International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 9 No. 2 Sep. 2014, pp. 225-227

http://www.ijisr.issr-journals.org/

Peat soil stabilization with Rice husk ash and lime powder

G. Vishwanath, K.R. Pramod, and Dr. V. Ramesh

Department of Civil Engineering, East Point College of Engineering, Jnana Prabha, Virgo Nagar Post, Bangalore-49, India

ABSTRACT: Peat soil is said to problematic soil for any Engineering construction. Hence for any civil engineering construction on peat soil requires either replacement of soil or stabilization, in this paper an attempt is made to stabilize the peat soil using lime and rice husk ash. Rice husk ash being the waste material from rice industry and has pozzolanic property. A stabilizer was prepared by mixing 70%of rice husk ash and 30% of lime. Almost all the standard laboratory tests were conducted for peat soil and also by adding the stabilizer by varying the dosage as 5,10,15% by weight of soil. Finally study of the contribution of stabilizer on the properties of peat soils and its feasibility for various civil engineering applications is evaluated. The results show the increment of soil properties like dry density and unconfined compressive strength. From the study it was found that 15% of stabilizer yielded maximum density and strength indicating significant improvement in the engineering behavior.

KEYWORDS: stabilizer, RHA, Dolomitic lime, peat soil, calcium silicates.

1 INTRODUCTION

For construction of any civil engineering structures, the foundation is very important and has to be strong to support the entire structure. In order for the foundation to be strong, the soil around and below it plays a very important role. Hence the soil properties and factors affect their behaviour is very important for foundation design, pavement design and design of embankments.

The soil having low strength is not suitable for construction; hence it has to be replaced or stabilized.

The term soil stabilization means the improvement of stability or bearing power of the soil by use of controlled compaction, proportioning and or addition of suitable admixture or stabilizers. This helps to achieve the required properties in a soil needed for the construction work.

Peat soil is known as a very soft soil with high organic content (≥ 75%), it is composed of high contents of fibrous organic matters and is produced by the partial decomposition and disintegration of mosses, sedges, trees, and other plants that grow in marshes and other wet place in the condition of lack of oxygen. These soils are geo technically problematic as they show low bearing capacity and very high compressibility and low shear strength**.** In the present study an attempt is made to stabilize the peat soil with the help of lime and Risk Husk Ash (RHS) and to study the effectiveness of using RHA as a plazonic material to enhance the lime as a stabilizing material of peat soil.

Rice milling generates a by-product known as husk. This surrounds the paddy grain. 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 boiling process. This husk contains about 75% organic volatile matter and the remaining 25% of the weight of this husk is converted into ash during the firing process, known as Rice Husk Ash (RHA). This RHA in turn contains around 85% - 90% amorphous silica. So for every 1000 kg of paddy milled, about 220 kg (22%) of husk is produced, and when this husk is burnt in the boilers, about 55 kg (25%) of RHA is generated. India is a major rice producing country and the husk generated during milling is mostly used as a fuel in the boilers for processing paddy, producing energy through direct combustion and/ or by gasification. About 20 million tonnes of RHA is produced annually. This RHA is a great

Corresponding Author: K.R. Pramod

environmental threat causing damage to the land and the surrounding area in which it is dumped. Lots of ways are being thought for disposing it by making commercial use of RHA.

As a stabilizer The Rice Husk Ash would appear to be an inert material with the silica in the crystalline form suggested by the structure of the particles, it is very unlikely that it would react with lime to form calcium silicates. It is also unlikely that it would be as reactive as fly ash, which is more finely divided. So Rice Husk Ash would give great results when it is used as a stabilizing material.

Lime in the form of quicklime (calcium oxide – CaO), hydrated lime (calcium hydroxide – Ca [OH]2), or lime slurry can be used to treat soils. Quicklime is manufactured by chemically transforming calcium carbonate (limestone – CaCO3) into calcium oxide. Hydrated lime is created when quicklime chemically reacts with water. Most lime used for soil treatment is “high calcium” lime, which contains no more than 5 percent magnesium oxide or hydroxide. On some occasions, however, "dolomitic" lime is used. Dolomitic lime contains 35 to 46 percent magnesium oxide or hydroxide. Dolomitic lime can perform well in soil stabilization, although the magnesium fraction reacts more slowly than the calcium fraction.

From various literatures it was found that 70%and 30%of rice husk ash and lime respectively was mixed to from the satabilizer.

1.1 EXPERIMENTAL STUDIES

A number of laboratory tests were done for the physical properties as well as the engineering properties of peat and black cotton soil. Properties were compared without stabilizer and after addition of stabilizer. Sp Gravity, Liquid limit, Plastic limit were found out. Soil is classified as per Indian Standard Classification System ISCS (IS 1498-1970).

For peat soil $I_P = W_L - W_P$

$= 43.491\ \% - 22.58\%$

$=20.91\ \%$

A_{Line} Equation, $I_P = 0.73\ (W_L - 20)$

Soil is classified as OH. This soil is highly organic soil with high compressibility. This can be readily identified by colour, odour, spongy feel and fibrous texture.

1.2 FORMULATION OF EXPERIMENTS

Table 1. Physical Properties of Peat Soil

Properties	**Peat Soil**
Specific gravity	1.58
Natural Moisture content	64.7 %.
Liquid Limit	43.491 %
Plastic Limit	22.58%
P^H	3.2.
Direct shear	10.67 kPa
Unconfined compression test(UCC)	18.65 kPa

1.3 OPTIMIZATION OF STABILIZER IN PEAT SOIL

1.3.1 BY USING COMPACTION TEST

Compaction factor test conducted on soil alone and varying percentages of stabilizer mixed with soil such as 5%, 10%, 15%, the pest soil mixed with 10%stabilizer yielded maximum dry density. Table 2 below shows the variation of maximum dry density and optimum moisture content of peat soil with varying percent of stabilizer.

Table 2. Variation of maximum dry density and optimum moisture content of peat soil with varying percentage of cement

Sl .No	Mixture	Maximum dry density(KN/m^3)	Optimum moisture content
1.	Peat soil	1.91	12.58
2.	Peat soil+5% Stabilizer	1.90	14.56
3.	Peat soil+10% Stabilizer	1.96	17.02
4.	Peat soil+15% Stabilizer	1.93	18.23

1.3.2 BY USING UNCONFINED COMPRESSIVE STRENGTH TEST

From Table 3 it indicates unconfined compressive strength of untreated and 5%, 10%, 15%, percent stabilizer treated peat soil. In order to optimize stabilizer content in soil unconfined compressive strength test were conducted by compacting soil to optimum moisture content, maximum dry density and both immediate as well as 10,20,30 days curing test were conducted. Samples which are intended for immediate test were tested on the same day where as samples which are planned with curing were tested 10, 20, 30 days all the test were conducted at a strain rate of 1.25mm per minute for each trail combination three samples were tested out three samples which ever two samples having close values were taken as unconfined compressive strength. From test conducted peat siol+10% stabilizer yielded maximum strength compared to other dosage of stabilizer.

Table 3. Variation strength with curing period of soil alone compared with CI soil 1 to 6% cement

Sl no	Mixture	Unconfined compressive strength(kN/m^2)			
		Curing period (Days)			
		0 Day	10 Days	20 Days	30 Days
1	peat Soil	10.60	10.60	10.60	10.60
2	peat Soil+5%stabilizer	13.51	17.21	20.23	21.56
3	peat Soil+10%stabilizer	15.60	18.46	22.78	27.00
4	peat Soil+15%stabilizer	14.56	17.23	21.21	23.24

2 CONCLUSION

1. The use of 10% stabilizer material (30% lime + 70% rice husk ash) is able to improve physical and engineering characteristics of peat soil, those are: specific gravity and wet unit weight increase; water content and void ratio decrease; soil shear strength increases and its compression decreases.
2. Curing period very much improve the stabilized peat soil properties; the increment of curing period causes the increase of specific gravity and wet unit weight; and it decreases water content, organic content, and acidity level.
3. The acidity and organic content of the stabilized peat soil decreases so that it becomes neutral peat soil with low organic content.
4. 10% stabilizer and 30 days of curing period is able to increase the shear strength about 25% from the initial condition (undisturbed peat soil) and significantly decrease the total compression.

REFERENCES

[1] Dhowian, A,W and T.B. Edil (1980). ”ConsolidationBehavior of Peat”. Geotechnical Testig Journal, Vol.3. No.3. pp 105-144

[2] Edil, T.B. and Dhowian, A,W. (1979). ”Analysis of Long-Term Compression of Peats”. Geotechnical Engineering, Southeast Asian Society of Soil Engineering, Vol. 10, pp159-178.

[3] Gibson, R.E and Lo, K.Y. (1961), “A Theory of Consolidation of Soil Exhibiting Secondary Compression” Acta Polytechnica Scandinavica Ci. 10296, pp.1-16

[4] Hanrahan, E.T. (1954). ”An Investigation of SomePhysical Properties of Peat”. Geotechnique,

[5] Landva, A.O., E.O. Korpijaakko, P.E. Pheeney, and P.M. Jarret, editor (1982). ”Geotechnical Classification of Peats and Organic Soils”. Testing of Peats and Organic Soils, ASTM, STP 820. Vol.4, No 3.

[6] Muskeg Engineering Handbook”. National Research Council of Canada, University of Toronto Press, Toronto, Canada.

[7] MacFarlane, I.C. (1959). ”Muskeg Engineering Handbook”. National Research Council of Canada, University of Toronto Press, Toronto, Canada.