran found the conclusion that density of soil increases with increase of stabilizer up to 8% but CBR value also increases up to 4%, after that it is decreases.

It means most of engineering properties enhance to certain percentage of stabilizer and after that decreases. Since this study was about soil of south India which had too much monsoon and it creates problem to foundation, this study made for improvement in the stability of structure. The maximum dry density increases up to 8% replacement, also CBR and UCS values increases at 8%, beyond which it decreases.

III. OBJECTIVES OF STUDY

Different ground improvement methods are used for improving the soil strength properties and one of the methods are soil stabilization. The improvement of soil depends upon a lot of factors like the quality of cementing agent, its composition with soil, the depth of soil strata.

The main objectives are

- To make the sugarcane waste from mills a soil stabilizing material with cementing properties
- Solving the waste disposal problem of sugarcane waste for the industry.
- To analyze the compaction properties of clay soil by mixing it adequate amount with different percentages of sugarcane bagasse ash.
- Analysis of clay soil strength properties like CBR, OMC etc. with different ash percentages.

IV. MATERIAL USED

Soil: Soil will be collected from village kharagpur of faizabad district.

SCBA: SBCA will be collected from masaudha mill faizabad.

V. DISCUSSION

From the above literature study, the bearing capacity of soil can be enhance by different methods of soil stabilization. We will use SCBA as a stabilizer with percentages 5%, 10%, 15%, 20%, 25%, 30% by weight with respect to parent soil. Our aim is to enhance the engineering properties like characteristics strength, CBR value, and shear strength.

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