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SOIL STABILIZATION USING WHEAT HUSK AND LIME

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Abstract – *Soil is a heterogeneous substance that exhibit variety of nature. Its properties differ from place to place and also changes as depth increases. In construction when excavation is done, the soil is very unstable and may collapse while construction. Soil stabilization is a technique of holding up of soil without collapsing and hence enhancing its properties. This study presented a review of literature on soil stabilization using wheat husk and lime. In this we have used wheat husk at different percentages like for 3%, 4.5%, 6% with and without lime. Lime percentages are taken as 3% with 3% Wheat Husk and 6% with 6% Wheat Husk. We have tested all these combination on light proctor compaction test to determine maximum dry density. Maximum dry Density will help us determine shrink-swell properties of a soil, thus improving the load bearing capacity of a sub-grade to support pavements and foundations.*

Key Words: Soil Stabilization, Lime, Wheat Husk, Dry Density, Strength, etc.

1. INTRODUCTION

Foundation is a very important part of a structure. It transfers all the load to the bottom strata of the soil. Hence soil needs to be of sufficient bearing capacity. When the excavation is done for the foundation work, the soil on the sides is very unstable and hence it may collapse while construction, due to any type of vibration in the soil. So in order to prevent the soil from collapsing the soil stabilization is done. Soil Stabilization is a process of enhancing properties of soil with the addition of different type of material like wheat husk, lime, coir, Plastic fiber etc. In this research we have used Wheat Husk and Lime as additive for the stabilization of soil. We have tested soil with only wheat husk and with the combination of wheat husk and lime.

1.1 Wheat Husk

Wheat is the most common and important type of food grain and ranks second in total production. Wheat husk is the outer covering of the grain that is separated from the grain as it is of no use. Wheat Husk is considered a waste product and is extracted out while washing the grain..

Fig -1: Wheat Husk

1.2 Lime

Lime is a calcium-containing inorganic mineral. It is obtained from limestone that are primarily composed of calcium oxides. Lime is widely used in construction materials like in cement. It contributes a great part in cement production. Lime is easily available material in the market and at very cheap prices. Using lime in soil stabilization will lead to an economical concept.

2. PROBLEM RELATED TO SOIL

Problems that occur with the soil are only related to its geotechnical properties. These problems can contribute a faulty construction. The geotechnical properties of soil such as size, moisture content, specific gravity, maximum dry density broadly affect any structure to be constructed, whether it be a residential building or airport or highway or a dam. Some remedial measures can be taken to prevent damages. These are Moisturizing the soil or addition of some additives that fill up the voids between the soil particles.

3. REMEDIAL MEASURES

Soil Stabilization is the process of making soil more stable. Soil stabilization is process of blending and mixing material with a soil to improve some geotechnical properties of the soil. The process may include the blending of soils to achieve a desired gradation or the mixing of additive that change the properties of soil like in this process we have use wheat husk and lime.

4. METHODOLOGY

The following experiments are conducted based on IS codes:

A. Determination of soil specific gravity
B. Particle size distribution by sieve analysis
C. Determination of soil index properties (Atterberg Limits)
D. Liquid limit by Casagrande's apparatus
E. Plastic limit
F. Determination of maximum dry density (MDD) and the corresponding Optimum Moisture Content (OMC) of the soil by standard proctor compaction test
G. Determination of shear strength by California Bearing Ratio Test.

5. EXPERIMENTAL INVESTIGATION

Soil with Wheat Husk

Liquid Limit Test

Moisture Content (%) = w = $(W_w/W_d)*100$

Table -1: Liquid Limit for Soil with only Wheat Husk

Wheat Husk Percentage	3%	4.5%	6%
No. of Blows	25	25	25
Wt. of empty container in gm,W_1	10	16	16
Wt. of container + wet soil in gm, W_2	30	27	27
Wt. of container + dried soil in gm, W_3	25	24	24
Wt. of oven dried soil in gm, $W_d=W_3-W_1$	15	08	08
Wt. of water in gm, $W_w=W_2-W_3$	05	03	03
Moisture content of Soil (%)	33.33	37.5	37.5

Plastic Limit Test

Moisture Content (%) = w = $(W_w/W_d)*100$

Table -2: Plastic Limit for Soil with only Wheat Husk

Wheat Husk Percentage	3%	4.5%	6%
Wt. of empty container in gm,W_1	16	16	15
Wt. of container + wet soil in gm, W_2	27	26	26
Wt. of container + dried soil in gm, W_3	25	23	24
Wt. of oven dried soil in gm, $W_d=W_3-W_1$	09	07	09
Wt. of water in gm, $W_w=W_2-W_3$	02	03	02
Water content (%)	22.22	42.85	22.22

Soil with Wheat Husk and Lime

Liquid Limit Test

Moisture Content (%) = w = $(W_w/W_d)*100$

Table -3: Liquid Limit for Soil with Wheat Husk and Lime

Percentages	3% WH + 3% Lime	6% WH + 6% Lime
No. of Blows	25	25
Wt. of empty container in gm,W_1	16	07
Wt. of container + wet soil in gm, W_2	30	18
Wt. of container + dried soil in gm, W_3	25	14
Wt. of oven dried soil in gm, $W_d=W_3-W_1$	09	07
Wt. of water in gm, $W_w=W_2-W_3$	05	04
Moisture content of Soil (%)	55.55	57.14

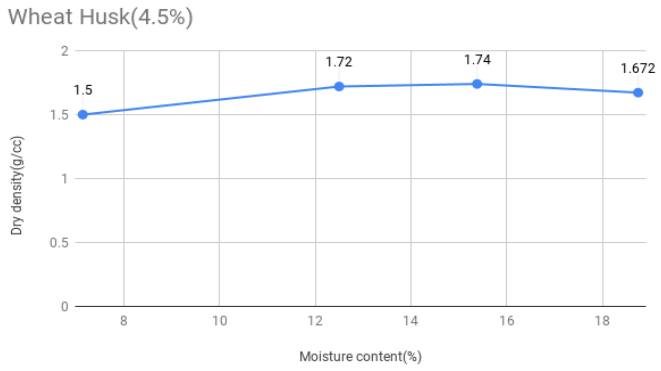
Plastic Limit Test

Moisture Content (%) = w = $(W_w/W_d)*100$

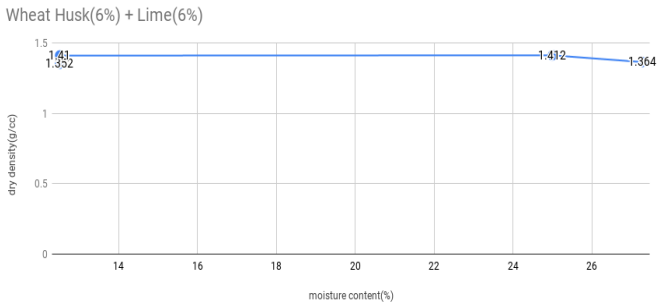
Table -4: Plastic Limit for Soil with Wheat Husk and Lime

Percentages	3% WH + 3% Lime	6% WH + 6% Lime
Wt. of empty container in gm,W_1	8	11
Wt. of container + wet soil in gm, W_2	25	32
Wt. of container + dried soil in gm, W_3	21	27
Wt. of oven dried soil in gm, $W_d=W_3-W_1$	13	16
Wt. of water in gm, $W_w=W_2-W_3$	4	5
Water content (%)	30.76	31.25

Procter compaction test



Graph -1: Dry Density VS Moisture content curve



Graph -2: Dry Density VS Moisture content curve

Table -5: CBR Values of Soil

% Wheat Husk & Lime	CBR Value @2.5mm Penetration (%)	CBR Value @5mm Penetration (%)
3% Wheat Husk	3.428	3.324
4.5% Wheat Husk	4.56	4.22
6% Wheat Husk	10.62	10.16
3% WH & 3% Lime	8.66	8.43
6% WH & 6% Lime	6.24	6.12

6. CONCLUSIONS

Since wheat husk is generally a waste but when mixed with lime shows engineering properties which is a very good indication of its utilization.

Also use of lime and wheat husk together can solve many engineering problems related to soil. It is also economical and can save a lot of project amount to utilize for solving other problems involved in the project.

The values of OMC and CBR are widely used by engineers for designing and construction of structures. Since the values have increased by using a mixture of wheat husk and lime so they can be easily used for the construction purposes.

The two materials used are readily available and their transportation is also easy and they won't even deteriorate so can be travelled for large distances for the use.

The use of wheat husk and lime can be used for repair work of structures also.

These two materials can also be used for the construction of pavements.

Wheat husk and lime can be used not only with soil but with cement too.

They can act as very good binders to replace some percent of fine aggregates.

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