Effect of Rice Husk Ash on Cement Stabilized Laterite

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Abstract **-Consolidation tests have been prepared at optimum moisture content and maximum dry density by adding 4, 8, 16 and 20% by weight of rice husk ash to the originate soil. Specimens have been subjected to increments of vertical pressure of 0.25, 0.50, 1.00, 2.00 and 4.00 kg/cm2 in a fixed ring consoled meter. [1]Coefficient of compressibility (a_v) and coefficient of volume compressibility (m_v) show no significant quality for variation in values with change in proportion of rice husk ash in the soil at a particular effective stress. It has been observed that there is decrease in the values of these parameters with increase in effective stress for a particular percentage of rice husk ash. Compression index (c_c) has been found to decrease significantly with increase in percentage of rice husk ash, hence decreasing consolidation settlement of parent material. It has also been observed that the time required for achieving a given degree of consolidation decreases with increase in the percentage of rice husk ash at a particular effective stress[2]. Overall, it has been observed that rice husk ash effectively increase one-dimensional stiffness and therefore, reduce settlement.**

Keywords:- 1-D , Cc , Mv , Av, Rice husk ash (RHA), stabilization, compressibility, characteristics, maximum dry density and optimum moisture content.

I. INTRODUCTION

Soil stabilization is modification of soil properties to improve its engineering performance. However the original objective of the soil stabilization is to increase the strength or stability of soil but now-a-days stabilization is used to increase or decrease almost every engineering property. Over the last few years, the use of industrial waste has increased as stabilizing materials for naturally occurring fine grained soil .In the present work, compressibility characteristics have been studied for locally available highly plastic clay treated with different percentages of rice husk by conducting a series of one dimensional consolidation tests. Rice Husk is an agricultural waste obtained from milling of rice. About 10 tones of rice husk is generated annually in the world. Meanwhile, the ash has been categorized under pozzolana, with about 67-70% silica and about 4.9% and 0.95% Alumina and iron oxides, respectively[3]. The silica is substantially contained in amorphous form, which can react with the CaOHlibrated during the hardening of cement to further form cementations compounds.

A. Materials

1. Clay used in the experiments was collected from Industrial Area , Phase-II, PGI Road Jaipur (Raj.) . The soil is classified as highly plastic clay

2. Rice husk ash It was collected from Kohinoor Foods Limited, GT Road, Murthal, District Sonipat, Haryana.

B. Chemical Properties

Constituent	Composition (%)
SiO2	67.3
Al2O3	4.9
Fe2O3	.95
CaO	1.36
MgO	1.81
Loss On Ignition (LOI	17.78

C. Physical Properties

Physical Properties	Materials	
	Rise husk ash	Parent clay
Specific Gravity	2.45	1.90
Liquid Limit	52	NP
Plasticity Index	29	NP
OMC%	28	NP
MDD (g/cc)	1.56	-

II. SAMPLE PREPARATION

A. Composition of specimens

Specimens of parent clay and clay treated with 4, 8, 12, 16 and 20% by weight of rice husk ash passing 425 micron) B. Mixing Oven dry soil was dry mixed with various percentages of rice husk ash. Sufficient quantity of water was then added to bring the moisture content to the desired level. The mixture was then manually mixed thoroughly with a spatula.

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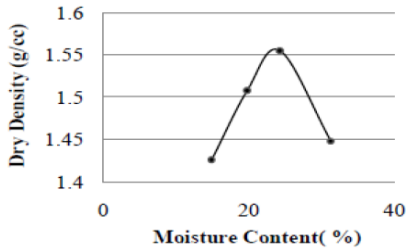
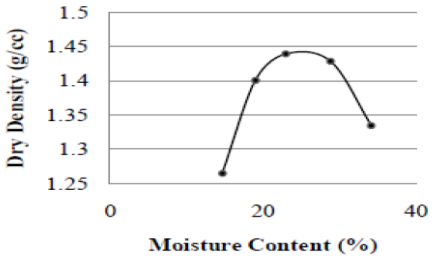
C. Static compaction

Cylindrical specimens were compacted by static compaction in 10 cm diameter consolidation ring to the required height of 2.5 cm. The inner surface of the ring was smeared with mobile oil to help minimize friction between

inner surface of the ring and the soil sample during consolidation process[5] The wet homogenous mixture was placed inside the specimen ring using spoon and leveled. Sample was placed in specimen ring with extension collar attached to it and both the exposed sides of the sample were covered with filter papers.





TESTING AND RESULTS

A series of one-dimensional consolidation tests were conducted to determine the compressibility characteristics of untreated clay and clay stabilized with rice husk ash to evaluate its effect in reducing compressibility of the soil. These characteristics have been illustrated by establishing the relationships between void ratio and effective stress. In order to determine rate and magnitude of consolidation.

A. Moisture

Density relationships For parent clay OMC and MDD have been observed as 23.5% and 1.56 g/cc respectively. For clay stabilized with Rice husk ash OMC varies from 23.7 to 33% and MDD varies from 1.553 to 1.28 g/cc, with increase in percentage of rice husk ash. It has been observed that there is an increase in OMC and decrease in MDD due to an increase in percentage of rice husk ash.

B. Coefficient of compressibility (a_v)

Based on the analysis of variation in equilibrium void ratio for various values of effective stress, the coefficient of compressibility (av) values, for all stabilized clay samples have been determined over a range of consolidation pressures. For parent clay the value of av decreases from 13.9 x 10-2 to 5.97 x 10-2 cm2/kg as the pressure increases from 0.25 kg/cm2 to 4.0 kg/cm2, which shows that compressibility of soil decreases with the increase in effective stress[8]. It has been observed that values of av vary from 9.3 x 10-2 to 0.60 x 10-2 cm2/kg for various percentages of rice husk ash at different effective stresses. [9]

C. Coefficient of volume compressibility (m_v)

Based on the analysis of variation in equilibrium void ratio for various values of effective stress, the coefficient of volume compressibility (mv) values, for all stabilized clay samples have been determined over a range of consolidation pressures. For parent clay the value of mv decreases from 8.99 x 10-2 to 3.82 x 10-2 cm2/kg as the pressure increases from 0.25 kg/cm2 to 4.0 kg/cm2, which shows that volume compressibility of soil decreases with the increase in effective stress.

D. Compression index (c_c)

Based on the analysis of pressure-void ratio curves on semi-log plot i.e. virgin compression curves, compression index (Cc) values, for all stabilized clay samples have been determined[6] The value of Cc for parent clay is observed as 0.458. It has been observed that values of Cc vary from 0.508 to 0.181 for various percentages of rice husk ash. It has been observed that there is a general decrease in value of Cc with an increase in rice husk ash content.

E. Coefficient of consolidation (c_v)

Based on the analysis of variation of dial gauge readings at various time intervals for a particular stress level with respect to square root of time, the coefficient of consolidation (Cv), for all stabilized clay samples have been determined over a range of consolidation pressures. For parent clay, the value of Cv decreases from 0.347 x $10^{-3}$to 0.0732 x 10^{-3} cm2/sec as the pressure increases from 0.25 kg/cm2 to 4.0 kg/cm2,[7]which shows that the time required for the soil to reach a given degree of consolidation increases with increase in effective stress. It has been observed that the values of C_v vary from 0.151 x 10-3 to 1.4899 x 10-3 cm2/sec for various percentages of rice husk ash at different effective stresses.

III. CONCLUSIONS

The study demonstrates the influence of rice husk ash on the compressibility characteristics of highly plastic locally available clay. The following conclusions have been drawn based on the laboratory investigations carried out in this study:

1. The addition of rice husk ash to the parent material results in an increase in optimum moisture content and decrease in maximum dry density with increase in rice husk ash content.
2. Compressibility analysis of the parent clay and clay stabilized with various industrial wastes indicates that coefficient of compressibility (av) shows no significant trend with the variation in the percentage of rice husk ash for a particular effective stress.
3. However, a decrease in value of av has been observed with an increase in effective stress at a particular percentage of rice husk ash.

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