iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** V **Month of publication:** May 2021

DOI: https://doi.org/10.22214/ijraset.2021.34528

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue V May 2021- Available at www.ijraset.com

Soil Stabilization using different Stabilizers

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Abstract: Soils exhibit generally undesirable engineering properties. Stabilization can increase the shear strength of a soil and control the shrink-swell properties of a soil, thus improving the load bearing capacity of a sub-grade to support pavements and foundations.
Among the several modes of and widely used medium. Since ancient times for transportation of goods travelling purpose, we used roads with special care and attention during different phases of construction so that they can bear maximum load. Some of the soil having sufficient load bearing capacity but some having poor. This research work mainly focuses on soil stabilization using different stabilizers to improve geotechnical proper, Compressive Strength of the studied soil. Soil stabilization is required when the soil is available for construction & it is not suitable for carrying structural load.
Keywords: Soil stabilization using cement and fly ash, clay soil, Black Cotton Soil, Optimum Moisture Content (OMC), Maximum Dry Density (MDD), Plastic Limit Test, Liquid Limit Test, California Bearing Ratio Test(CBR Test)

I. INTRODUCTION

Soil stabilization with different stabilizers is discussed. On earth there is different types of soil is present like loose soil, clay soil etc. individual having its various property, in which stabilization is also a property of soil, due to this properties a disturbance occurs during construction, hence to avoid this it is necessary to change some properties or let's say in other words improve some properties of soil like soil stabilization, compressibility, strength etc.

II. TYPES OF SOIL USED FOR TESTING

In this we have been used the locally available Soil for this project.

1) Clay Soil (Brought from KDK Nagpur Polytechnic, Nagpur College ground)

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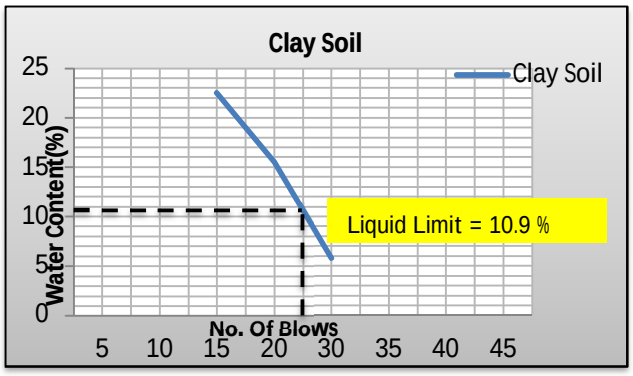
2) Black Cotton Soil (Brought From Construction Site, starting near Gangavihar colony) -

A. Test Carried Out On Soil

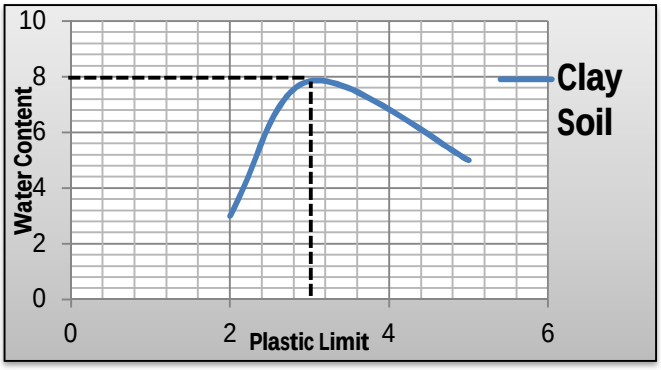
1) Optimum Moisture Content (OMC)
2) Maximum Dry Density (MDD)
3) Plastic Limit Test
4) Liquid Limit Test
5) California Bearing Ratio Test(CBR Test)

B. Test On Clayey Soil

1) Liquid Limit Test

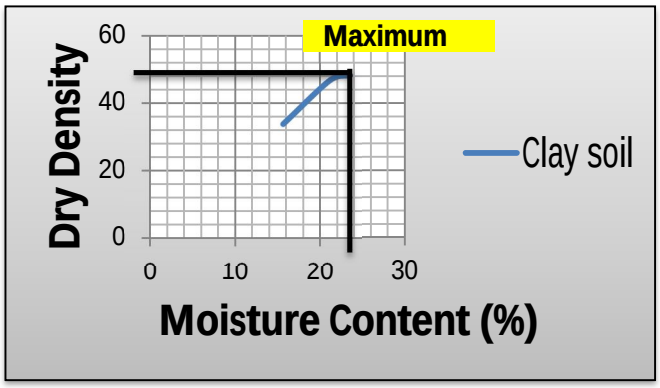


2) Plastic Limit Test



3) Test And Relation Between Optimum Moisture Content(OMC) And Maximum Dry Density (MDD)

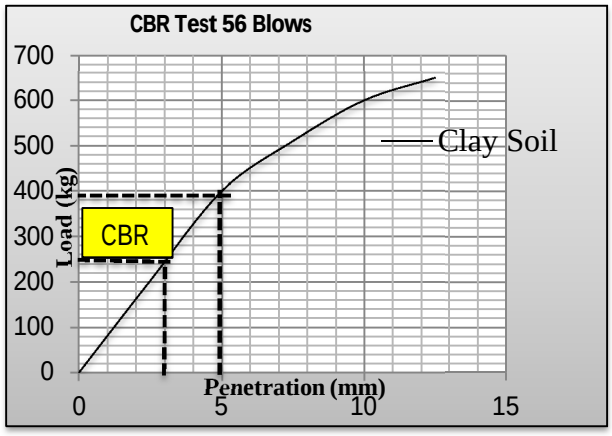
Moisture content (%) Clayey Soil	Dry Density
15.63	33.76
21.21	46.87
23.53	48.23



4) California Bearing Ratio Test (CBR Test)

5) Dry Density and CBR Data

Moisture Content		Dry Density	
Wt. of Container (gm)	20	Wt. of Empty Mould (gm)	4625
Wt. of cont. + Wet soil (gm)	94	Wt. of Mould + Compacted Soil (gm)	6487
Wt. of cont. + Dry Soil (gm)	75	Volume Of Mould (cm^3)	863.93
Water content (%)	34.54	Bulk Unit (gm/cm^3)	2.149
		Dry Density (gm/cm^3)	42.95



From Graph,
CBR @ 2.5mm= (230/1370)*100 =16.78%
CBR @ 5.0mm= (390/2056)*100 =18.96% So CBR is 16.78%

C. Test on Black Cotton Soil

1) Liquid Limit Test

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
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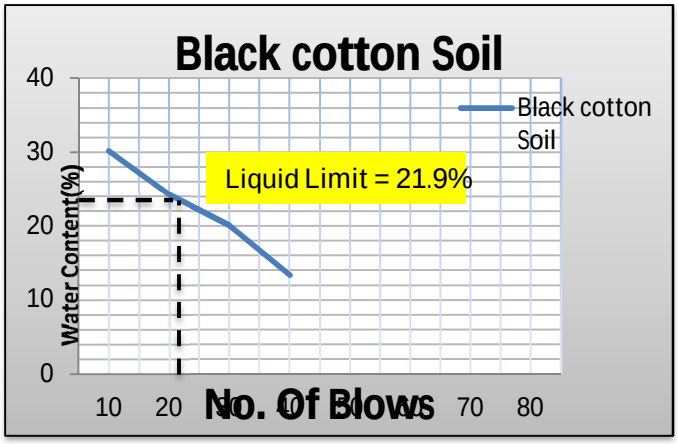
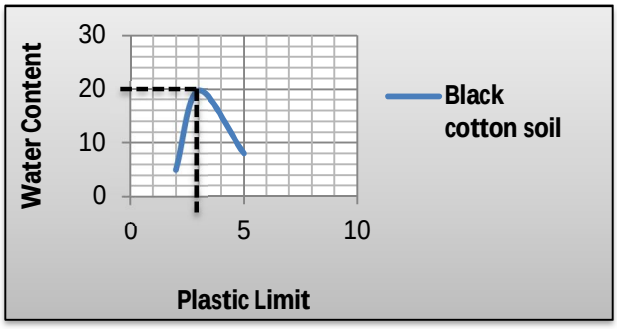
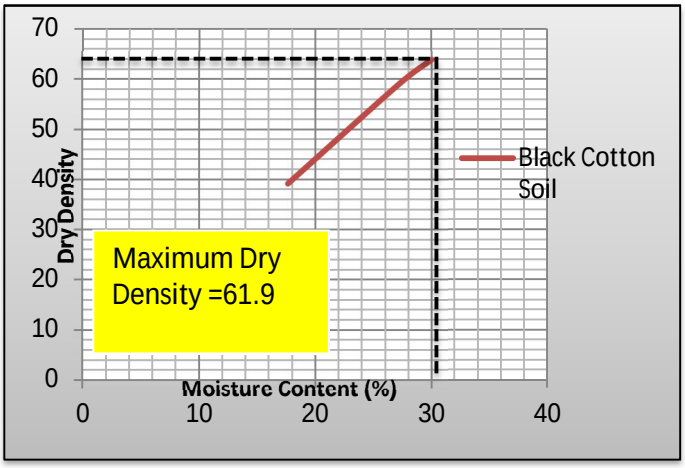


2) Plastic Limit Test



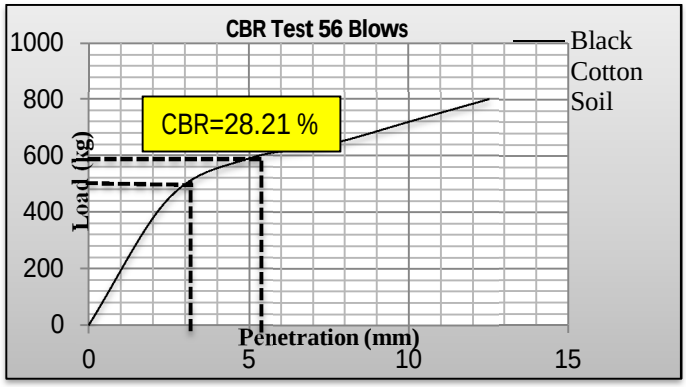
3) Test And Relation Between Optimum Moisture Content(OMC) And Maximum Dry Density(MDD)

Moisture content (%) Black Cotton Soil	Dry Density
30	63.9
27.27	59.18
17.64	39.16



4) Dry Density and CBR Data

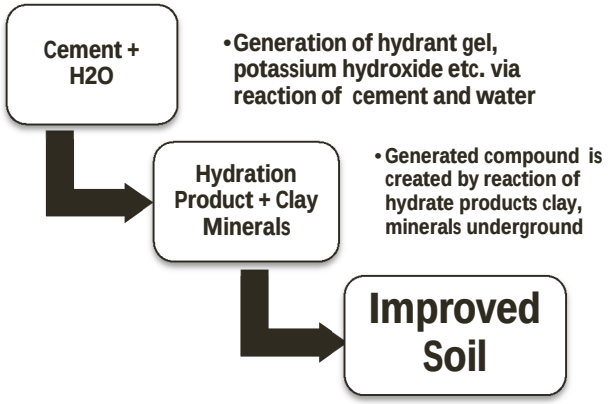
Moisture Content		Dry Density	
Wt. of Container (gm)	20	Wt. of Empty Mould (gm)	4625
Wt. of cont. + Wet soil (gm)	105	Wt. of Mould + Compacted Soil (gm)	6500
Wt. of cont. + Dry Soil (gm)	70	Volume Of Mould (cm^3)	863.93
Water content (%)	70	Bulk Unit (gm/cm^3)	2.13
		Dry Density (gm/cm^3)	63.9



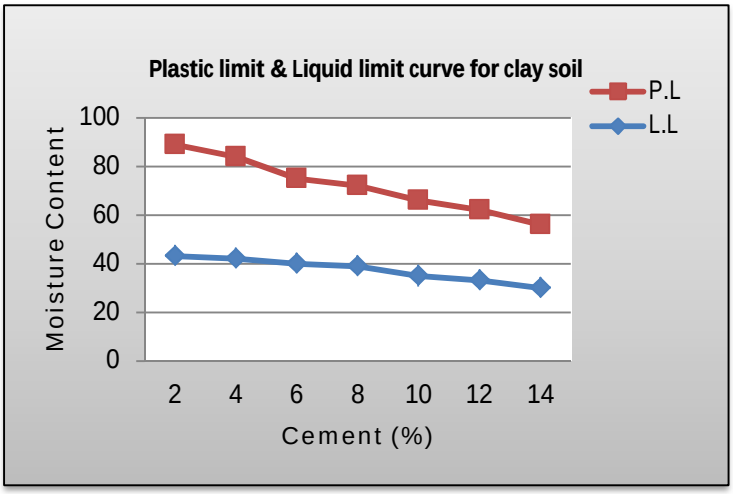
From Graph,
CBR @ 2.5mm= (500/1370)*100 =36.49%
CBR @ 5.0mm= (580/2056)*100 =28.21% So CBR is 28.21%

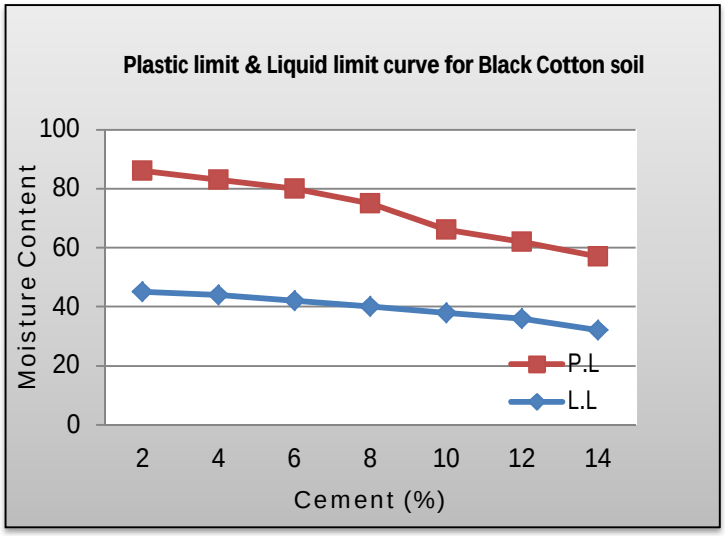
III. METHODOLOGY

A. Soil Stabilization Using Cement or Cement Deep Mixing Method (CDM Method)

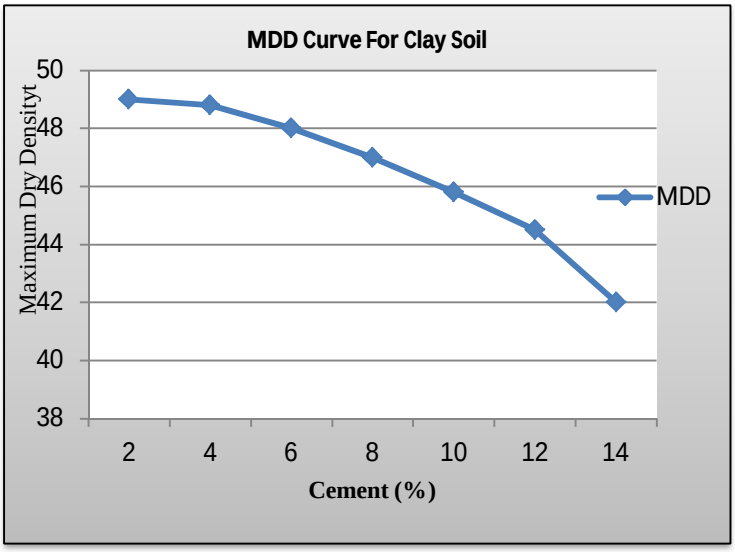


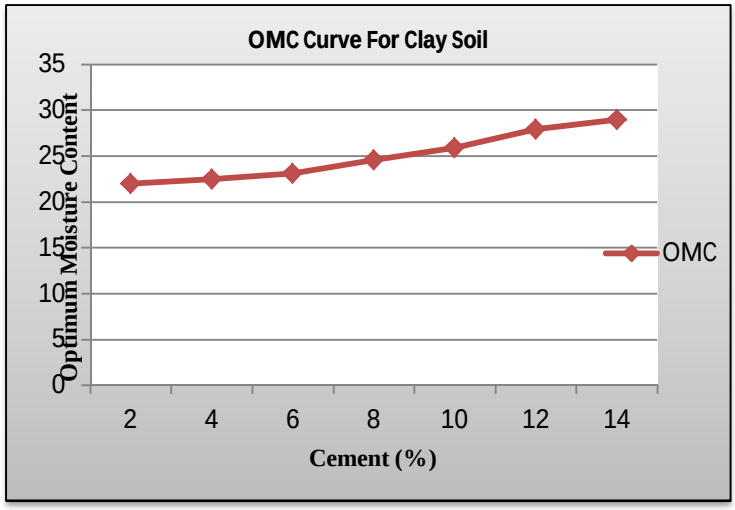
B. Plastic Limit and Liquid Limit Curve For Soil With Cement

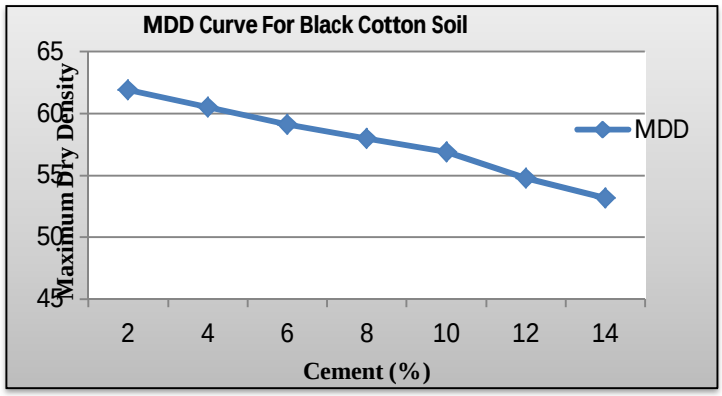


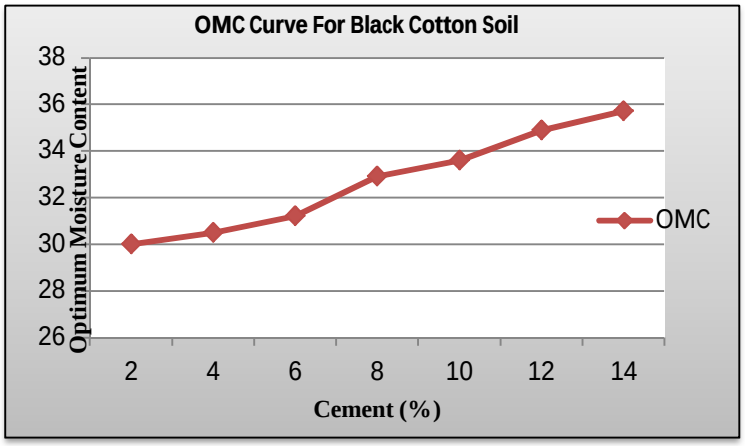


C. OMC Curve and MDD Curve For Soil With Cement









D. Effects of Cemenpt On Different Properties Of Soil On Graph

1) Cement treatment leads to significant increase in unconfined compressive strength and modulus of elasticity of the soils.
2) Decreased cohesiveness (Plasticity).
3) Decreased volume expansion or compressibility.
4) Increased strength.
5) Decreased Plastic limit of both the soil.
6) Decreased Liquid Limit of both the soil.

E. From Graph,

Clay Soil with cement (%) =14. stabilized with cement.

1) Increased proportion of cement in clay-cement mixture did not produce uniform changes in the liquid limit of the mixture so that no generalization could be made about its behaviour.

2) Liquid limit of the mixture decreased comparing with the liquid limit of unmixed soil specimen.

3) Plastic Limit also decreased.

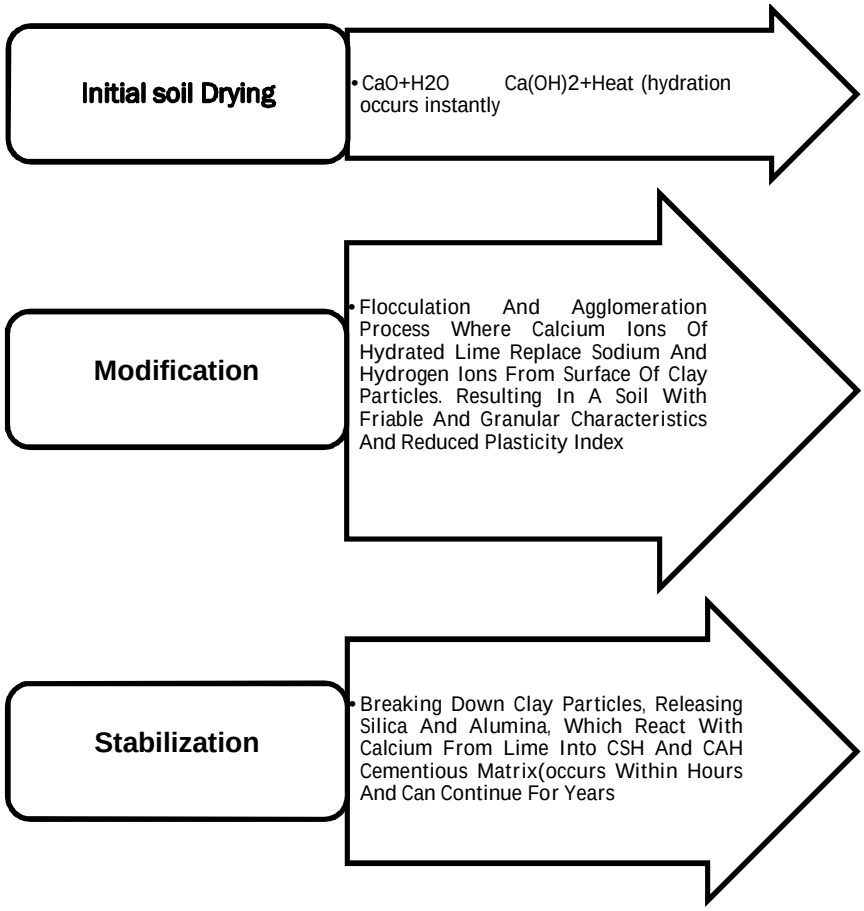
a) During laboratory experiments, the BC (Black Cotton) Soil samples was first pulverized, soaked in water for 24hours and the vegetation was removed was removed. After drying in Oven, the BC soil was tested in its natural state for Atterberg Limits. The test results obtained are showing the basic nature of BC soil. Liquid limit & Plastic limit obtained to higher side with average value of 21.9% & 19.9% respectively. This BC soil will definitely not suitable for civil construction works on it. The dry density, penetration (using CBR test) & other parameters located. But this paper only pertaining to L.L, P.L, Maximum Dry density, Optimum moisture content, CBR test. All the results has achieved using this test & it is observed that

- Liquid limit had decreased.
- Plastic limit Decreased.
- Increased Moisture Content.
- Decreased Dry Density of soil.

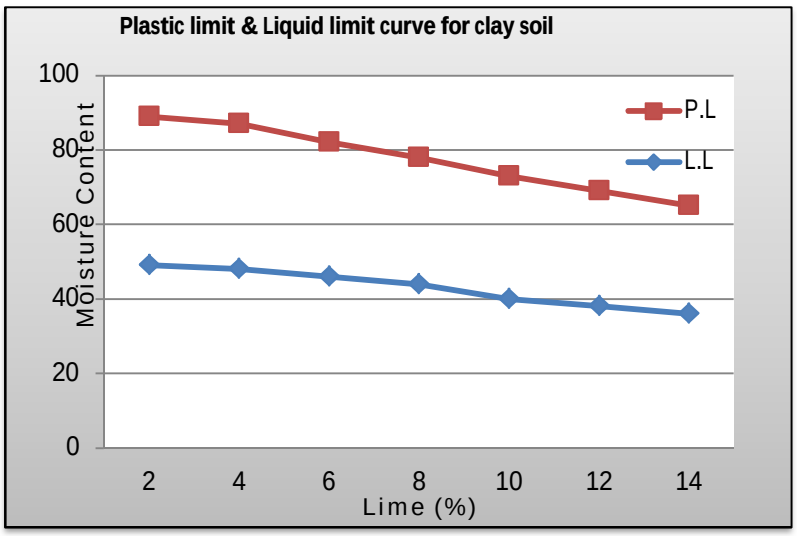
b) Clay soil stabilization with cement is best effective when the soil liquid limit ranges from 45 to 50 and its plasticity index is less than 25. The decreases in soil liquid limit following cement addition depend on the type of the soil so that a general claim may not be made about the decreases in liquid limit in all fine-grain soils.

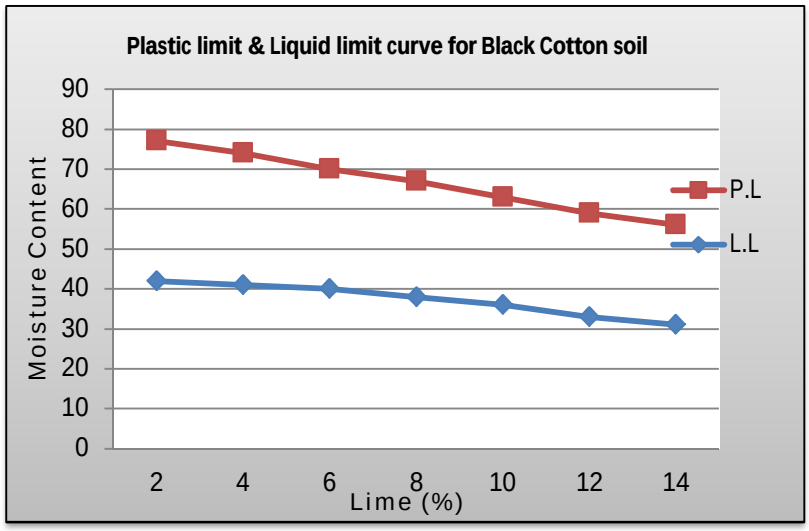
IV. SOIL STABILIZATION METHOD USING LIME

A. Soil Stabilization Using Lime

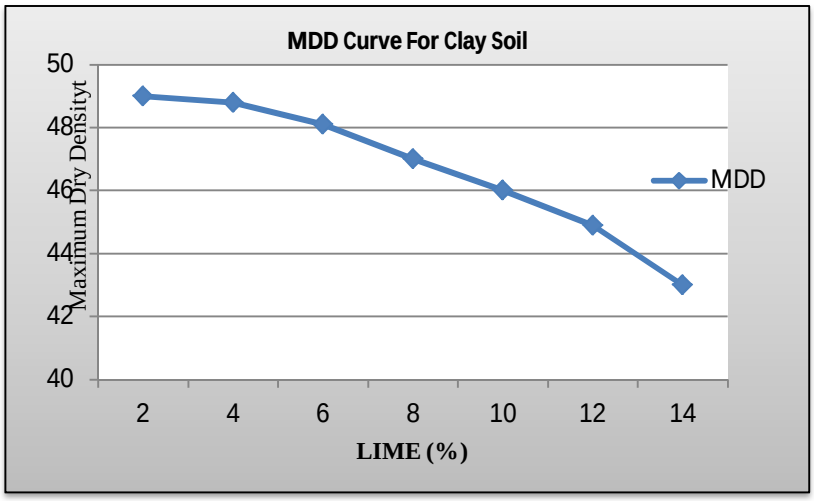


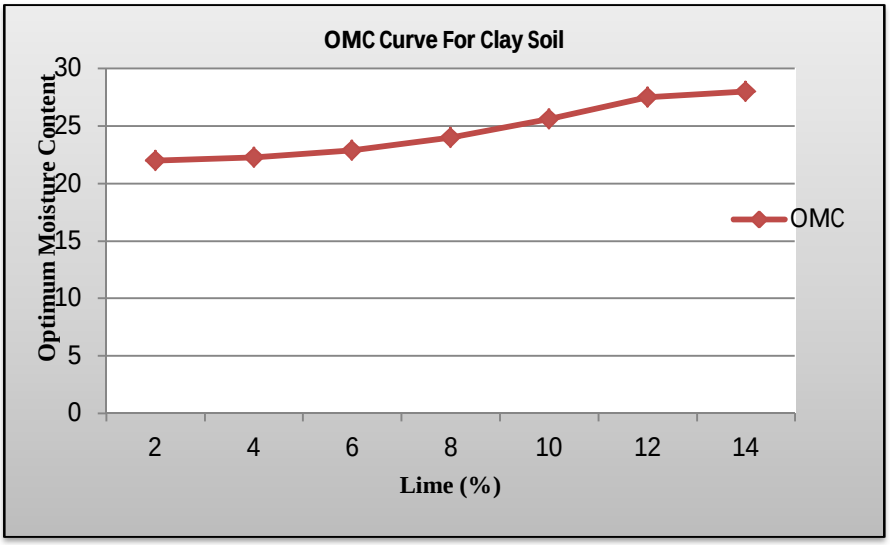
B. Plastic Limit And Liquid Limit Curve For Soil With Lime

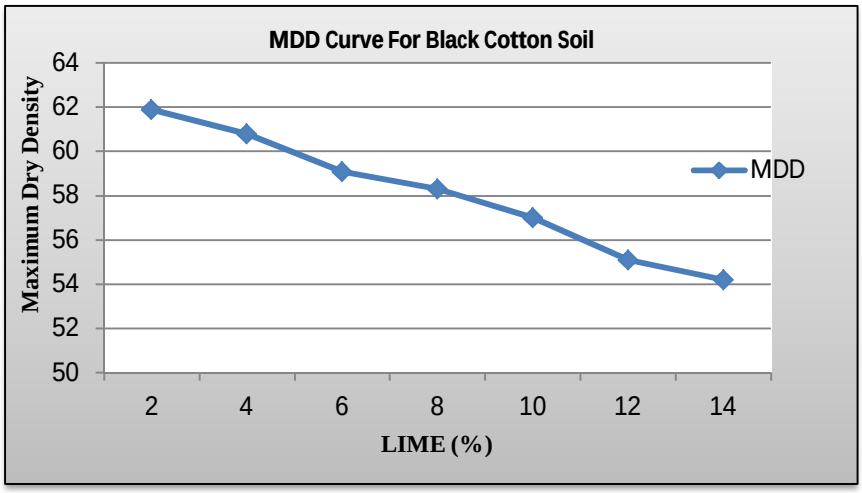


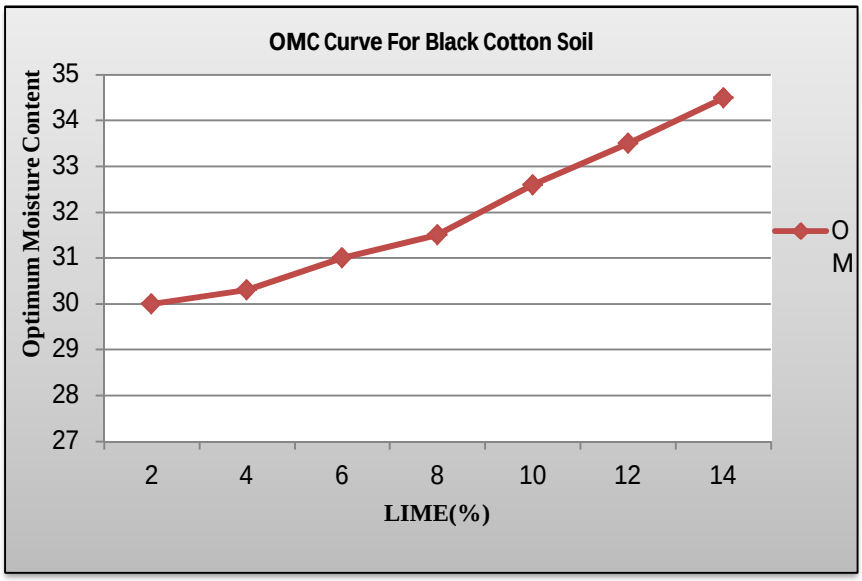


C. OMC Curve And MDD Curve For Soil With Lime









D. Effects Of Lime On Properties Of Soil

1) *Effects on Liquid Limit:* It is observed that the liquid limit of both the soil (i.e. clay soil & Black cotton soil) has decreased with increase in percentage of lime.
2) *Effects on Plastic Limit:* It is observed that the Plastic limit of both the soil (i.e. clay soil & Black cotton soil) has decreased with increase in percentage of lime.
3) *Effects on Water Content & Density Relation:* When lime is used as stabilizer, soil particles became large in size, clusters results in texture change. This flocculation-agglomeration process results in flock formation. The enlarged particle size results in the increase of void ratio. Due to this property, soil particle reflects and decreases to maximum dry density. The moisture content for the soil-lime mixture compaction has been increased.

In this literature we does not provide information on the precise effect of lime treatment on some other property of soil , but on the basis of no. of previous studies it also effects –

a) Effects on Permeability: Hydraulic conductivity increases when the soil is mixed with lime. However soil permeability decreases when lime content is increased.
b) Increase in Fatigue Strength: The number of load cycles that a given material can tolerate at a constant stress level that reflects on the fatigue strength of that given material.
c) Effects on Compressibility: Similar to permeability studies, limited studies have dealt with the effect of lime on soil compressibility.
d) Increased Durability: Durability is the capability of lime-treated soil to resist the adverse effects of the watery and freeze-thaw cycles resulting from the changes in environmental conditions during a year.

V. RESULTS AND DISCUSSION

After carried out all the test on soil using cement, Lime & Fly ash use as stabilizer.
It is observed that,

A. Cement is more reactive than lime and Fly ash. It's Give more Stabilization as well as improve strength with change in properties.
B. Lime gives much better strength to soil as compare to Fly ash stabilization.

It is observed that Class C fly ash nearly same as lime. Its property, chemical composition is also comparatively same as lime. Hence it can be used for stabilization instead of Lime.
The Final Result found out after performing various tests is that the cement is the best Stabilizer for the process of soil stabilization.

VI. CONCLUSION

A. Cement gives strength to soil and increases durability of soil Also, cement in soils perfectly replaces low cost structures.
B. When cement added to soil it also helps the pavement for uniformly distributed loads to the ground surface which further eliminates base rutting and reduces deflection and results in reduction of moisture problems.
C. The OMC of mixture of ratio of soil and cement increases with increase in cement content.
D. The UCS of stabilised soil increases with increase in the quantity of cement in a mixture.
E. The UCS of stabilised soil increases with the increase of the duration period of curing.

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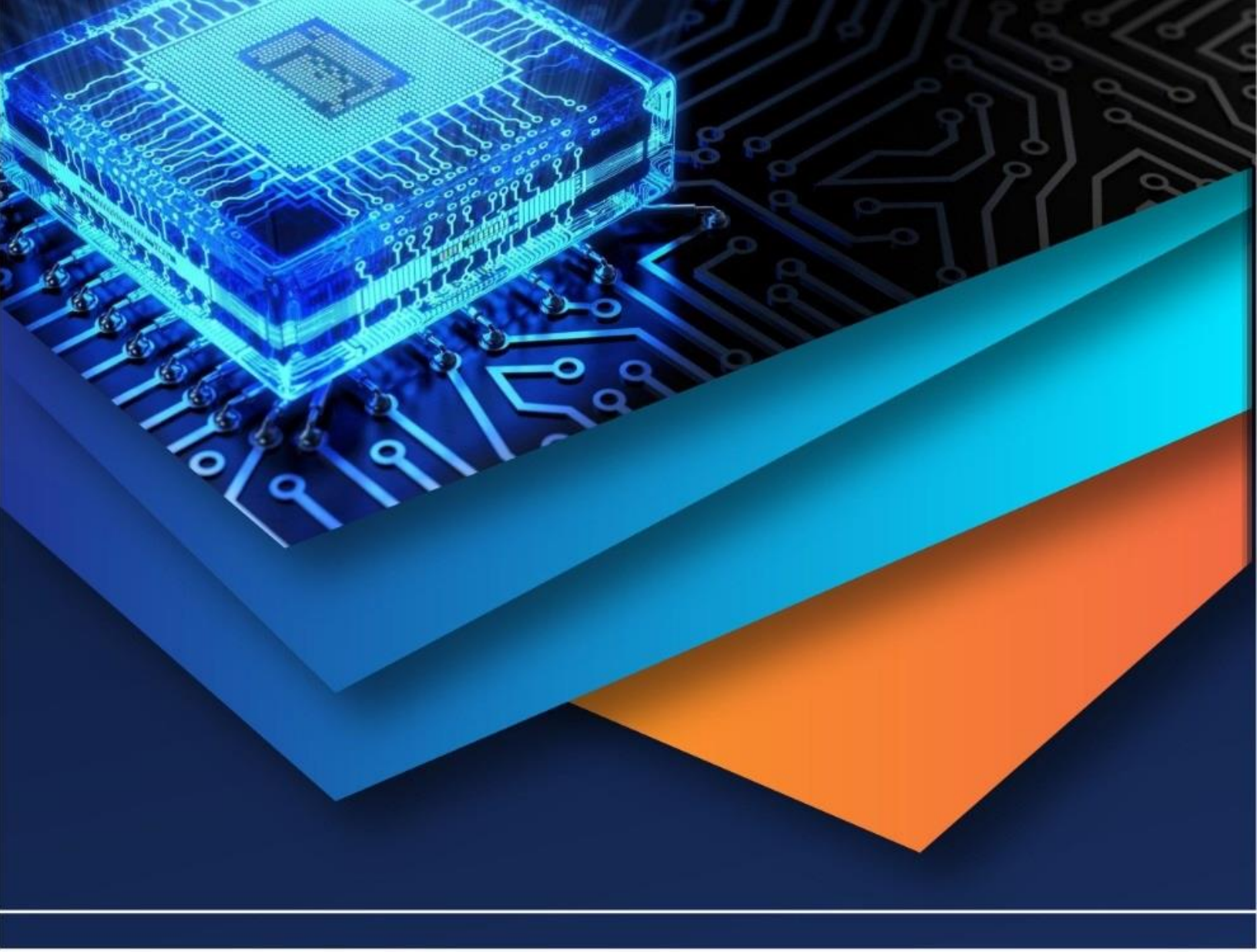
[1] Prem Kishore, A.K. Ghose, dileep kumar (department of soil science and agriculture chemistry)
[2] Ahsan Rabbani national institute of technology rourkela | nitr · department of civil engineering (ce)
[3] By: Michael thomas, Ph.d, professor of civil engineering, university of new Brunswick.
[4] Nishant a. Upadhye, b.e (civil)
[5] Dr. D.K.Gupta, S.A. Rasal, V.K. Sonarkar



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