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STRENGTH IMPROVEMENT OF DREDGED SOIL BY USING RICEHUSK ASH AND LIME

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Abstract: The soil found in the ocean bed is classified as marine soil. It can even be located onshore as well. The properties of marine soil depend significantly on its initial conditions. The properties of saturated marine soil differ significantly from moist soil and dry soil. Dredged Marine sample is uncommon type of clay and normally exists in soft consistency. In this study, Vizhinjam dredged soil is considered. The dredged soils are treated with different proportion of ricehusk ash and lime in order to obtain strength values Laboratory experiments to check the geotechnical properties of soil like hydrometer tests, proctor test, Atterbergs limit and UCC test were conducted. Organic content is also determined. The optimum amount of ricehusk ash and lime to be added is determined by unconfined compression tests. The results shows that RHA and lime when used together can improve the strength property of the dredged soil. Upon the addition of rice husk ash and lime, the UCC value increases.

Keywords: Dredged soil, ricehusk ash, lime, strength improvement**.**

I. INTRODUCTION

The rapid industrialization and urban development has lead to a scenario where we are in short of land for constructional activities. Hence we are forced to construct our buildings and structures on the available land, which may not have the required engineering properties. Most of the essential structures are built along coastal areas that are composed of highly compressible and weak soils up to significant depths.Soft alluvial and marine clay deposits have very low bearing capacity and excessive settlement characteristics, with obvious design and maintenance implications on tall structures and large commercial buildings, as well as port and transport infrastructure. Before commencing construction, stabilization of these soft soils is essential for both long term and short term stability of the structure. The engineering properties of such dredged fills are too poor to support the construction of structures. Even after years of self-weight consolidation, the fills still have a high water content, low bearing capacity, and high compressibility. Therefore, it is essential to stabilize the soft clayey soil before any construction work is conducted.Commonly adopted methods for soil stabilization are adding stabilizing agents to soil. It was found out that Rice husk ash can be used as an economic stabilizing agent in conjunction with lime for stabilizing

2. LITERATURE REVIEW

Zheng Shun Hong, Ling-Ling Zeng and Yu-Feng Gao(2016) conducted the practical estimation of compression behaviour of dredged clays with three physical parameters. Measuring consolidation parameters of dredged clays at high initial water contents is a time-consuming work.Dr.D.S.V.,Prasad,H., Venkateswarlu,N., Janardhan Rao, Chaitanya Kumar, J. (2015) studied the Strength Behaviour of Marine Clay treated with Rice husk ash. Studied the effect of addition of rice hash ash on marine clay selected from various cites.The marine clay has been stab added with rice husk ash from 0 to 20 %.Studied for maximum dry density, optimum moisture content and California bearing ratio.AsmaMuhmed and DariuszWanatowski(2013) studied the Effect of Lime Stabilization on the Strength and Microstructure of Clay. A series of laboratory tests were conducted.SEM analysis were carried out on kaolin clay mixed with 5% hydrated lime. Curing time contributed to an increase in the UCS.AgusSetyoMuntohar and GendutHantoro(2000) studied the influence of the rice husk ash and lime on engineering properties of clayey sub-grade. Varieties of samples are made by blending both rice husk ash and lime together. From the results swell behaviour of clayey soils is diminished. Bell, F.G., (1996) conducted lime stabilization of clay minerals and soils.All materials experienced an increase in

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their optimum moisture content and a decrease in their maximum dry density, as well as enhanced California bearing ratio, on addition of lime.

3.OBJECTIVES

- To determine the geotechnical properties of the Vizhinjam dredged soil.
- To determine compaction characteristics of the soil with the ricehusk ash and lime.
- To determine the optimum amount of ricehusk ash and lime to be added to improve the unconfined compressive strength of the dredged soil.

4. MATERIALS

4.1. VIZHINJAM DREDGED SOIL

Collected from Vizhinjam Sea Port, Thiruvananthapuram district in Kerala,the dredged soil is obtained at a depth of 20m. The natural properties of the dredged soil are given below.

Fig.1. Vizhinjam Dredged Soil

Table:1. Properties of Vizhinjam Dredged Soil

PROPERTIES	VALUE
Specific Gravity(IS 2720 PART 3)	2.14
Natural Moisture Content (%) (IS 2720 PART 2)	61.5
Max Dry Density (kN/m^3)(IS 2720 PART 7)	15
Optimum Moisture Content (%)(IS 2720 PART 7)	27
Liquid Limit (%) (IS 2720 PART 5)	61
Plastic Limit (%)(IS 2720 PART 5)	32
Plastic Index (%)(IS 2720 PART 5)	29
Shrinkage Limit (%)(IS 2720 PART 6)	11
Unconfined Compressive Strength (kg/cm^2)(IS 2720 PART 10)	0.322
Organic Content (%) (ASTM D 2974)	16.66

Differential Free Swell Index(%)(IS 2720 PART 40 1970)	40
Grain Size Distribution (%)	
Sand(IS 2720 PART 4)	11
Silt(IS 2720 PART 4)	53
Clay(IS 2720 PART 4)	36
Soil Classification	MH

4.2. RICEHUSK ASH

Rice milling generates a by-product know 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.

Fig.2. Ricehusk ash

Table: 2. Properties of Ricehusk ash

PROPERTIES	VALUE
Specific Gravity	2.16
Max Dry Density (g/cc)	1.15
Optimum Moisture Content (%)	38.46
Coefficient of uniformity (C_U)	11.18

4.3. LIME

Lime, chemically known as Calcium Oxide commonly known as quick or burnt lime, is a widely used chemical compound. It is a white, caustic, alkaline crystal solid at room temperature.

Fig.3. Lime

Table: 3. Properties of Lime

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Components	Amount (%)
Calcium Hydroxide	90
Silica	1.5
Ferric oxide	0.5
Magnesium Oxide	1
Alumina	0.2
Carbondioxide	3

5. METHODOLOGY

5.1COMPACTION TEST. The test to determine the optimum moisture content and maximum dry density were done using standard proctor test according to IS 2720. 1980 (Part VIII). The variation in optimum moisture content and maximum dry density was studied with the addition of various percentages of ricehusk ash (5, 10, 15&20 %) and lime (2, 4, 6&8%).

5.2UNCONFINED COMPRESSIVE STRENGTH. The unconfined compressive strength tests are conducted on Marine Clay, Marine Clay+ Ricehusk ash, Marine Clay + Ricehusk ash-lime as per IS 2720 part 10 (1973). All the samples are prepared by static compaction using split mould at Optimum moisture content and Maximum dry density to maintain same initial dry density and water content. The test was conducted under a constant strain rate of 1.5mm/min. The proving ring reading is noted for 50 divisions, and loading was continued until 3 (or) more reading are decreasing (or) constant (or) strain 20% has been reach.

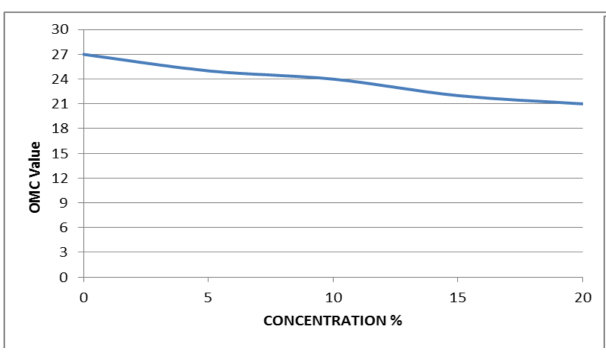
5.3ATTERBERG LIMITS.

The liquid limit and plastic limit test were carried out as per IS: 2720 [Part V] and shrinkage limit test was carried out as per IS: 2720 [Part VI].

6. RESULTS

6.1. EFFECT OF RICEHUSK ASH ON COMPACTION

Percentage of ricehusk ash used for the test was 5,10,15 and 20. The result shows that the OMC decreases and the dry density increases upon addition of ricehusk ash.



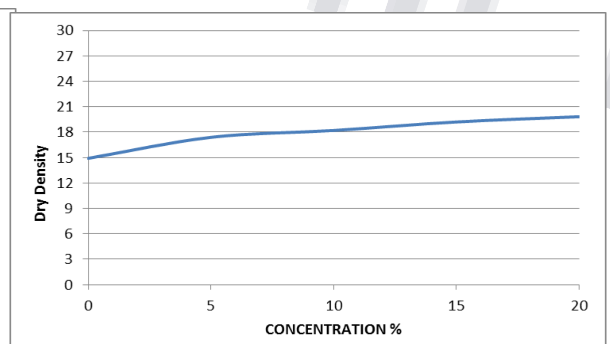


Fig.4. Variation of OMC with Rice husk ash **Fig.5.** Variation of Dry Density with Rice husk ash

6.2 .VARIATION OF UCS VALUE WITH RICEHUSK ASH

The optimum amount of ricehusk ash is found to be 10% as the increase in strength is to be 1.54 times compared to the untreated soil.

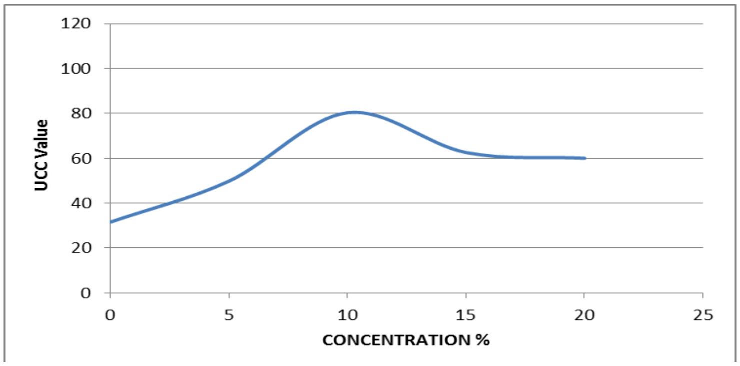


Fig.6. Variation of UCS with ricehusk ash

6.3. EFFECT OF 10% RICEHUSK ASH + LIME ON COMPACTION

The soil with optimum amount of ricehusk ash (10%) is then treated with varying percentage of lime (2, 4, 6 and 8% respectively)

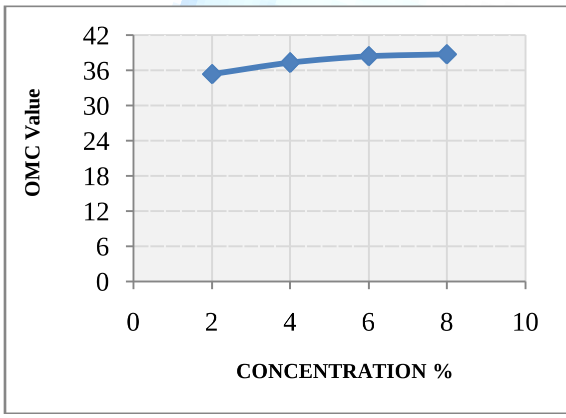


Fig.7. Variation of OMC

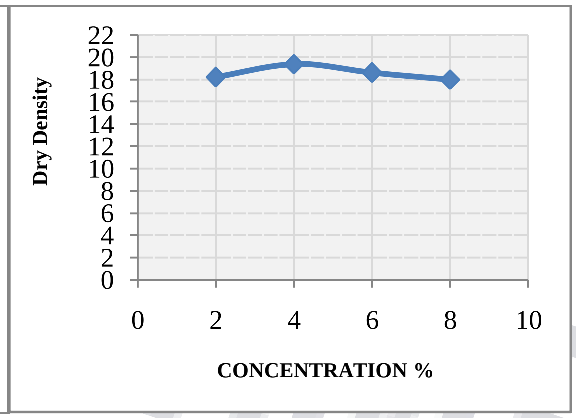


Fig.8. Variation of Dry Density

6.4. VARIATION OF UCS VALUEWITH10% RICEHUSK ASH + LIME

The optimum amount of lime is found to be 4% as the increase in strength is to be 1.78 times compared to the soil – ricehusk ash mixture.

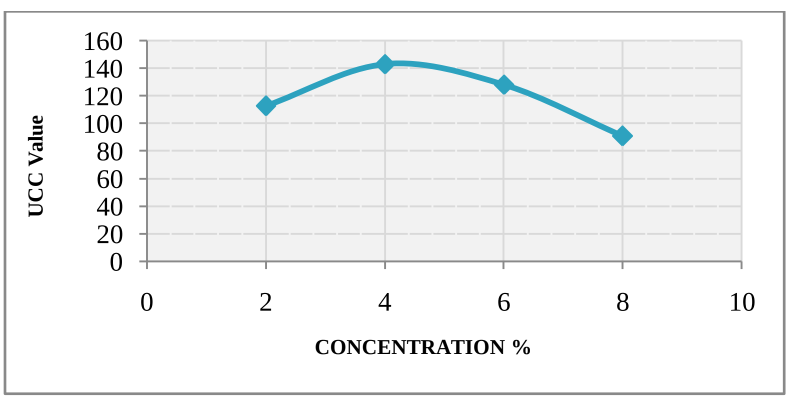


Fig.9. Variation of UCS value

7. CONCLUSIONS

- The geotechnical properties of the Vizhinjam marine dredged soil were studied.
- The optimum moisture content increases and maximum dry density decreases upon addition of the lime.
- The optimum amount of ricehusk ash is found to be at 10% with an increase in strength of about 1.54 times compared to untreated soil and lime is found to be 4% with increase in strength of about 1.78 times when compared to the soil – ricehusk ash mix.

8. REFERENCES

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