An Experimental Study On Soil Stabilization Using Juliflora Ash

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Abstract: The Project comprises of "Experimental study on Soil Stabilization using Juliflora Ash". In this project, the soil is stabilized by using Juliflora plants which is available in large quantities in our surroundings. The Juliflora plant causes various nuisance such as it absorbs more water surrounding the plant it leads to reduction in ground water table, it also attract more mosquitoes thus spreads Malaria. Due to environmental impacts, Juliflora is considered as an Invader. We have planned to stabilize the soil by Juliflora in the form of ash which has been added for replacement for various proportion such as 5%, 10%, 15% etc., and to attain the maximum (Optimum) percentage for replacement of soil by increasing the soil shear strength and CBR value. Being increasing the soil strength which is used for many work such as embankment filling, earth filling works in various works in transportation work such as Railway, Highway department and also in construction works etc., . Stabilized soil is more important in construction field. We have planned to achieve the strength with easily available material such as Juliflora ash.

Keywords: Soil Stabilization, Juliflora ash, Shear strength, CBR test.

1. Introduction

Soil is an important material in construction. It provides base for all construction. So, its strength is important. If soil is weak, then it is not useful for the process like building construction, Embankment construction, etc. For this, Stabilized soil is used. Stabilization is done by using some materials called Geotextiles. This material provides strength and support to the soil. But they are uneconomical. In recent years, studies are done for economical way of stabilization using Industrial By-products and waste products. The material which is used is called soil stabilizer. Based on properties of soil, different materials were used as soil stabilizing agents.

1.1 Objective

The main objectives of this project are,

1. To reduce the growth of juliflora plants.
2. To increase strength of soil by utilizing the waste products.
3. To determine the optimum percentage of juliflora ash for stabilizing the soil and its engineering properties.

2. Literature review

Monica Malhotra, Sanjeev Naval (2013) [1] studied that the problems in Expansive soils create more disadvantages which is higher in lightly loaded structures compared to moderately loaded structures. Low cost materials such as lime and fly ash are used to stabilize the soil. Upto 5 % lime and 15% fly ash were added to stabilize the soil.

Ashkan GHolipoor Norozi et al. (2015) [2] studied that the waste materials such as rice husk ash, fly ash, Tire cord waste and Stone Powder Waste are utilized for specific purpose with lime or without cement or without lime. 5 % of waste stone and tire were used and 15% fly ash is used.

Pankaj R. Modak et al. (2012) [3] studied that the alteration in moisture content in BC soils, plastic nature and compressible properties is highly increased using Fly ash and Lime upto certain percentages. 6% lime and 9% fly ash gives the better result in CBR value and shear strength.

Karthik.S et al. (2016) [4] studied that the waste materials available such pond ash, Rice Husk Ash (RHA), Fly Ash are utilized to enhance the soil stability. Adding such waste material to improve both the physical properties and also chemical properties to increase the nature of the soil. Fly ash is added upto 5% for better result for CBR value.

Vishnu T.C et al. (2016) [5] studied that the materials which contains pozzolanic properties such as jute, Rice Husk Ash (RHA), and also lime are useful for increase strength properties of clay, to commence the construction in a weak and unstable soil. RHA is added upto 5% with 6% lime and 2% jute gives the better result.

3. Materials used

1. *Soil*: The soil sample for this project taken is soil with silt obtained in our campus.

Properties	Values
1. Specific gravity	2.4
2. Liquid limit	17.2%
3. Plastic limit	13.23%
4. Optimum moisture content	9.67%
5. Maximum dry density	2184.5 kg/m^3
6. Cohesion	30 kN/m^2
7. Angle of internal friction	43°
8. CBR Value	4.67%

2. *Juliflora ash*: Juliflora plants were cut down and dried in sunlight for around 15 days. After drying, The various parts of trees such as leaves, wood, barks were fired in open air without any fuels. After

the complete combustion, the residual ash is kept in room temperature and it is sieved in IS sieve no. 25 (600 micron) sieve stored in air tight container. The specific gravity of ash is 2.12 by pycnometer method.

4. Methodology

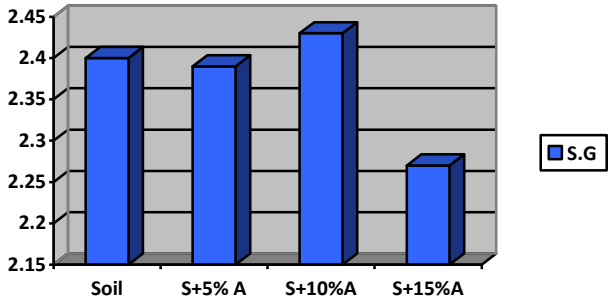
The samples of soil are collected and then soil properties were studied by testing the parameters such as Liquid limit, Plastic limit, Standard Proctor compaction test (SPCT), direct shear test and California Bearing Ratio test. After determining the properties of soil, the stabilizer (Juliflora ash) is prepared and its properties were determined. Then, the soil specimens are prepared by stabilizing it with juliflora ash of various proportions such as 5%, 10% and 15% by normal hand mixing. The most favorable percentage of juliflora ash is obtained to determine their optimum content of ash in percentage by testing the samples as per IS standards as in previous manner. Thus the results obtained from the above tests were interpreted, compared and concluded.

5. Results and Discussion

1. Specific gravity

It is determined by Pycnometer method. Various proportions stabilized soil were taken tested and interpreted below:

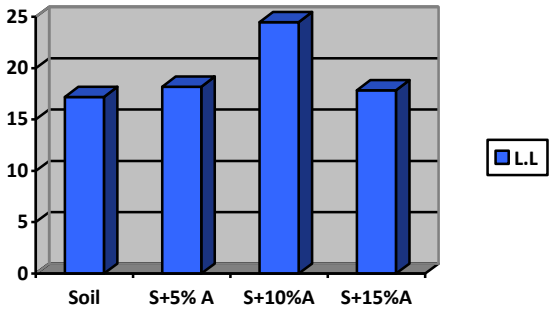
Specimens	Values
a. Soil	2.4
b. Soil+5% ash	2.39
c. Soil+10% ash	2.43
d. Soil+15% ash	2.27



2. Liquid limit

It is determined by Casagrande's liquid limit device.

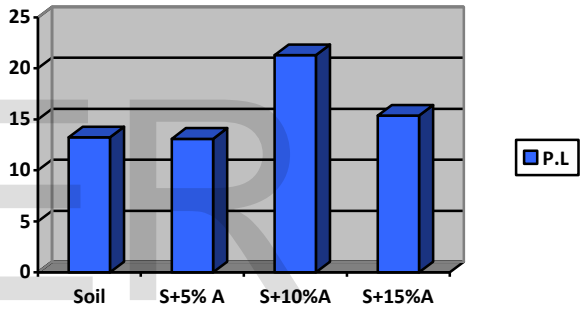
Specimens	Values
a. Soil	17.2%
b. Soil+5% ash	18.2%
c. Soil+10% ash	24.5%
d. Soil+15% ash	17.86%



3. Plastic limit

The water content in soil sample is noted at which the soil crumbles when it is threaded upto 3mm.

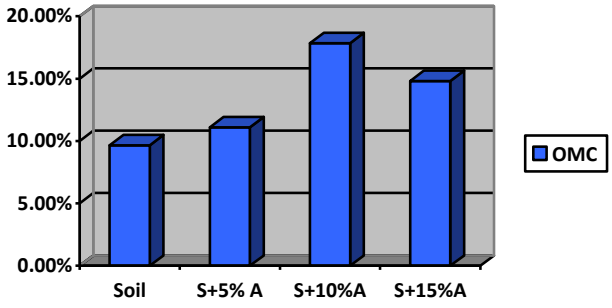
Specimens	Values
a. Soil	13.23%
b. Soil+5% ash	13.1%
c. Soil+10% ash	21.3%
d. Soil+15% ash	15.36%



4. Optimum moisture content

It is determined by Standard Proctor compaction test. It is the moisture content at which the soil attains maximum density.

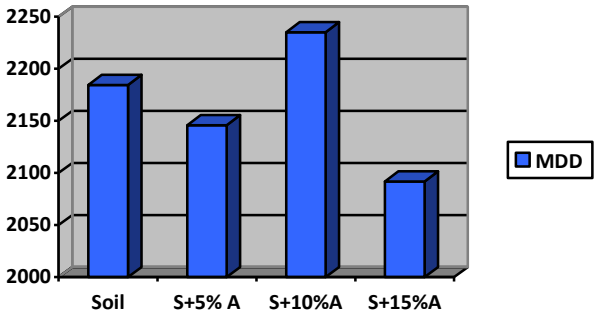
Specimens	Values
a. Soil	9.67%
b. Soil+5% ash	11.11%
c. Soil+10% ash	17.85%
d. Soil+15% ash	14.81%



5. Maximum Dry Density

The extreme density of soil at zero moisture content is called Maximum Dry Density.

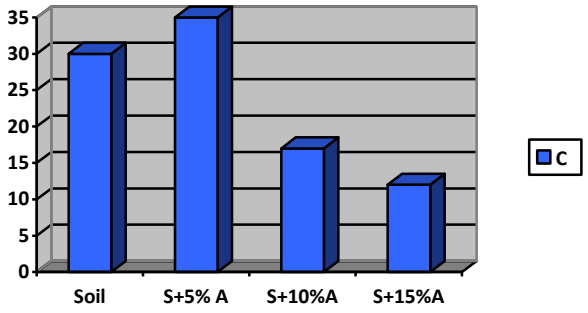
Specimens	Values (kg/m³)
a. Soil	2184.5
b. Soil+5% ash	2146
c. Soil+10% ash	2235
d. Soil+15% ash	2092



6. Cohesion

It is determined by direct shear test. It is the Y-intercept obtained from direct shear testing graph (Mohr's circle).

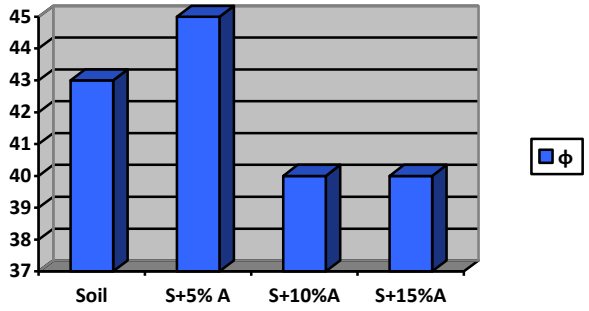
Specimens	Values (kN/m2)
a. Soil	30
b. Soil+5% ash	35
c. Soil+10% ash	17
d. Soil+15% ash	12



7. Angle of internal friction

It is determined by direct shear test. It is the angle of the line obtained from direct shear testing graph.

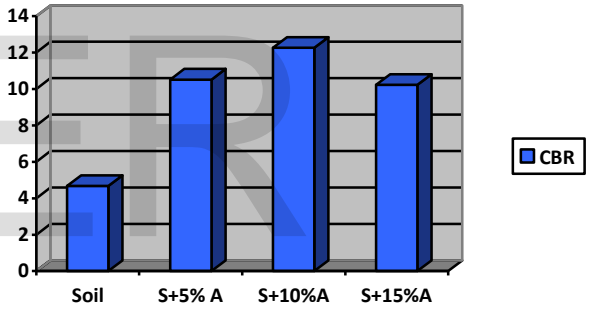
Specimens	Values
a. Soil	43°
b. Soil+5% ash	45°
c. Soil+10% ash	40°
d. Soil+15% ash	40°



8. CBR value

The ratio of load resisted by the material for specified penetration to the load resisted by the standard material to the same penetration.

Specimens	Values
a. Soil	4.67%
b. Soil+5% ash	10.51%
c. Soil+10% ash	12.26%
d. Soil+15% ash	10.22%



9. Conclusion

1. Based on the results, the stabilized soil with 5% ash gives better result in all parameters compared to other mixes.
2. For enhancing CBR only, the mix with 10% ash gives good result but it reduces the shear strength of the soil.
3. For Maximum dry density and OMC, the mix with 10% ash gives better result.
4. Thus, the stabilized soil with 10% ash is useful for subgrade in road, it will helpful in reducing the depth of road upto 30%.
5. The stabilized soil with 5% ash is useful for embankments, since, it has increased cohesion and angle of repose.

10. References

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