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Strengthening of Subgrade Soil by using Agricultural Waste

Sabde P. U[1], Charakpalle C. V.[2], Bukka R. S.[3]
Lecturer[1, 2, 3]
Vishweshwarayya Abhiyantriki Padavika Mahavidyalay Almala, India

Abstract:
To investigate the use of agricultural wastes such as sugar cane bagasse ash, rice husk ash and groundnut shell ash to stabilize the weak subgrade soil. The subgrade soil is treated with the above three wastes separately at 3%, 6%, 9%,12%and 15% and C.B.R. test, Standard Proctor's Test, liquid limit, plastic limit, plasticity index and free swell index tests will be carried out. The results of these tests showed improvement in C.B.R. value and M.D.D. while O.M.C. reduces with the increase in percentage of waste. Hence there is a value addition to these three agricultural wastes serving the benefits of Safe disposal of wastes and using as a soil stabilizer.

Keywords: Agricultural wastes, RHA, GNSA, CBR, SCBA

I.INTRODUCTION

For any land-based structure, the foundation is very important and has to be strong to support the entire structure. In order to strengthen the foundation, the soil around it plays a very important role. So, to work with soils, we need to have proper knowledge about their properties and factors which affect their behavior. The process of soil stabilization helps to achieve the required properties in a soil needed for the construction work.
It became necessary for the engineers to look at means to improve soil other than replacing the poor soil at the building site. Soil stabilization was used but due to the use of obsolete methods and also due to the absence of proper technique, soil stabilization lost favour. In recent times, with the increase in the demand for infrastructure, soil stabilization has started to take a new shape. With the availability of better research, materials and equipment, it is emerging as a popular and cost-effective method for soil improvement. Mostly black cotton soil is considered as non-suitable for construction due to high swelling and shrinkage behavior of soil. The soil poses problems to the structures which are founded on them. Such black cotton soil can be improving with suitable materials and if these materials are of waste from any source then that will help to disposal from that source. If we consider agricultural field the disposal of wastes creates a potential negative impact on the environment causing air pollution, water pollution finally affecting the local ecosystems. Hence safe disposal of agricultural wastes becomes challenging task. Hence these waste materials are required to be disposed of scientifically due to their huge generation every year & problem of management of solid waste causing number of hazardous effects on the environment of our earth.

II. MATERIAL

SOIL:

The engineering properties of the soil are determined by carrying out the experiments. The various properties of black cotton soil are determined such as specific gravity, liquid limit, plastic limit, plasticity index, free swell index, optimum moisture content and California bearing ratio value in the soil engineering laboratory following are the basic properties of soil which is used for this project.

Table.1.1 Engineering Properties of Soil before modification

Sr. No.	Property	Value (%)
1	Specific Gravity	2.67
2	Liquid Limit	59
3	Plastic Limit	26.62
4	Plasticity Index	32.38
5	Free Swell Index	23.08
6	Optimum Moisture Content	27.21
7	Maximum Dry Density (g/cm3)	1.445
8	California Bearing Ratio Value	2.49

RISE HUSK ASH: Rice milling industry generates a lot of rice husk during milling of paddy which comes from the fields. This rice husk is mostly used as a fuel in the boilers for processing of paddy. Rice husk is also used as a fuel for power generation. Rice husk ash (RHA) is about 25% by weight of rice husk when burnt in boilers. It is estimated that about 70 million tons of RHA is produced annually worldwide During milling of paddy about 78 % of weight is received as rice, broken rice and bran .Rest 22 % of the weight of paddy is received as husk. This husk is used as fuel in the rice mills to generate steam for the parboiling process. This husk contains about 75 % organic volatile matter and the balance 25 % of the weight of this husk is converted into ash during the firing process, is known as rice husk ash (RHA). This RHA in turn contains around 85 % - 90 % amorphous silica. **GROUND NUT SHELL ASH:** The groundnut shell obtained worldwide from milling of groundnut. The next stage is to heat the groundnut shell in an electric muffle furnace at a temperature of 500˚C to 600˚C for 4 hours in order to produce the groundnut shell ash.

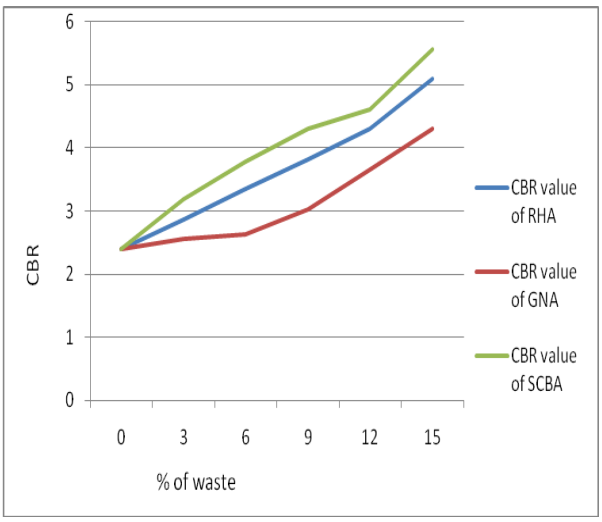
III.METHODS AND RESULTS

The weak subgrade soil is treated with the three wastes at 3%,6%,9%,12%,15%separately and for each percent CBR test and standard proctor test is carried out. The results of these

tests showed improvement in CBR value with the increase in percentage of waste, value of MDD will also increases while the value of OMC will reduce with increase in the percentage of waste.

Table.1.2. CBR value of soil added with waste.

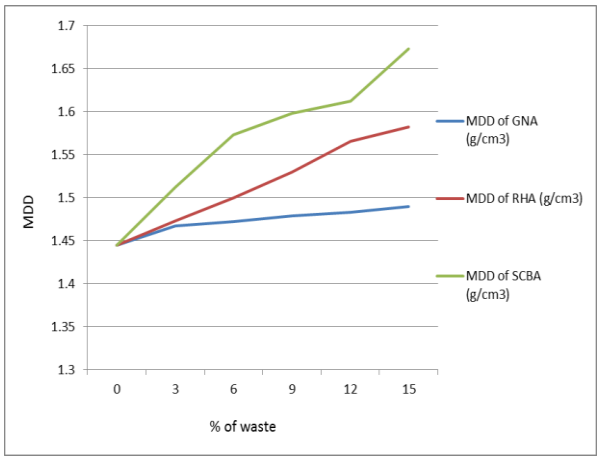
Percentage of Waste	CBR Value of RHA	CBR Value of GNSA	CBR Value of SCBA
0	2.49	2.49	2.49
3	2.86	2.55	3.18
6	3.34	2.63	3.78
9	3.82	3.02	4.30
12	4.3	3.66	4.61
15	5.09	4.3	5.57



Graph1.1: Variations of CBR value with different % of waste

Table 1.3: MDD value of soil added with waste.

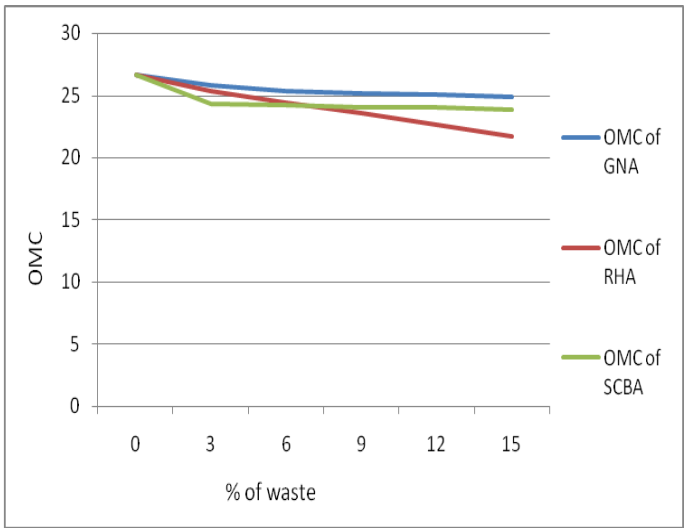
Percentage of Waste	MDD of GNSA (g/cm^3)	MDD of RHA (g/cm^3)	MDD of SCBA (g/cm^3)
0	1.445	1.445	1.445
3	1.467	1.473	1.512
6	1.472	1.500	1.573
9	1.479	1.530	1.598
12	1.483	1.566	1.612
15	1.490	1.582	1.673



Graph1.2. Variations of MDD value with different % of waste

Table 1.4: OMC value of soil added with waste.

percentage of waste	OMC of GNA	OMC of RHA	OMC of SCBA
0	27.21	27.21	27.21
3	25.77	25.29	24.35
6	25.35	24.33	24.19
9	25.12	23.49	24.02
12	25.05	22.57	24.04
15	24.84	21.67	23.86



Graph1.3: Variations of OMC value with different % of waste

IV. CONCLUSION

In India Production of large quantity of Agricultural waste faces serious problem s of handling and disposal. For doing safe disposal of agricultural waste without adversely affecting the environment and a large storage area required are major concerns. Hence in our investigation an attempt has been made to utilize certain agricultural waste such as RHA, GNSA and SCBA to stabilise weak subgrade soil use of these agricultural waste improve the subgrade strength of weak soil. Hence there is value addition to these agricultural wastes serving the three benefits of safe disposal of effluent, using as a stabiliser and return of income on it.

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