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USE OF GROUND NUT SHELL ASH AND COAL ASH TO MODIFY THE PROPERTIES OF SOIL

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Abstract— *Utilization of industrial and agricultural waste products in the industry has been the focus of research for economic, environmental, and technical reasons. Construction and subsequent maintenance of pavements in good condition has become quite problematic especially in areas where soft or expansive soils are available below the sub grade. During rainy season the natural sub grade soils become soft and pose serious problem, strengthening of sub grade soil appear to be the only solution for keeping the pavement of surfaces serviceable.*
The performance of COAL ASH stabilized soil was evaluated using physical and strength performance tests namely; plasticity index, specific gravity, compaction, California bearing ratio (CBR) and Unconfined compressive strength. This research is aimed at evaluating the possibility of utilizing groundnut shell ash (GSA) in the stabilization of soils.

Keywords— *Expansive soil(black cotton),groundnut shell ash,coal ash,proctor test,ucs test,cbr tes,.etc.*

I. INTRODUCTION

The foundation of a building or road is an essential part for effective transmission of load to the subsoil present beneath it. The quality of soil has large impact on type of structure and its design. The expansive soils are examples of weak soils, which encountered in foundation engineering for bridges, highways, buildings, embankments etc. Expansive soil undergoes volume changes when they come in contact with water. They show alternate swelling and shrinkage properties. It expands during rainy season and shrinks during summer season.
Expansive soil covers nearly 20% of the land mass in Indian. In Maharashtra region the expansive soils are identified by name „Black Cotton" soil. These soils possess weak properties due to presence of clay minerals known as „Montmorillonite". Typical behavior of soil results into failure of structure in form of settlements cracks etc. Therefore it is important to remove the existing weal soil and replaced it with a non expansive soil or improves the properties of weak soil by stabilization.
Today, world faces a serious problem in disposing the large quantity of agricultural and industrial waste. The disposal of agricultural waste without proper attention creates impact on environmental health. It disturbs ecosystem, causes air pollution, water pollution etc. The engineers have to take challenge for safe disposal of agricultural waste. This research undertakes use of agricultural waste in stabilizing black cotton soil, various attempts have been made to improve the strength of soil using different chemical additives in combination with lime and cement, but research work has to focus more on use of cheaper and locally available material.
Industrial waste is increasingly becoming a focus of researchers because of the enhanced pozzolanic capabilities of such waste when oxidized by burning. Thus, this study is aimed at evaluating the possibility of utilizing industrial wastes in the stabilization of black cotton soils. Addition of coal ash to Expansive soil is one such attempt to understand the possible mechanism governing the behavior of expansive soils-Coal ash mixes. Coal ash is an industrial waste obtained from thermal power plants by burning of coal. In India these plants produce 130MT Coal ash as a waste product. Therefore bulk stabilization of Coal ash becomes very essential in view of huge producing and to reduce the disposal areas under Environmental concerns.
Application of solid waste (Groundnut Shell Ash) disposal for soil stabilization is a significant which serves various benefits to the environment. The term solid waste includes all those solid and semi-solid materials that are discarded by the community. Improper management of solid waste causes adverse effects on ecology which may lead to possible outbreaks of diseases and epidemics. The over dependence on industrially manufactured soil improving additives (cement, lime etc) have kept the cost of construction of stabilized road financially high. This hitherto have continued to deter the underdeveloped and poor nations of the world from providing accessible roads to meet the need of their rural dwellers who constitute large percentage of their population which are mostly rural farmers. Furthermore, the World Bank has been expending substantial amount of money on research aimed at harnessing industrial waste products for further usage. Black cotton soils are expansive clays with potential for shrinking or swelling under changing moisture condition.

II. STUDY AREA

I have taken the soil sample from near to gayatri mandir from km 8 to km 13,vadodara to vaghodiya road.State highway number 158.vadodara district,Gujarat,india.

III. MATERIALS USED

3.1 BLACK COTTON SOIL

Black cotton soil is the Indian name given to the expansive soil deposit in the central part of the country. Black cotton Soil is a residual soil, which have been formed from basalt or trap and contain the clay mineral montmorillonite that causes excessive swelling and shrinkage characteristics of the soil. The swelling behavior of the soil would depend largely on the type of clay minerals that are present in these soils and proportions in which they are present. The swelling and shrinkage of the black cotton soil can lead to damage the foundations of the buildings and road pavements. This results in difficulty of construct of foundation on such soil, so this soil needs special care. This soil produces excessive settlement of the foundation due to high compressibility. So it is important to improve the geotechnical properties of the blacksoil.

3.2 GROUNDNUT SHELL ASH

Today, world faces a serious problem in disposing the large quantity of agricultural and industrial waste. The disposal of agricultural waste without proper attention creates impact on environmental health. It disturbs ecosystem, causes air pollution, water pollution etc. The engineers have to take challenge for safe disposal of agricultural waste. This research undertakes use of agricultural waste in stabilizing black cotton soil, various attempts have been made to improve the strength of soil using different chemical additives in combination with lime and cement, but research work has to focus more on use of cheaper and locally available material. Application of solid waste (Groundnut Shell Ash) disposal for soil stabilization is a significant which serves various benefits to the environment. The term solid waste includes all those solid and semi-solid materials that are discarded by the community. Improper management of solid waste causes adverse effects on ecology which may lead to possible outbreaks of diseases and epidemics.

3.2 COAL ASH

Coal ash is an industrial waste obtained from thermal power plants by burning of coal. In India these plants produce 130MT Coal ash as a waste product. Therefore bulk stabilization of Coal ash becomes very essential in view of huge producing and to reduce the disposal areas under Environmental concerns.

IV LABORATORY INVESTIGATION

4.1 Methodology

Basic laboratory tests (Attenberg's limit, compaction, CBR, UCC) were carried out on black cotton soil sample, and on combination of soil and groundnut shell ash and coal ash to determine the basic properties of soil sample.

- Then the stabilization of black cotton soil with bagasse is carried out by blending the soil with different percentages of groundnut shell ash and coal ash (5%,10%,15%,20%,25%) and then optimum percentage of bagasse Ash can be added have determined.

- To determine the strength behaviour of black cotton soil with groundnut shell ash and coal ash, the laboratory tests (compaction, California bearing ratio, unconfined compressive strength) are carried.

- The strength tests are carried out on each percentage of blends. By getting the results of all these blends the comparison of the best suitable additive mix will be carried out.

- The results are concluded suitably

4.2 sample preparation

Collected soil sample is first dried in direct sunlight; the clods are broken to get a uniform sample. The organic matters, small aggregates, broken wooden material, pieces of glasses are removed carefully from soil sample. Sample is kept in oven for drying to use in test at temperature 105 C for 24 hrs. The prepared sample is then used for the test specified

V. RESULTS AND DISCUSSIONS

5.1 SOIL SAMPLE + GROUNDNUT SHELL ASH

S.NO	PROPERTIES	RESULTS					
		Soil	Soil+5%GSA	Soil+10%GSA	Soil+15%GSA	Soil+20%	Soil+25%
1	Atterbergs limit test in %						
	Liquid limit	59.45	58.36	54.86	46.29	41.69	37.18
	Plastic limit	29.50	26.70	28.10	24.10	22.20	20.40
	Plasticity index	29.95	31.66	26.76	22.19	19.49	16.78
2	Classification of soil	CH	CH	CH	CI	CI	CI
3	Standard proctor test						
	MDD in gm/cc	1.791	1.710	1.600	1.595	1.571	1.570
	OMC in %	13.00	12.00	12.50	12.00	12.50	13.00
4	Modified proctor test						
	MDD in gm/cc	1.850	1.734	1.610	1.600	1.583	1.578
	OMC in %	14.00	12.50	13.50	13.00	13.00	12.50
5	CBR %						
	Un soacked	3.44	5.69	6.18	9.24	9.73	9.52
	Soacked	3.08	5.14	5.97	8.51	9.02	8.93
6	UCS (Kg/cm2)	3.943	3.510	2.892	1.900	0.850	0.730

Table 1 comparision between different % of groundnut shell ash added with soil

5.2 SOIL + GROUNDNUT SHELL ASH + COAL ASH

S.NO	PROPERTIES					
		Soil+20%GSA+ 5%CA	Soil+20%GSA+ 10%CA	Soil+20%GSA+ 15%CA	Soil+20%GSA+20%CA	Soil+20%GSA +25%CA
1	Atterbergs limit test in %					
	Liquid limit	72.28	71.23	62.34	70.09	72.27
	Plastic limit	35.13	36.09	32.21	36.11	35.48
	Plasticity index	37.15	35.14	30.13	33.98	36.79
2	Standard proctor test					
	MDD in gm/cc	1.212	1.220	1.229	1.264	1.305
	OMC in %	26	26.40	27	29.50	30
3	Modified proctor test					
	MDD in gm/cc	1.2200	1.238	1.240	1.285	1.322
	OMC in %	26.50	26.50	27.50	27	31
4	CBR %					
	Un soacked	3.59	4.86	5.03	5.51	6.38
	Soacked	3.26	4.42	4.59	5.22	6.02
5	UCS (Kg/cm2)	2.463	2.659	3.003	3.790	4.067

Table 2 comparision between different % of coal ash, groundnut shell ash added with soil.

VI. CONCLUSIONS

- On testing of soil it is observed that the value of LL is obtained >50% .But on addition of GSA the value of LL decreases continuesly and found 37.18% on addition of 25% of GSA.
- It is found that plasticity index is decreases with increase in the value of GSA.
- While dry density and moisture content is decreases to some extent as compared to soil sample on addition of GSA material.
- CBR value obtained of soil sample is rapidly increases on increasing the amount of GSA till 20% then start reducing and UCS value decreases constantly on addition of similar amount of GSA material.
- Now when adding the second additive material CA it increases the LL of soil to higher value > 70%, and PI too as compared to GSA .
- MDD is decreases on adding CA as compared to GSA and OMD increases to greater value.
- CBR value on addition of CA first of all decreases then start increases on increasing amount of CA.
- The UCS value which obtained very low on addition of GSA is increases to greater value on adding and increasing the value of CA.

VII. REFRENCES

C.Rajakumar, T.Meenambal, Effect of Coal Ash in the Stabilization of Expansive Soil for the Pavement ,2015 pg 170-177..

C.Rajakumar, Dr.T.Meenambal, CBR and UCC Strength Characteristics of Expansive Soil Subgrade Stabilized with Industrial and Agricultural Wastes,2015 pg 1-17.

Emmanuel Akintunde Okunade, Geotechnical Properties of Some Coal Fly Ash Stabilized Southwestern Nigeria Lateritic,2010.pg 66-73.

S. Bhuvaneshwari R. G. Robinson S. R. Gandhi , Stabilisation of expansive soil using fly ash ,2005.

Mr. N. V. Gajera and Mr. K. R., Thanki Stabilization Analysis of Black Cotton Soil by using Groundnut Shell Ash, 2015.pg 158-162.

T. Murali Krishna and Sd. Shekun Beebi, Soil Stabilization by Groundnut Shell Ash and Waste Fiber Material,2015.pg 52-57,

B. Ahmed, A. Rahman, J. Das, Improvement of subgrade CBR value by using Bagasse ash and Eggshell powder,2015 pg 86-91.

Patrick Khaoya Barasa1, Dr. Too, Kiptanui Jonah, S. M. Mulei, Stabilization of Expansive Clay Using Lime and Sugarcane Bagasse Ash,2015 pg 2112-2117 .

Ogunribido T.H.T. MNMGS, MTRCN, Potentials of Sugar Cane Straw Ash for Lateritic Soil Stabilization in Road Construction ,2011 pg 102-106.

Adetoro A. Ezekiel, Dada O., Michael Potentials of Groundnut Shell Ash for Stabilization of Ekiti State Soil, Nigeria, 2015 pg 2301-2304.

