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Stabilization of Soil Using Agricultural Waste

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Abstract:-
While making subgrade of a road or highway we need to compact the soil and when it require to raise the height of pavement such as bridge, flyover then soil stabilization plays a vital role. Shear strength of soil should be optimum to bear the load. As we know expansive soil has property of swelling when moisture content increases, water can infiltrate easily through it, its volume changes with respect to water content. After evaporation it shrinks. Rice husk is a major agricultural waste in our country and is easily available in every area. But it cannot be used as raw material because it decomposes in soil with the time, so its ash is used. It has been observed that at a certain % amount of rice husk Ash can improve plasticity of soil, increases CBR value. Shear strength is also increased at 10% amount of rice husk as admixture gives the best stability.
Key word: *Expansive soil, Rice husk ash, Liquid limit, OMC, MDD, CBR.*

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I. Introduction:-

Civil engineer we have to do the work economically and efficiently. It requires the use of locally available raw materials. In soil stabilization using agricultural waste it is important to use such a material which is available in major quantity, gives better result and not so much costly. Majorly lime and cement is used for stabilization but it is costly and is increasing day by day. Lime manufacture process is costly and transportation is also costly. Rice husk can be used as stabilizer in place of lime but in form of ash. It has properties of cementation; it requires to be mixed with cement for better result. It can bind soil particles and provide much strength. There are many more agriculture wastes that can be used for stabilization as groundnut cell, Palm leaves, and sugarcane bagasse. But availability of rice husk and its properties of binding are efficient of them.

II. Material Used:-

Soil sample used for test is expansive soil, Rice husk ash. It was collected from rice mill. Its sieve size was made upto size of soil particles (0.07 mm).

2.1 Expansive Soil:-

The expansive soil is collected from site.
Properties of soil are given in table below.

Parameter	Value
Plastic Limit	30%
Liquid limit	65%
Particle Density	35%
Shrinkage Limit	11
OMC	30
Specific Gravity	2.6
MDD	1.7 g/cm2
UCS	85 Kpa
CBR (unsoaked)	1.4
Free swell Index	50%

Table 1. Properties of soil

2.2 Rice Husk Ash:-

The rice husk ash was collected from mill. It is by-product material produced from the process of manufacturing puffed rice. RHA contains large amount of iron oxide and silicate. RHA is chemically stable and its physical properties are similar to that of natural sand. It contributes to excellent stability and load bearing capacity.

III. Methodology:-

To study the effect of rice husk ash (RHA) on soil as a soil stabilizer it mixed in various proportions with soil. The mixers are further tested to find index properties (specific gravity, liquid limit test, plastic limit test and standard Procter compaction test) and Engineering properties (California bearing ratio test).
The tests are conducted for expansive soil with the addition of RHA by the percentage replacement of RHA i.e. 5%, 10%, 15%, 20% by weight of soil mass.

Test conducted are

- Atterberg's Limit Test
  - Liquid Limit Test
- Standard Proctor Compaction Test
  - Optimum Moisture Content(OMC)
  - Maximum Dry Density (MDD)
- CBR (California Bearing Ratio) Test.

IV. Result and Discussion:-

a) Liquid Limit

Description	Liquid Limit
Soil	50.23
Soil + 5% RHA	47.57
Soil + 10% RHA	46.18
Soil + 15% RHA	43.19
Soil + 20% RHA	39.75

Table 2. Effect of RHA on Liquid Limit Behaviour

Table 2 shows the effect of Liquid Limit behaviour of RHA on different percentage (5%, 10%, 15%, and 20%). It can be seen that with addition of RHA, the liquid limit continuously decreases (50.23% to 39.75%).

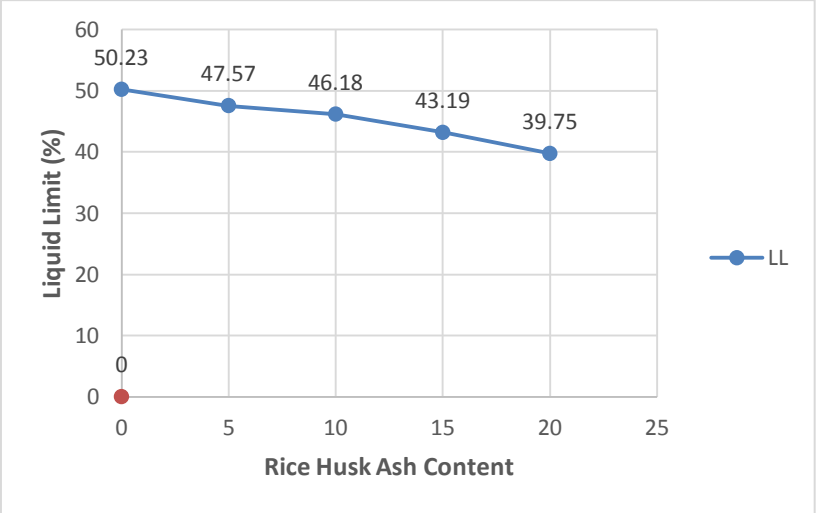

Figure 1. Effect of RHA on Liquid Limit Behaviour of soil

Figure 1 shows the variation of liquid limit of a soil with increasing percentage of RHA. The variation in liquid limit highly effect the compressibility and swelling characteristics of soil i.e. reduction in liquid limit means reduction in the compressibility and swelling.

b) Standard Proctor Compaction Test

Description	OMC (%)	MDD (g/cc)
Soil	15.93	1.638
Soil + 5% RHA	17.82	1.43
Soil + 10% RHA	20.08	1.47
Soil + 15% RHA	21.85	1.39
Soil + 20% RHA	23.62	1.27

Table 3. Effect of RHA on OMC and MDD

Table 3 shows the effect of RHA on optimum moisture content (OMC) and maximum dry density (MDD) of soil.

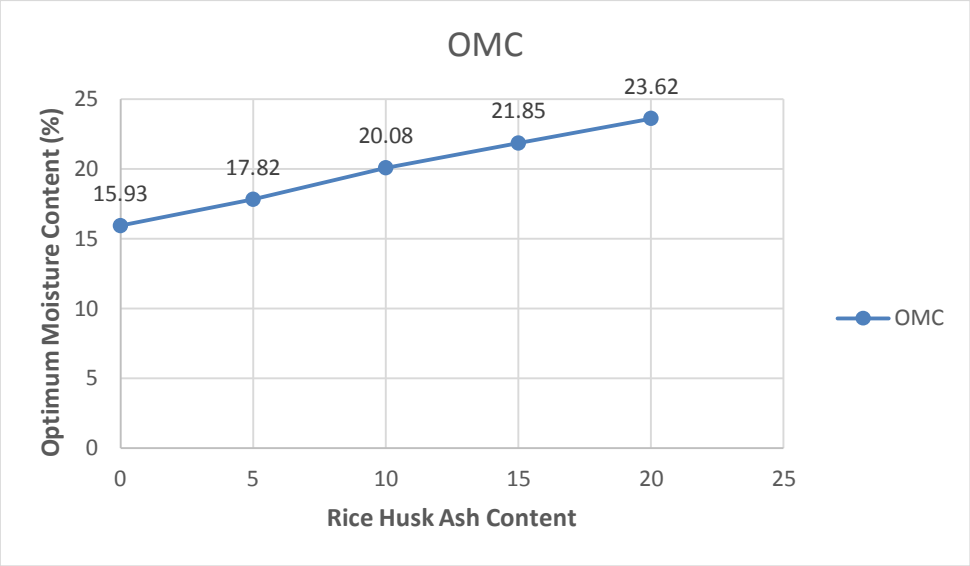

Figure 2. Effect of RHA on OMC of Soil

Figure 2 shows the variation in optimum moisture content (OMC) on adding RHA in different proportion. OMC is increase in the RHA content. The increase is due to the addition of RHA, which decreases the quantity of free silt and clay fraction and coarser material with large surface areas are formed.

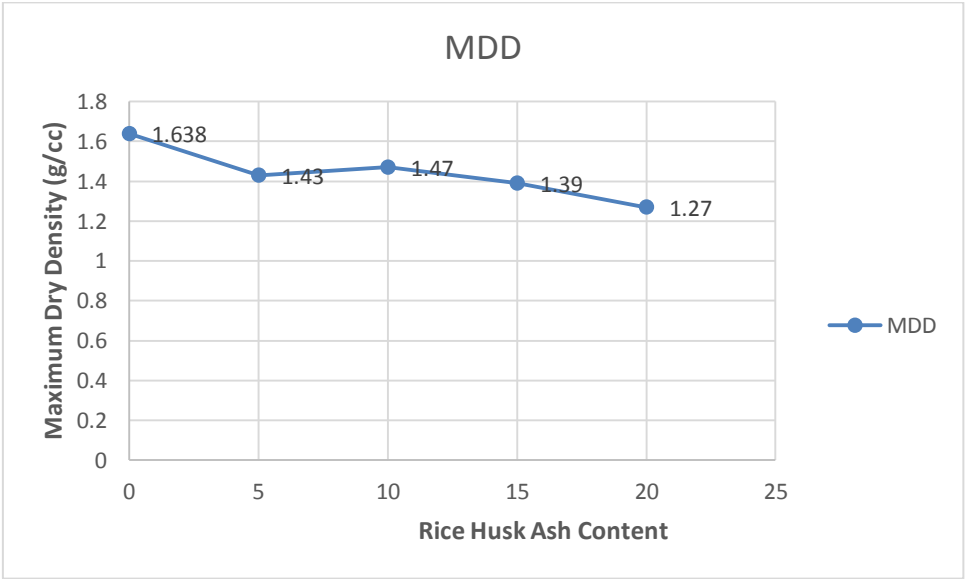

Figure 3. Effect of RHA on MDD of Soil

Figure 3 shows the variation in maximum dry density (MDD) on adding RHA in different proportion. The MDD is decreased with increasing in the RHA content. The decrease in maximum dry density (MDD) can be attributed to the replacement of soil and by the RHA in the mixture. The decrease in MDD may also be explained by considering the RHA as filler in the soil voids.

c) CBR Test

Description	CBR @ 2.5 mm	CBR @ 5 mm
Soil	1.438	1.871
Soil+ 5% RHA	2.176	2.198
Soil+ 10% RHA	2.575	2.374
Soil+ 15% RHA	2.204	2.192

Table 4. Effect of RHA on CBR Value

Table 4 shows the CBR value corresponding to 2.5mm and 5mm penetration. Sub grade soil of flexible pavement decide the thickness of flexible pavement. Higher the sub grade strength lesser will be the flexible pavement thickness. On adding RHA we got positive response up to certain point.

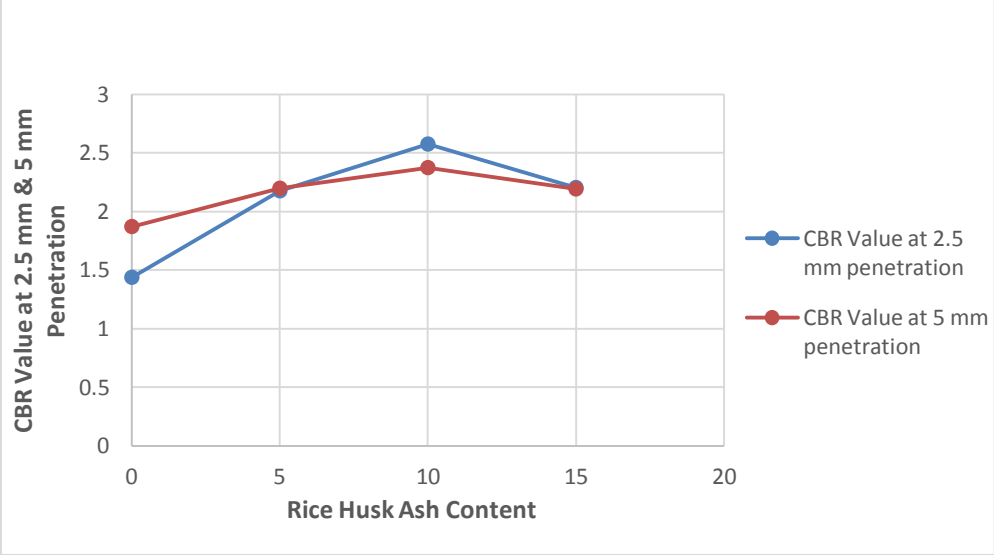

Figure 4. Effect of RHA on CBR Value for Soil

Figure 4 shows that the comparison of CBR value at 2.5mm and 5mm percentage of RHA. In graph, up to 10% increase in CBR values, beyond 10% it start decreasing.

V. Conclusion:-

The main objective of this research was to study the effect of adding RICE HUSK ASH on the engineering properties of soil. From this research work it has been found that on addition of RHA alone to the test soil resulted in decrease in the value of liquid limit and MDD and increase in OMC. Due to presence of silica in RHA is capable to replace the exchangeable ion present in clay mineral thus can reduce shrinkage and swelling property of clay minerals. The addition of RHA to the test soil resulted in first increase in CBR value upto 10% thereafter it decreases.

References:-

[1]. Vishal Ghutke, Pranita Bhandari, Vikash Agrawal (2018) Stabilisation of soil by using Rice Husk, The International Journal of Engineering and Science (IJES).
[2]. Aparna Roy, "Soil Stabilization using Rice Husk Ash and Cement" International Journal of Civil Engineering Research.
[3]. Sabat, A.K. (2013) "Engineering Properties of an Expansive Soil Stabilized with Rice Husk Ash and Lime sludge," International Journal of Engineering and Technology.
[4]. Sabat, A.K. (2012) "Effect of Polypropylene Fibre on Engineering Properties of Rice Husk Ash Lime Stabilized Expansive Soil," Electronic Journal of Geotechnical Engineering.
[5]. IS 2720, "Methods of Test for Soil".
[6]. Punmia B.C. 2007, "Soil Mechanics & Foundations" Laxmi Publications.

[7]. S Chandra, S Kumar and R K Anand (2005), "Soil Stabilization with Rice Husk Ash and Lime Sludge". Indian Highways.
[8]. R S Sharma, B R Phani Kumar, and B V Rao (2008), "Engineering behaviour of a Remolded Expansive Clay Blended with Lime and Rice Husk Ash", Journal of Materials in Civil Engineering.
[9]. D K Rao, P R T Pranav and M Anusha (2011), "Stabilization of Expansive Soil with Rice Husk Ash and lime" an experimental study," International journal of Engineering Science.
[10]. A S Muntohar and G Hantoro (2000), "Influence of Rice Husk Ash and Lime on Engineering Properties of a Clayey Subgrade", Electronic Journal of Geotechnical Engineering.