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Investigation on Stabilization of Different Types of Soils by using Wood Shaving Geotextiles

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ABSTRACT

Soil stabilization is the process of improving the load bearing capacity and engineering properties of subgrade soil to support pavements and structure. Most geotextiles consist of polymers of polyolefin, polyester or polyamide family. Geotextiles can be used for at least one of the following functions Separation, reinforcement, filtration, drainage, stabilization, barrier, and erosion protection. Due to the characteristics of high strength, low cost, and easy to use, geotextiles are widely used in geotechnical engineering such as soft foundation reinforcement, slope protection, and drainage system.

This work examined the stabilization of three different soil samples by using wood shaving geotextile and mixed in soil with 0%, 2%, 4%, and 6% and the jute fiber cuts into different sizes. Geotechnical tests were carried out to determine Atterberg Limits, moisture content, specific gravity, Compaction test. The experimental results give a clear indication that the presence of geotextiles increases the properties of the soil thus, geotextile should be employed as a modernized form of improving construction on poor soils.

KEYWORDS: Red soil, Black Cotton Soil,Clay Soil, Wood Shavings,Max Dry Density,Shear Strength.

INTRODUCTION

The amount of waste generated from varied sources has increased in recent years due to increase in population, industrialization, social as well as economic activities. It has become the need of the hour to utilize this waste in the best manner yet to encourage the concept of reusing in waste management and thus reduce the cost of waste disposal. One such method of reusing is that by using it in the process of soil stabilization. A suitable stabilizing or ground improvement technique usually involves modification in undesirable characteristics of problem soil. This ultimately leads to improvement of engineering performance of subgrade. For air field and road pavements, main purpose is to increase stability of soil while taking the approach where in construction cost is minimized by making best use of locally available materials.

I. LITERATURE REVIEW

II. Red Soil Stabilization Using Silica Fumesand Alcofine

Jeevan Singh1, Neeraj Sharma. (2018)

The main objective of this research work wasto study the engineering characteristics of red soil. The engineering behavior of residual soils in the area, derived from the in-situ weathering and decomposition of parent rock, is determined by

certain physical characteristics designated as engineering properties. For this work both Primary and secondary data from organizations were in use. Red soils occur mostly in tropical and sub-tropical regions with hot, humid climatic conditions. It has been suggested that a mean annual temperature of around 25°C is required for their formation, and in seasonal situations there should be a coincidence of the warm and wet periods. The red soil also called as red earth contains kaolinite type clay along with silt & fine sand. It has got its red color due to the presence of considerable quantities of iron oxide. It is less clayey and siltier in nature, and has low humus content. This soil is acidic in nature and is not ableto retain moisture.

Effect of Wood Shaving Ash on Index Properties of Black Cotton Soil

Rashmi Bade, Nuzra Zainab Khan, Jaya Sahare, Faisal Ameen, Danish Ahmed. (2017)

The addition of ash of wood shavings has an effect on liquid and plastic limits of the soil and thus on plasticity of the soil. Black cotton soils a highly fertile soil for agricultural purposes. They are characterized by high moisture retaining capacity, are extremely compact when wet and develops deep, wide cracks upon drying. Black cotton soil occurs mostly in the central and western parts and covers approximately 20% of the total area of India. It contains montmorillonite clay which renders it its expansive property. Due to its high shrink and swell property, black cotton soil has been a challenge to the highway engineers and structural engineers alike.

Utilization of Hypo Sludge for the Stabilization of Red Soils along with Cement and Molasses

K. Mahendran and N. P. Vignesh. (2016)

The present study investigates the use of hypo sludge with cement and molasses for the preparation of stabilized red mud blocks. Methods/Statistical Analysis: The Laboratory test results show that the physical and the mechanical properties of the red soil were assessed. The unconfined compressive strength, modulus of rupture, Ultrasonic Pulse Velocity (UPV) and water absorption tests were performed for this soil with and without hypo sludge, cement and molasses. Findings: It has been identified that 15% of Hypo Sludge with Cement and Molasses as additives provides optimum stabilization to the soil and it is proven with the help of unconfined compression test. Applications/ Improvements: The results show that the hypo sludge can be effectively used in red soil for the preparation of mud blocks.

Stabilization of Industrial Waste Red-Mud with Cement T.D.V.Lakshmi, Dr. DSV,Dr. M Anjan Kumar, Dr.GVR Prasada Raju (2015)

Red mud is one of the bi-products obtained during refining process of Bauxite currently estimated to be 2.7 billion tons with an annual growth rate of over 120 million tons. Its disposal isproblematic and it is hazardous to environment. It is necessary to utilize the waste affectively with technical development in each field. In order to overcome this problem it has to be reused in various fields like agricultural, civil engineering and Road pavements. Attempts are made to investigate the stabilization process in the laboratory with different percentages of cement with red mud. Compaction, UCS and split tensile tests were tests were carried out in red mud with different cement with a view to obtain optimum percentage.

Stabilization Analysis of Black Cotton Soil by using Groundnut Shell Ash

N. V. Gajera, K. R. Thank. (2015)

Addition of Groundnut Shell Ash significantly improves the index properties, compaction and strength characteristics of black cotton soil. Liquid limit and Plasticity index values of 83.36 % and

89.32 % respectively suggest that the soil is highly plastic. Thus, from the results obtained, the soil falls below the standard recommended for most geotechnical work (Butcher and Sailie, 1984). Groundnut Shell Ash (GSA) is used as a stabilizer for improving the geotechnical characteristics of

black cotton soils. Addition of Groundnut Shell Ash significantly improves the index properties, compaction and strength characteristics of black cotton soil under study and the effect of GSA vary depending upon the quantity of GSA that is mixed with the black cotton soil samples.

Effect of cement stabilization on geotechnical properties of sandy soils Issa Shooshpasha andReza Alijani Shirvani. (2014)

The lack of accessibility of highquality materials and the increased costs associated with the use of these materials will finally necessitate engineers to use local soils. In such cases, ground improvement behaved satisfactorily in many conditions. Ground improvement can be defined as the procedure of increasing shear strength parameters and decreasing the permeability and compressibility of the soil. Different methods can be used to improve the geotechnical properties of the problematic soils that one of them is using additives

* A Review of Stabilization of Soils by using Nanomaterials Zaid Hameed Majeed and Mohd Raihan Taha. (2013)

Nanotechnology revolves around the creation of a varied collection of nanomaterials (NM), which encompass nanoparticles (NP) along with nano objects. NM are known to be 100 nm lower in terms of dimensions whereas nano objects fall two dimensions lower. An example of this phenomenoncan be observed through carbon nanotubes. Nanoparticles are described as materials three dimensions lower than 100 nm. This paper reviews the application of nanotechnology in geotechnical engineering. It discusses soil stabilization and its types, as well as the nanomaterial additives used in soil improvement, and analyzes its effects on soil.

Effect of lime and fly ash on Engineering Properties of Black Cotton soil

Bairwa Ramlakhan , Saxena Anil Kumar, Arora. (2013)

the waste material such as fly ash can be used effectively in the civil engineering construction but it is become more effective with lime. Liquid limit and plastic limit of BC soil decrease with increasing % fly ash. But Liquid limit and plastic limit of BC soil increase with increasing

% lime. Compaction characters of BC soil also affected by varying % of fly ash, i.e. OMC of BC Soil increase with increasing % fly ash and MDD decrease with increase of fly ash Likewise Compaction characters of BC soil also affected by varying % of lime, i.e. OMC of BC Soil increase with increasing % lime and MDD decrease with increase of lime .

Lime Stabilization of Soils Sujit Kumar Dash, Monowar Hussain. (2012)

Lime generally improves the engineering performance of soils. However, in some cases, lime has been reported to have an adverse effect. To develop an understanding of the possible mechanisms involved, a series of experiments through careful variation of different parameters were carried out, based on which the following conclusions are drawn. The liquid limit of soils initially decreases with an increase in lime content. This result is attributed to a reduction in the thickness of the double layer attributable to increased electrolyte concentration in the pore fluid.

Use of Natural Pozzolana and Lime for Stabilizationof Cohesive Soils

Khelifa Harichane , Mohamed Ghrici , Said Kenai ,Khaled Grine. (2011)

The reduction of available land resources and the increased cost associated with the use of highquality materials have led to a large need for using local soils in geotechnical construction. Many sites around big cities such as Algiers present poor engineering properties and land for construction projects is scarce. Hence, sites with poor soils have to be used. Poor engineering properties of some of these soils create difficulties

during construction and hence the need to stabilize these soils to improve their properties.

MATERIALS

COLLECTION OF SAMPLES:

1. Red Soil
2. Black Cotton Soil
3. Clay Soil 4.wood shavings

1. RED SOIL:

Red soils are generally derived from the weathering of crystalline and metamorphic rock in areas of high rainfall. Red soil contains large amounts of clay and thin organic and organic-mineral layers of highly leached soil resting on an alluvium red layer. Thin organic layers overlying a yellowishbrown leached deposit resting on an alluvial red soil is a type of soil that typically develops in warm, temperate, and humid climates and comprise approximately 13% of Earth's soils. It contains thin organic and organic-mineral layers of highly leached soil resting on a red layer of alluvium.

1. BLACK COTTON SOIL:

It is a highly fertile soil for agricultural purposes. They are characterized by high moisture retaining capacity, are extremely compact when wet and develops deep, wide cracks upon drying. Due to its high shrink and swell property, black cotton soil has been a challenge to the highway engineers and structural engineers a like. Therefore, the sub grade and its undesirable and highly sensitive properties need to be modified using a suitable ground improvement or stabilizingtechnique.

2. CLAYEY SOIL:

Clay soil is soil that is comprised of very fine mineral particles and not much organic material. The resulting soil is quite sticky since there is not much space between the mineral particles, and it does not drain well at all. If you have noticed that water tends to puddle on the ground rather than soak in, it is likely your soil is clay. If the soil sticks to shoes and garden tools like glue, forms big clods that aren't easy to separate, and crusts over and cracks in dry weather, you have clay.

3. WOOD SHAVINGS:

These are small- to medium-sized pieces of wood formed by cutting or chipping larger pieces of wood such as trees, branches, logging residues.

Figure 1: Wood shavings

Physical Properties of Wood Shavings:

Moisture content: Wood shavings can contain a varying amount of moisture, which can affect their weight, combustibility, and other properties. Wet shavings are heavier and less flammable than dry shavings.

Size and shape: Wood shavings can vary in size and shape depending on the tool used to produce them. They can be short, fine shavings produced by hand planes or long, curly shavings produced by a lathe. Color: The color of wood shavings can varydepending on the species of wood, the age of the wood, and the processing method used. Some wood shavings may be light in color while others may bedarker.

Texture: Wood shavings have a fibrous texture that can vary depending on the species of wood and the size of the shavings. They can be soft and fluffy or coarser and more rigid.

Combustibility: Wood shavings are highly combustible and can be used as a source of fuel. The moisture content of the shavings can affect their combustibility.

Absorbency: Wood shavings have good absorbency properties, which makes them

suitable for use as animal bedding and in gardening.

Durability: Wood shavings are not as durable as solid wood and can break down over time, especially if exposed to moisture. However, their durability can be improved by using certain processing methods.

Mechanical Properties of Wood Shavings: Density: Wood shavings have a relatively low density compared to solid wood. The density can range from about 100 to 300 kg/m3 depending on the wood species and the size of the shavings.

Compression strength: Wood shavings can withstand a certain amount of compressive force before they start to deform or break. The compression strength of wood shavings varies depending on the wood species and the size of the shavings.

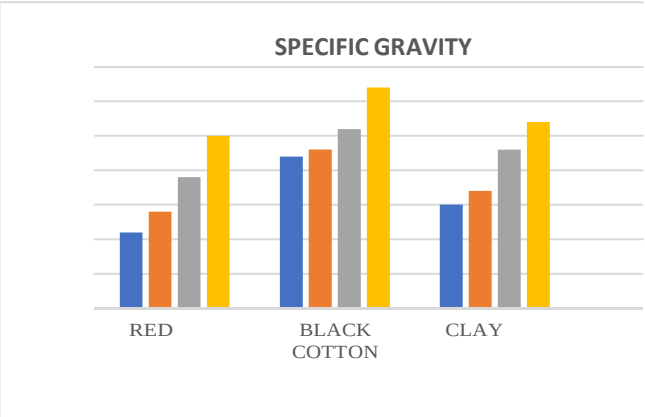
Tensile strength: The tensile strength of wood shavings is relatively low and can vary dependingon the wood species and the size of the shavings. Shear strength: Wood shavings have a relativelylow shear strength compared to solid wood. Theshear strength can vary depending on the woodspecies and the size of the shavings.

Elasticity: Wood shavings have some elasticity, but it is lower than that of solid wood. The elasticity can vary depending on the wood species and the size of the shavings.

V. EXPERIMENTAL WORK

SPECIFIC GRAVITY

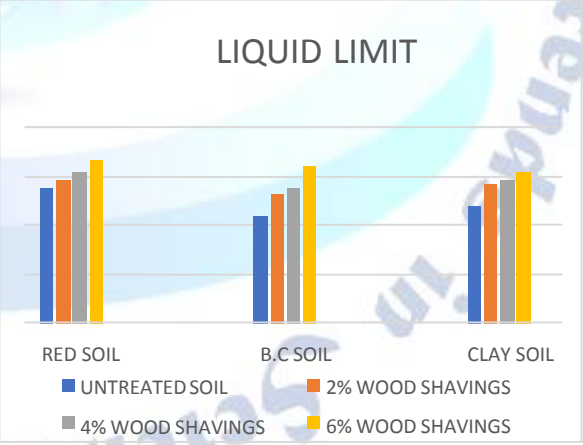
RED SOIL	BLACK COTTON SOIL	CLAY SOIL
Untreated soil =2.51	Untreated soil =2.62	Untreated soil =2.55
2% wood shavings=2.54	2% wood shavings=2.63	2% wood shavings=2.57
4% wood shavings=2.59	4% wood shavings=2.66	4% wood shavings=2.63
6% wood shavings=2.65	6% wood shavings=2.72	6% wood shavings=2.67



Graph1: Specific Gravity

LIQUID LIMIT IN (%)

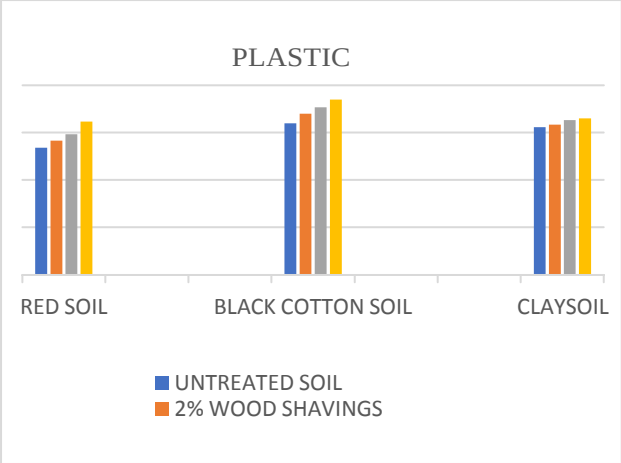
RED SOIL	BLACK COTTON SOIL	CLAY SOIL
Untreated soil =55	Untreated soil=47	Untreated soil =48
2% wood shavings=59	2% wood shavings=53	2% wood shavings=57
4% wood shavings=62	4% wood shavings=55	4% wood shavings=59
6% wood shavings=67	6% wood shavings=64	6% wood shavings=62



Graph2: Liquid Limit

PLASTIC LIMIT IN (%)

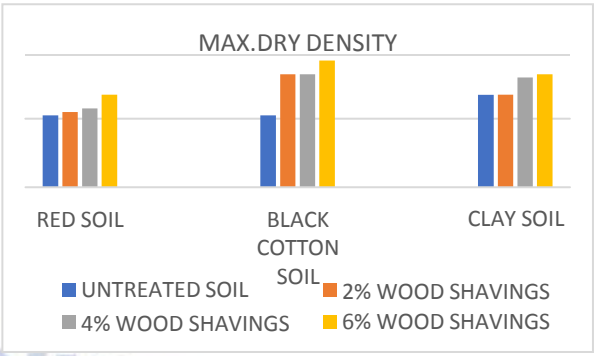
RED SOIL	BLACK COTTON SOIL	CLAY SOIL
Untreated soil =26.81	Untreated soil =32	Untreated soil =31.18
2% wood shavings=28.33	2% wood shavings=34	2% wood shavings=31.67
4% wood shavings=29.67	4% wood shavings=35.33	4% wood shavings=32.67
6% wood shavings=33.33	6% wood shavings=36.98	6% wood shavings=33



Graph3: Plastic Limit

MODIFIEDPROCTOR COMPACTION IN (G/CC)

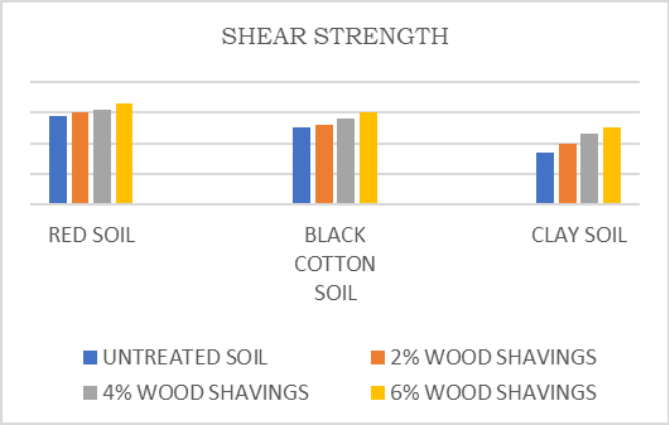
RED SOIL	BLACK COTTON SOIL	CLAY SOIL
Untreated soil =1.41	Untreated soil =1.41	Untreated soil =1.47
2% wood shavings=1.42	2% wood shavings=1.53	2% wood shavings=1.47
4% wood shavings=1.43	4% wood shavings=1.53	4% wood shavings=1.52
6% wood shavings=1.57	6% wood shavings=1.57	6% wood shavings=1.53



Graph4: Modified proctor Compaction

UNCONFINED COMPRESSIVE STRENGTH

RED SOIL	BLACK COTTON SOIL	CLAY SOIL
Untreated soil =2.51	Untreated soil =2.62	Untreated soil =2.55
2% wood shavings=2.54	2% wood shavings=2.63	2% wood shavings=2.57
4% wood shavings=2.59	4% wood shavings=2.66	4% wood shavings=2.63
6% wood shavings=2.65	6% wood shavings=2.72	6% wood shavings=2.67



Graph4: UNCONFINED COMPRESSIVE STRENGTH

CONCLUSION

1. The wood shavings as an additive for stabilization of soilincrease the strength of soils.
2. The specific gravity of soils increased by adding of the woodshavings
3. The liquid limit of soils increased by adding of the

woodshavings

4. The plastic limit of soils increased by adding of the woodshavings
5. The max. dry density value was observed for a wood shavings adding to the soils.
6. The shear strength value was observed for a wood shavingsadding to the soils.
7. The addition of wood shavings has an effect on increasingproperties of the soils.
8. The results of the research thus indicate increasing properties of soils in each sample after addition of variouspercentages of wood shavings.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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[10] P. Vignesh*Effect of cement stabilization on geotechnical properties of sandy soils Issa Shooshpasha a and Reza Alijani Shirvani Red Soil Stabilization Using Silica Fumes and Alccofine Jeevan Singh1 , Neeraj Sharma2 1 M.Tech (CE), Sri Sai Group of Institution, Badhani, Punjab, India 2 Astt. Prof. (CE), Sri Sai Group of Institution, Badhani, Punjab, India Department of Civil Engineering, Faculty of Civil Engineering, Babol University of Technology, Iran (Received January 09, 2014, Revised July 17, 2014, Accepted August 27, 2014)