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Compare the Peat Soil Stabilization Using Gypsum and Quick Lime With Fly Ash

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Abstract: ***These paper demonstrate the comparative study on peat soil stabilization with different stabilizing agents. Peat soil are highly organic content and well kown for high compressibility, natural wetness content, dumpy shear strength and long term settlement. In this study, the peat soil is collected and to evaluate their index or physical and geotechnical properties. Some combination of gypsum and quick lime with fly ash is added for stabilizers. The amount of fly ash with gypsum and fly ash with quick lime were added to the peat soil sample, as a percentage of dry sample mass, were in the range 5 to 30% and 2 to 8%, respectively for a curing period of 7,14 and 28 days. The Unconfined compressive strength (UCS) test was carried out on stabilized soil samples with above mentioned percentages and compare the results of stabilizing agents shows the UCS value increases significantly with increasing all stabilization agents used and also with increasing curing periods.***
Keywords: Peatsoil, gypsum, Flyash(FA), Quicklime(QL), Unconfinedcompressivestrength(UCS), stabilization.

I. INTRODUCTION

Peat is generally defined as a soil which has build up partially decomposed plant and animal deposit under anaerobic conditions. Peat soil is well known for their very low shear strength and high compressibility characteristics. For this reason, these soil cause serious foundation problems and constitute one of the most difficult ground condition for the construction of civil engineering structure. The settlement characteristic associated with peat is very complex due to the high compressibility and mainly large secondary consolidation compression characteristic i.e., creep effect of the peat soil.

A number of researchers have tried to improve constructability on soft soil.The available methods are displacement method, replacement method, stage loading and surface reinforcement method, pile supported embankment , light weight fill raft method, deepin-situ chemical stabilization method and Thermal precompression method to improve soft or peat soil. However, these methods have high financial cost. Out of several alternatives, one of the promising methods of construction on the peat soil is to stabilize the peat soil itself by appropriate stabilizer. Soil stabilization can be defined as a mean of permanently altering soil properties to increase its strength and bearing capacity, and decrease its water sensitivity and volume change potential.

There are many types of admixtures such as gypsum, quick lime, fly ash etc, available to stabilize the soft or peat soil. Hence, the present learn concentrates on comparision of the stabilization of peat soil samples with different types of stabilizers or admixtures i.e., combination of gypsum with flyash and combination of quick lime with fly ash. Finding the most suitable stabilizer and optimum mixing quantity for stabilizing the local peat soil are final outcomes of the study.

II. PHYSICIAL PROPERTIES OF PEAT

The natural moisture content of peat soil samples have been determined by drying soil sample in an oven at 105°C for 24 hours as per BS 1377: Part 2: 1990. The Loss on Ignition test has been determined as a percentage of oven-dried mass as per ASTM D 2974. Organic content (H) is calculated according to an equation proposed by Skempton and Petley as follows:

$H\% = 100 - C\,(100 - N)$ Where, C is the correction factor and N is the Loss On

Ignition in percent. The degree of decomposition is generally assessed by means of the Von Post scale. There are 10 degrees of humification (H1 to H10) in the Von Post system. The specific gravity (G_S) of the highly organic or peat soil is determined based on procedure stated in BS 1377: Part 2:1990. In this test, G_S is determined by using small pycnometer. The average G_S is obtained from the results of three tests. The fiber content (FC) is determined from dry weight of fibers retained on ASTM D 1997–91 sieve no. 100 (> 0.15 mm opening size) as a percentage of oven dried mass. The particle size distribution of the peat soil samples were conducted by sieve analysis according to the method described in ASTM D 422–63. In this study, cone penetrometer method has been used to determine the liquid limit (LL) of peat soil sample. peat is the product of decomposition of

organic matter from plants and animals.It has the capacity of taking up and holding water.

High water content results in high pore volume leading to low bulk density and low bearing capacity. Voids ratio is an indicator for the compressibility of the material.Voids ratio of organic soils are generally higher than the inorganic soils. The higher specific gravity indicates a higher degree of decomposition and low mineral content.An easier method of determining specific gravity is to use ash content. The unit weight is influenced by the water content and organic content of peat. Unit weight will increased with increment of specific gravity. Unit weight of peat is typically lower compared to inorganic soils.Peat will sinks extensively when dried.

III. ENGINEERING PROPERTIES OF PEAT

The shear strength of peat soil is very low, however, the strength could increase significantly consolidation shear strength is associated with several variables such as the origin of soil,water content, organic content,anddegree of decomposition. The shear strength of peat is determined based on drained condition. Considering the presence of peat soil is always below the groundwater level, the determination of undrained shear strength is also important. The compresswion behavior of fibrous peat is different from clay soil.Initial compression occurs instantaneously after the load being applied,the primary and secondary compression are time dependent.Permeability is one of the important properties of peat because it controls the rate of consolidation and increase in the shear strength of the soil.

IV. METHODOLOGY

Physcial propeties such as moisture content, specificgravity, partical size and liquid limit are determined are to establish the basic characteristics of peat soil. Peat soil are classified base on von post scale for degree of decomposition,fibre content, loss of ignition and organic content. Engineering properties such as standard protector test and unconfined test as also been studied.

The soil sampel is collected,approximately at the depth of 0.5m to 1m, at first sundried followed by grinding and sieving. The soil particales pass through 1.18mm sieves are collected to conduct different test with different percentage of admixtures.The procedure for conducting the experimental investigation based on British standard BS 1377:1990 and ASTM standards.The tests on different portion of Fly ash with gypsum and fly ash with quick lime are designed to obtained the most appropriate proportion of stabilizer that will improve the peat soil sample most in terms of strength and other physical and engineering properties.Test on original peat soil alone also been conducted in order to access the improvement made on the peat soil samples.

After obtaining the value of maximum dry density and optimum moisture content of the sample from standard proctor test, the specimens were tested using stabilized agents

such as gypsum of 2,4,6and 8%, and fly ash of 5,10,20and 30% of dry weight of the sample, and compare the stabilization with another sample with quick lime of 2,4,6 and 8%, and fly ash of 5,10,20 and 30% of dry weight of the samples.To prepare the cylindrical sample for UCS test, using a mould of 50mm diameter and 100mm height . After sample preparation, the sample has been kept for approximately 24 hours before it being immersed in the water tank for curing. The unconfined compressive strength test were conducted after curing period 7,14 and 28 days to investigate the strength of treated soil.

V. RESULTS AND DISCUSSION

A. Physical Properties

The results of different physical properties of the peat soil samples are presented in Table 1. From the laboratory test, it has been observed that samples fall in the category with degree of humification of H4 respectively, according to the Von Post scale (1922). In this study samples contain more than 75% OC and can be categorized as peat.Loss of ignition test has been conducted on the samples.From Table 1 it can be observed that the sample has very high value of loss of ignition and organic content. The value of liquid limit is high because the sample content a lots of fibre which results in high water obsorption capacity. The result also shows that sample has lower pH value i.e., more acidic due to higher organic content.

Table1: Physical and geotechnical properties of soil.

Properties	Results
Natural moisture content, (%)	620.14
Degree of decomposition	H3
Loss on Ignition, (N) (%)	85.67
Organic content, (H) (%)	85.67

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Specific gravity, (G_S)	1.45
Fiber content (FC) (%)	65.00
Liquid Limit (LL) (%)	78.00
MaximumDry Density,MMD,(gm/cc)	0.56
Optimum Moisture Content,OMC(%)	95.17

B. Unconfined Compressive Strength

Unconfined comressive strength (UCS) test was performed on the cured peat soil sample with the different percentages of stablizers and the results are presented in the figure 1,2,3,4,5 and 6. UCS is the most common test used to determine the stablizer of the soil. For each UCS test, the stress-strain relationship was determined. The sample was mixed with various percentages of gypsum(2%,4%,6% and 8%) with fly ash(5%,10%,20% and 30%). Figure 1,2and 3 shows the gain in UCS with combination of gypsum and flyash. The sample was mixed with another admixture of Quick lime(2%,4%,6%and8%) withfly ash(5%,10%,20% and 30%). Figure 4,5 and 6 show the gain in UCS with combination of quick lime and flyash added to peat soil with different curing periods.compare the strength of admixtures.

In general, the compressive strength value indicates that all admixture treatment types resulted in strength gain. It can be notice that the strength of treated soil increased with curing time. Most of the strength gain occurred with in the first seven days curing. The results shows the higher strength achived for the sample mixed with gypsum and fly ash. The UCS value increase with combination of gypsum and fly ash and also with curing period of 28 days but decreases (UCS value of 20%FA plus 6% gypsum) after adding of 20% of FA and 6% of gypsum.

The UCS value increases with the increased combination of QL and FA, and also with a curing period of 28 days but decreases (UCS value of 10% FA plus 6% QL) after addition of 10% FA and 6% QL. It can be observed that, comparision of the Unconfined Compressive Strength (UCS) increases with the increasing of 20% percentage of FA and 6% of gypsum content added to the original peat soil sample and also with the curing period but decreases rather stedily beyond this percentage. But in the case of Flyash and QL , this result increases up to addition of 10% FA and 6% of QL, with a curing period of 28 days but decreases rather steadily beyond this percentage.

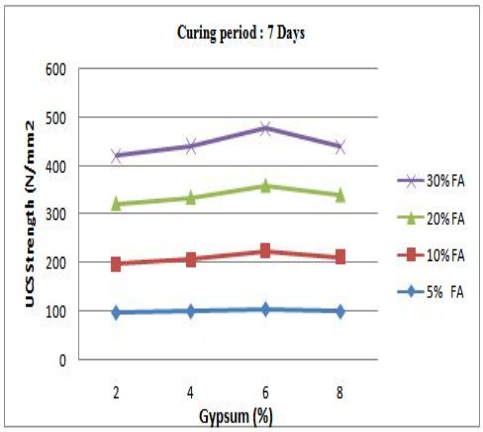

Fig- 1

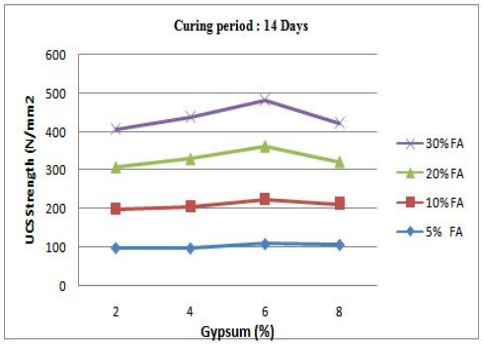

Fig- 2

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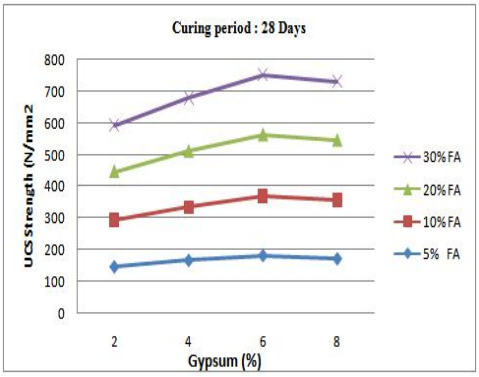
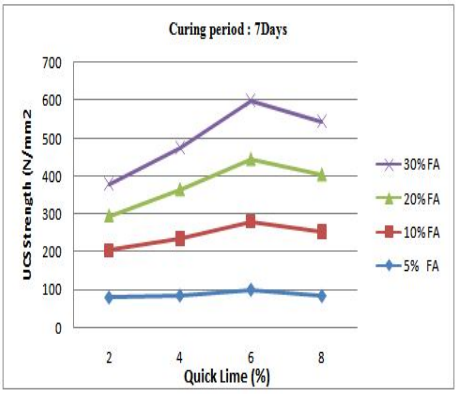


Fig- 3



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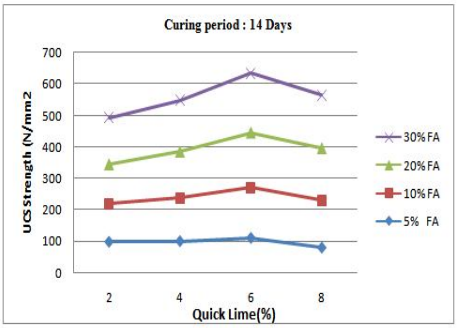

Fig- 5

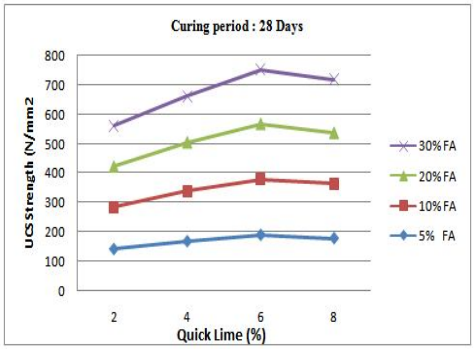

Fig- 6

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VI. CONCLUSION

The present paper investigates the effect of different types of stabilizer on peat soil samples. From the laboratory tests results, the following conclusions can be drawn:

A. The result of UCS test for combined FA and gypsum shows better results in comparision with the combination of FA and QL.

B. The stabilized peat soil sample increases with the increase of percentage of FA (i.e., 5,10, 20 and 30%)and gypsum(2%,4%,6% and 8%) added to the original peat sample.

C. The UCS values for peat soil samples increase with 2, 4,6 and 8% of gypsum and 5,10,20 and 30% of FA but decrease rather steadily beyond 6% of gypsum and 20% FA added.

D. The result of UCS test increases with curing period (i.e.,7, 14 and 28 days) for all types of stabilizer used.

E. The UCS value for combined QL and FA shows with a reduction of gypsum and flyashbecause it decreases progressively beyond 6%QL and 10% of FA

F. In the present study, the comparision of gypsum with fly ash and quick lime with fly ash, the gypsum with fly ash is the most suitable stabilizer.

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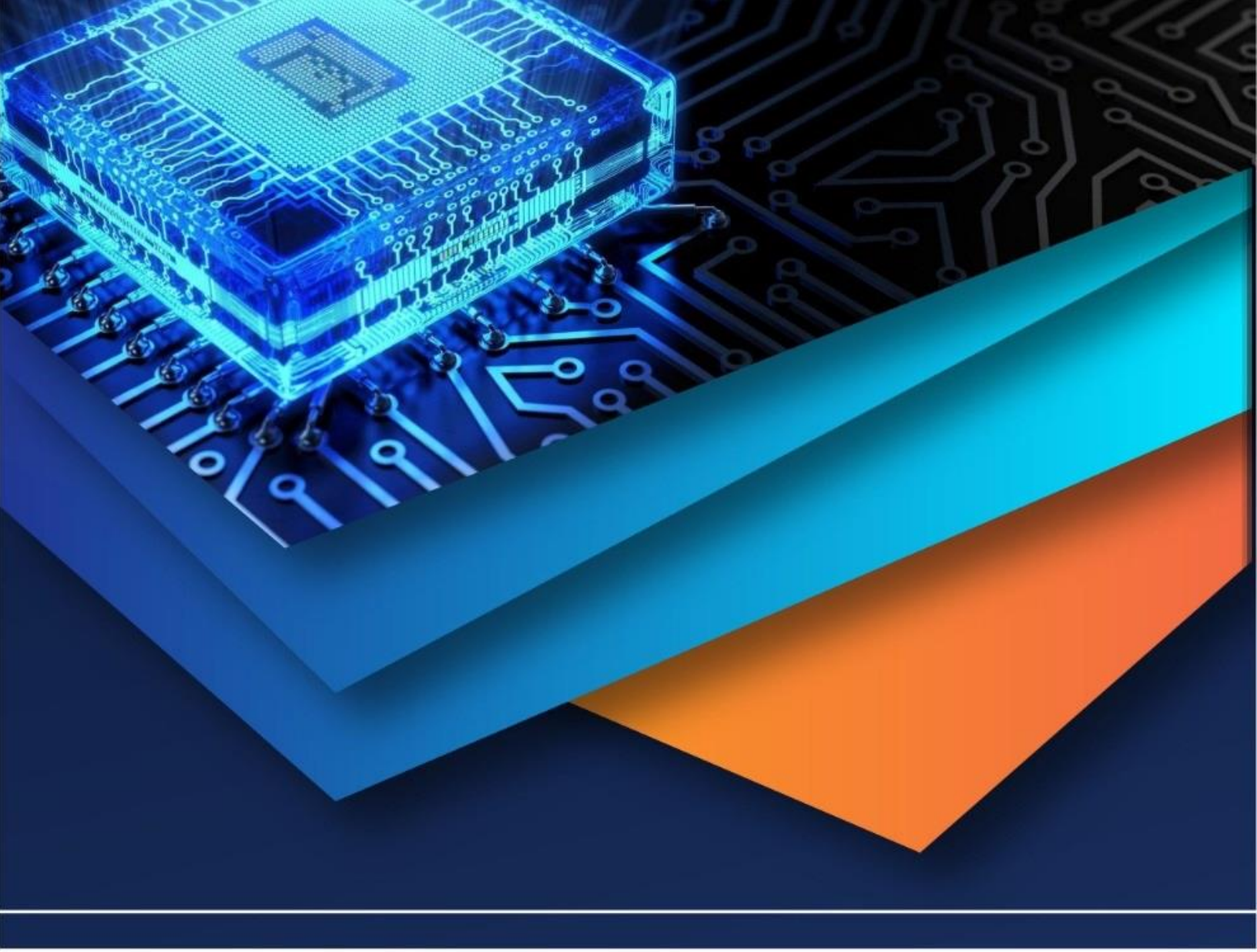

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