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Comparitive Study on Utilisation of Flyash and Bioenzyme in Lithomargic Soil Cement Blocks

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***Abstract*- Lithomargic clay (Shedi soil) is an expansive soil and has a great affinity towards water. When it comes in contact with water it expands and it behaves as a liquid by losing its strength. When it loses water from it, it shrinks. This makes it unsuitable for construction of any civil structures. The soil stabilisation method should be verified in laboratory before it is used for making blocks in construction. Various techniques are used to stabilize the soil .Stabilisation of soil with Bio enzymes and flyash is a newly method to improve the geotechnical properties of the soil .In this present study ,the effectiveness of Bio enzymes and Terrazyme in stabilizing the Lithomargic soil investigated through laboratory experiments. In this study, the Lithomargic soil sample are collected to investigate the geo technical properties and treated with variable dosage of Bio enzyme and variable percentage of flyash. The compressive strength have been evaluated for a curing period of 7, 14, and 28 days.**

Keywords- Lithomargicsoil, Flyash, Bioenzyme, Compressiontests.

1. INTRODUCTION

The ancient human activity was building construction. To moderate the effect of climate, the building construction was started with the purely efficient require of forbidden environment. In olden times (or days) of building were noticeable with number of trends. One was increasing the durability of materials used in it. In ancient time building materials were fragile, like leaves, branches and animal hides later more long-lasting natural materials- such as clay, stone and timber were used.

Stabilization is a technique of enhancing the characteristics of mud so that the mud will possess the enough wet strength, durability and dimensional stability without burning. Compacting a mixture of soil with small amount of cement and suitable quantity of flyash at optimum moisture in a press result in stabilized mud blocks. To the burnt bricks, the use of stabilized mud blocks were found as an alternative, where soils is being stabilized with the stabilizers such as cement, flyash and Terrazyme etc., and these stabilized mud blocks were pressed under high compaction which avoid burning which helps in avoiding burning process and saves a lot of energy and it becomes more economical. The overall energy consumption in stabilized mud blocks is very small when compared to burnt bricks. During soil stabilization compaction can be done by using a manually operated or mechanized press.

II METHODOLOGY

The materials to be used in the present study will be composed from various places and the basic tests were carried out on the procured materials to study the material properties in order to make suit the materials for the project. The materials used in the present study are Lithomargic soil, cement, Bio enzyme.

MATERIALS USED

Lithomargic soil

Lithomargic-soil consists an significant residual group of soils existing below the laterite soils usually found on western sides of India. It is much sensitive to water and loses a greater part of its strength when water present in it.

Cement

A binder material which is used as a stabilizer in the manufacture of stabilized mud blocks. In this investiguation OPC 53 is used.

Fly ash

Fly ash particles are generally a shape of spherical and the particle size ranges from 0.5 micron meter to 300 micron meter. Sio_2, Al_2O_3, Fe_2O_3 and Cao are the major components which are there in the flyash.

Bio-enzyme (Terrazyme)

Terrazyme is a liquid solution which is organic in nature and is originate from the fruit and vegetable extract. It enhances the quality of soil like strength, durability and decreases the OMC, plasticity index of soil

Figure 1: Lithomargic soil sample

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Figure 2: Flyash

Figure 3: Bioenzyme (Terrazyme)

III TEST PROCEDURE

1. Specific Gravity
2. Sieve Analysis
3. Liquid Limit
4. Plastic Limit
5. Standard proctor Test
   - Optimum Moisture Content
   - Maximum Dry Density
   - California Bearing Ratio Test
6. Dry Compression
7. Wet Compression
8. Dimensionality
9. Prism Test
10. Block density

Table 1: Properties of lithomargic soil

Soil property	Values
Specific gravity	2.25
Sand content	90.70%
Fineness modulus	3.57
Atterberg limits	
Liquid limit	39.4%
Plastic limit	33.5%
Standard Proctor test	
Maximum dry Density	1.68 gm /cc
Optimum Moisture Content	2O %
Unconfined Compressive Strength	105.00 KN /m^2
CBR test (%) 1) Un soaked 2) Soaked	 4.39 % 2.45 %

Table 2: Properties of Terrazyme:

Boiling Point	212
Specific gravity	1.000 to 1.090
Melting point	Liquid
Vapour Density	1
pH value	4.3 to 4.6
Appearance	Brown clear Liquid

Gradation curve

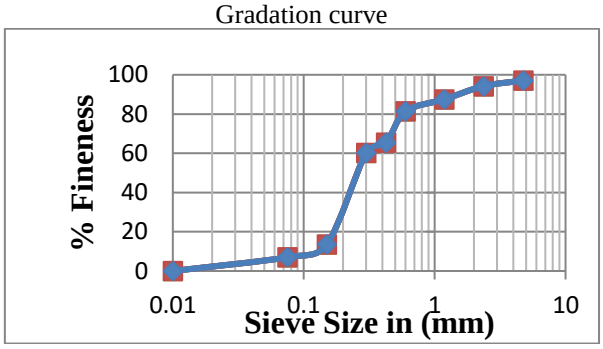

Figure 4: Sieve analysis of soil sample

IV DRY COMPRESSION TEST

The blocks are tested according to the procedure .Compression testing machine is used to get the compressive strength of block. Blocks cured for 28 days are taken out from curing and kept for surface drying the block is tested in the compression testing machine by applying load on the flat surface perpendicular to the thickness. A 3mm thick plywood sheet is used on either face of the block before applying load .The compressive strength of each specimen is calculated as the ratio of maximum load at failure in (N) to that of cross sectional area (mm^2).

$$\text{Compressive strength } (N/mm^2) = \frac{\text{Maximum load at failure in N}}{\text{Surface area of block in } mm^2}$$

V. WET COMPRESSION TEST

The bricks were tested in accordance with the procedure. Blocks cured for 28 days. The frogs on either face of the block are filled with 1:1 cement mortar and cured under wet gunny bag for a day. The block is then immersed in water for 4 days. The block is removed and the surface is thoroughly cleaned. A 3mm thick plywood sheet is used on either face of the block before applying load. The compressive strength of each specimen was calculated as

$$\text{Compressive strength } (N/mm^2) = \frac{\text{Maximum load at failure in N}}{\text{Surface area of block in } mm^2}$$

VI WATER ABSORPTION

The water absorption test is carried out as per the procedure laid down .After the preparation of blocks, the blocks are kept for curing process for 7, 14, 28 days etc. then the blocks are weighed and are kept in oven for 24hours and after 24 hours the blocks are removed and they are weighed and then the blocks are immersed in cold water for 24 hours, an average of water absorption shall not be more than 15% by weight after the removal of blocks from its water after 24hours.

$$\text{Water absorption} = (W_1 - W_2)/ W_2) \times 100$$

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VII RESULTS AND DISCUSSIONS

Table 3: Results of Dry compression test for Combination of soil, bioenzyme and Flyash blocks

COMBINATION	WATER ABSORPTION STRENGTH in N/mm^2		
	7 days	14days	28days
CSMB	7.24	7.15	6.99
Soil+30%FA +Dosage 3	6.45	6.05	5.75

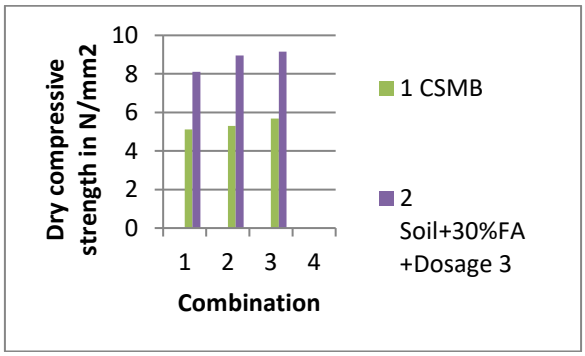

Figure 5: Analysis chart for Dry compression test for combination of all material.

Table 4:Results of wet compression test for Combination of soil, bioenzyme and Flyash blocks

COMBINATION	WET COMPRESSIVE STRENGTH in N/mm^2		
	7 days	14days	28days
CSMB	5.11	5.30	5.68
Soil+30%FA+ Dosage 3	8.10	8.95	9.15

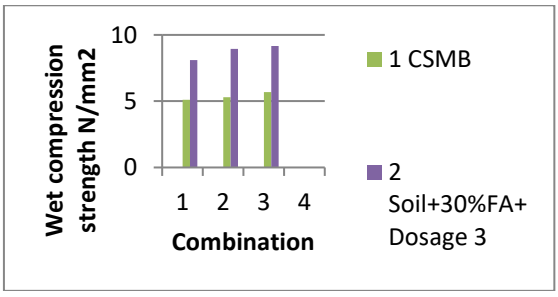

Figure 6: Analysis chart for Wet compression test for combination of all materials

Table 5:Results of Water absorption test for Combination of soil, bioenzyme and Flyash blocks

COMBINATION	DRY COMPRESSIVE STRENGTH in N/mm^2		
	7 days	14days	28days
CSMB	5.11	5.30	5.68
Soil+30%FA +Dosage 3	9.80	10.00	10.20

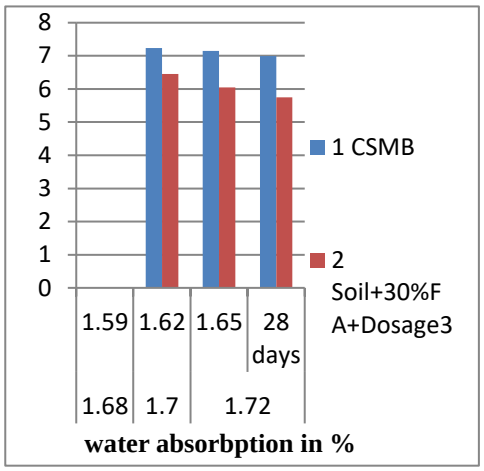

Figure 7: Analysis chart for Water absorption test for combination of all materials

VIII CONCLUSION

The dry density of bricks increases with increase of flyash % in soil and it is maximum for 30% flyash and it increases with increase in curing periods and also it is maximum for dosage 3 of Terrazyme for different curing periods. On combining soil with optimum flyash, Bioenzyme dosage, for 28 days curing period the dry density found to be increased.

The Dry and wet compressive strength of bricks is increases with increasing in the flyash % in soil and it is maximum for 30% flyash and increases with increase in curing phases. And also it is maximum for dosage 3 of Terrazyme. On combining soil with optimum flyash, Terrazyme dosage for 28 days curing period, the compressive strength is to be increased.

The water absorption of bricks reduces with increase in the percentage substitution of Flyash and increases in the replacement of Bioenzyme.

The soil blocks have good dimensional stability and the results of the dimensionality tests are well within the limits.

Elastic modulus of prism is 426.86 N/mm^2 and basic compressive strength of masonry is 0.445N/mm^2.

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