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STABILIZATION OF GRAVEL SOIL BY USING MOLASSES-LIME

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Abstract: An optimum of 10% of molasses when added to a soil sample is found to increase soil cohesion from 0.25 to 0.6 and increased the friction angle of soil from 9° to 19°. Also, 10% molasses and lime treatment increased the maximum dry density of soil from 1.89 gm/cm^3 to 1.933 gm/cm^3. The optimum moisture content of soil increased from 10.0% to 12.0% with the increased in molasses and lime percentage. The co-efficient of permeability of soil decreased to 4.566E-05 to 2.06E-05 by adding 10% of molasses and lime. These results showed that stabilization of soil with molasses and lime increased strength properties of soil by using 7% to 10%.

Keywords: Atterberg's limits, Blackstrap molasses, Gravel soil , Plasticity index, Strength properties.

1. INTRODUCTION

Soil is major element for the construction of engineering buildings so its engineering properties must be concentrated. For this the strength of the soil must be improved by adding suitable materials such as molasses-lime solution need of this solution in the soil will be studied and the results are examined.

Advancements on industries, agriculture and the increase of population growth lead to the release of variety of pollutants in to the soil. Thus the soil properties gets altered. The other issues concerned with the decrease in soil properties are weathering of soil, increase of waste in the soil which is dump by garbage, industrial waste

And improper use of soil leads to decrease in its properties. This issue has become a challenge foe the soil engineer as his role of maintaining soil strength is vital. So the increase of its properties by adding suitable materials should be adopted. The use of molasses lime for the stabilization of soil has been experimented and its results are studied with the increment of 5% by weight.

2. MATERIALS

2.1 soil

Soil sample was collected from the location dameergidda , chevella ,Hyderabad .the collected sample is tested for engineering and index properties .the results are listed blow

S.No	Properties	Results
1	Intial moisture content	15%
2	Specific gravity	2.65
3	percentage of gravel	2.8%
	Percentage of silt	28.2%
	Percentage of sand	40.2%
	Percentage of clay	31.6%
4	Liquid limit	55.6%
	Plastic limit	17.8%
	Shrinkage limit	13.2%
	Plasticity index	38.6%
5	Differential free swell	41.2%
6	Soil classification	CH
7	Optimum moisture content	22.8%
	Maximum dry density	0.988 g/cc

8	Unconfined compressive strength	0.523 N/mm^2
	cohesion	0.133N/ mm^2

2.2 Molasses

Molasses is a very thick dark brown syrupy liquid obtained as a by-product in processing cane sugar. It is also called treacle. It contains resinous and some inorganic constituents that renders it unfit for human consumption. This liquid is mildly discomforting and adhesive when it gets into contact with a person's skin. It is slippery when spilt and could be a cause of road accident if a major spill takes place on the road. Molasses could cause environmental pollution through aesthetic degradation if spills are not properly cleaned. It can also cause water pollution if major spills or factory effluents enter river streams. This molasses has a density of 1.4 g cm^{-3} and viscosity of 2.9 x 10-6 m^2 sec^{-1}

2.3 Lime

Lime is a calcium-containing inorganic material in which carbonates, oxides and hydroxides predominate. Strictly speaking, lime is calcium oxide or calcium hydroxide. The word "lime" originates with its earliest use as building mortar and has the sense of "sticking or adhering." These materials are still used in large quantities as building and engineering materials (including limestone products, concrete and mortar) and as chemical feed stock's, in sugar refining, and other uses.

3. EXPERIMENTAL WORK

The various experiments to find the properties of the gravel soil without using molasses and lime mixture as per IS 2720

1. Liquid Limit
2. Plastic Limit
3. Specific Gravity
4. Standard Proctor Compaction Test
5. Direct shear test
6. Permeability test

3.1Atterberg's limits relative graph

3.1.1 Liquid limit

These test was performed as per IS :2720 (Part 5)- 1985 and IS: 2720 (Part 6)-1972 on the normal and contaminated sample with different amounts of molasses -lime such as 5% 10% 15% 20% 25%.

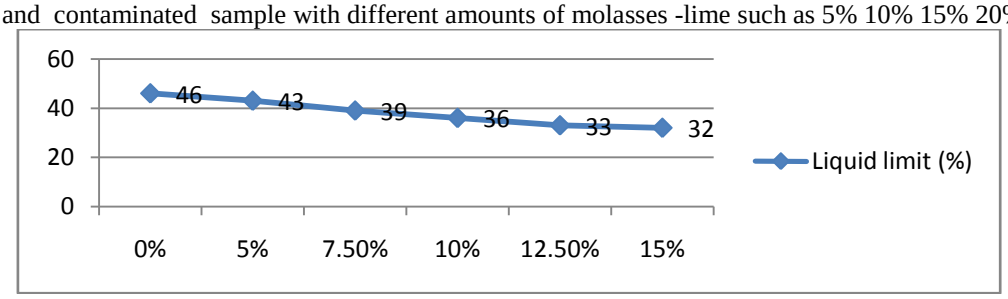

Fig.1Effective of molasses and lime treatment on liquid limit

From the above effective of molasses and lime treatment graph the optimum liquid limit may be taken 36% (10% of molasses and lime).

3.1.2 Plastic limit

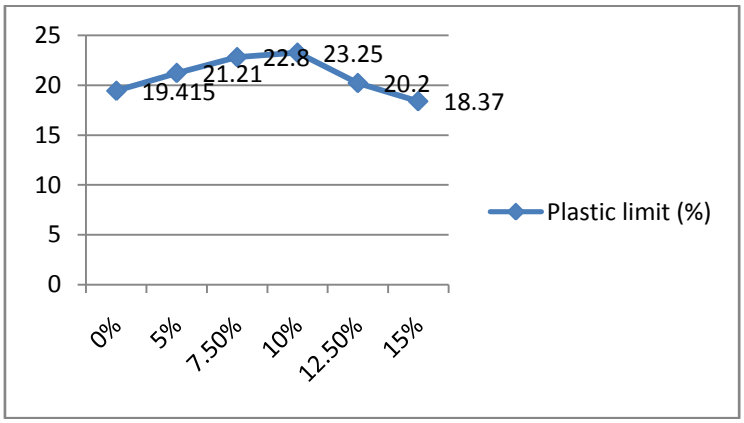

Fig.2 Effective of molasses and lime treatment on plastic limit

From the above effective of molasses and lime treatment graph the optimum plastic limit may be taken 23.25% (10% of molasses and lime).

3.1.3 PLASTIC INDEX

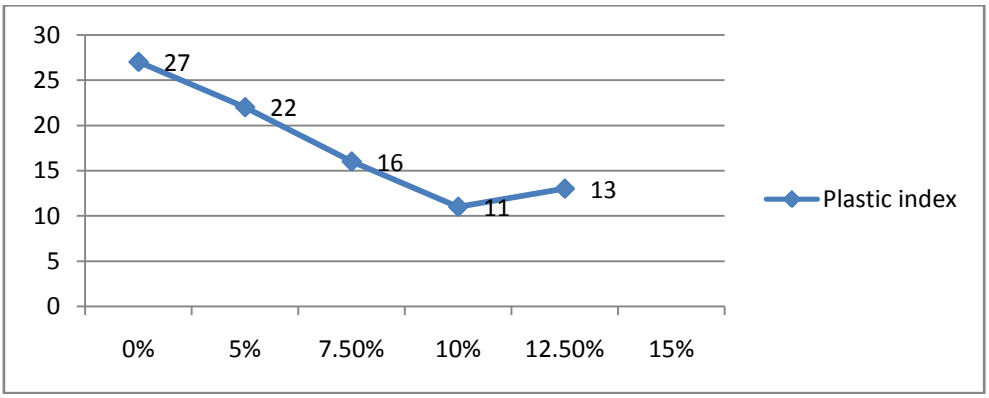

Fig.3Effective of molasses and lime treatment on plastic index

From the above effective of molasses and lime treatment graph the optimum plastic index may be taken 11 (10% of molasses and lime).

3.2 Proctor compaction relative graph

Standard proctors compaction test was conducted on the molasses-lime contaminated soil sample with different percentages such as 5% 10% 15% 20% 25%.

3.2.1 Moisture content graph

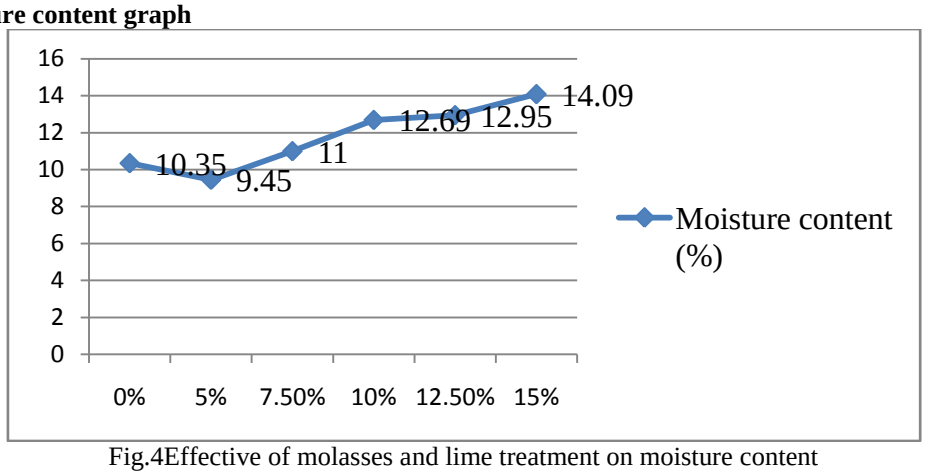

Fig.4Effective of molasses and lime treatment on moisture content

From the above effective of molasses and lime treatment graph the optimum moisture content may be taken 12.69% (10% of molasses and lime).

3.2.2 Dry density

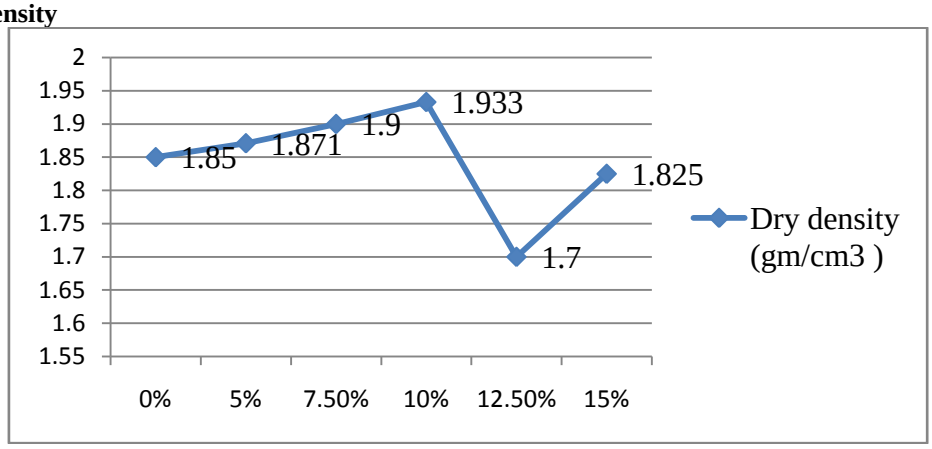

Fig.5Effective of molasses and lime treatment on dry density

From the above effective of molasses and lime treatment graph the dry density may be taken 1.93gm/cm^3 (10% of molasses and lime).

3.3 Direct shear relative graphs

3.3.1 Cohesion graph

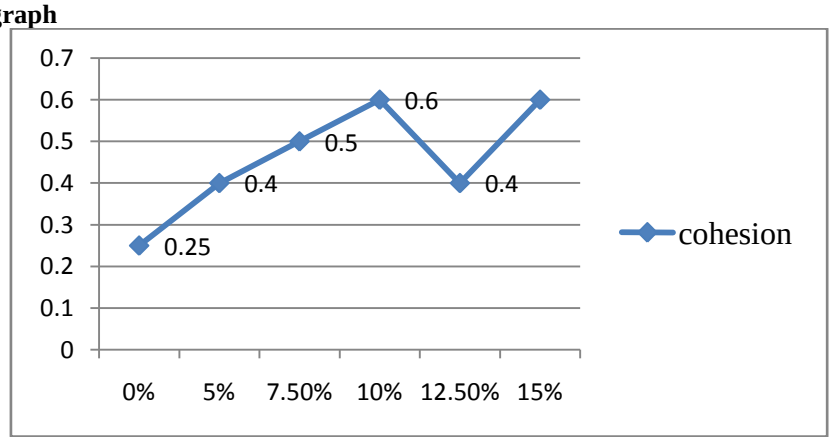

Fig.6 Effective of molasses and lime treatment on cohesion

From the above effective of molasses and lime treatment graph the optimum cohesion may be taken 0.6 (10% of molasses and lime

3.3.2 Friction angle

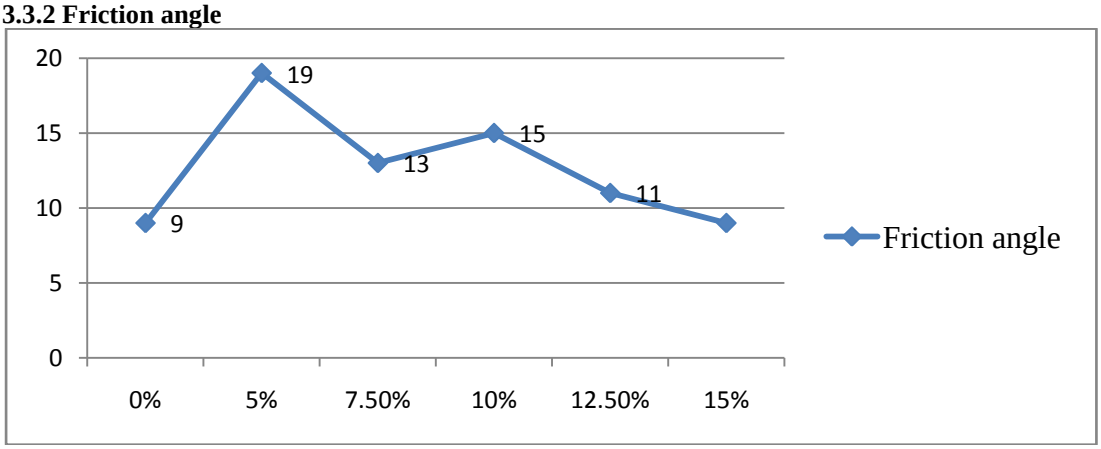

Fig.7Effective of molasses and lime treatment on friction angle

From the above effective of molasses and lime treatment graph the optimum friction angle may be taken 15º (10% of molasses and lime).

3.3.3 Permeability relative graph

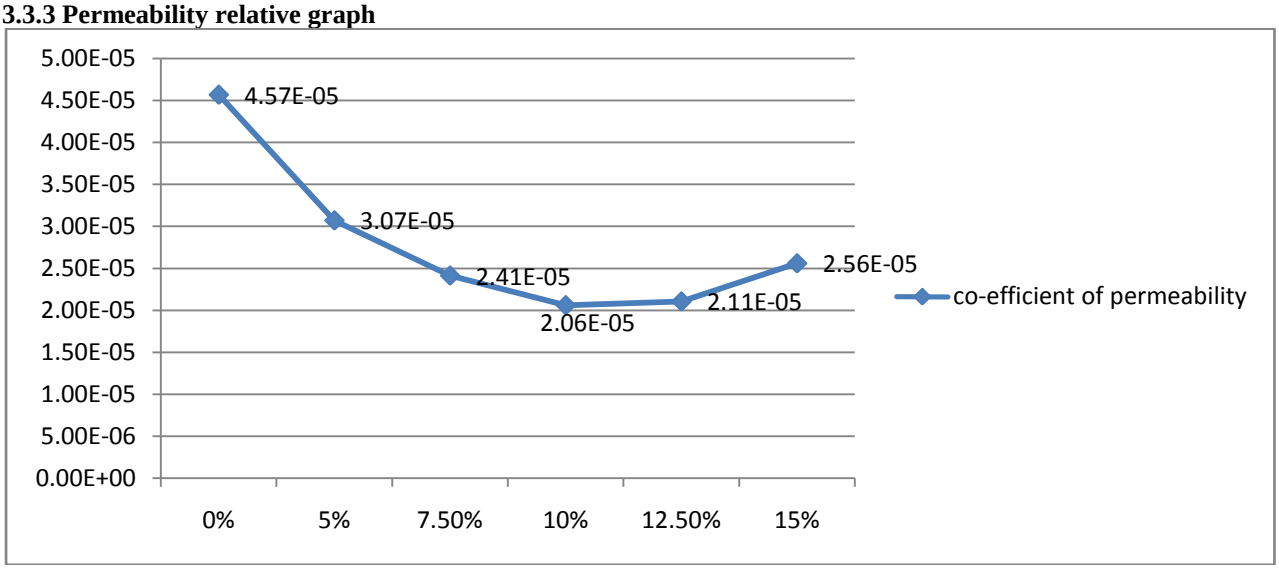

Fig.8Effective of molasses and lime treatment on permeability

From the above effective of molasses and lime treatment graph the optimum permeability co-efficient may be taken 2.06E-05 (10% of molasses and lime).

4. RESULTS & CONCLUSION

This research was conducted to study the effect of adding molasses and lime to soil. The soil was tested for plastic index, direct shear test and compaction. By adding 7% to10% of molasses and lime to a soil sample, cohesion of soil was increased from 0.25 to 0.6, while increasing friction angle of soil from 9º to 19º. At 10% molasses and lime treatment, maximum dry density of soil was increased from 1.9 gm/cm^3 to 1.933 gm/cm^3. The optimum moisture content of soil increased from 10% to 12% with the increased in molasses and lime percentage. The co-efficient of permeability of soil decreased to 4.566E-05 to 2.06E-05 by adding 10% of molasses and lime. These results showed that, stabilization of silt clay soil with molasses, increased strength properties of soil.

With the increase of addition of molasses and lime to the soil more than 10% there is reduction in strength. And 7% to 10% of addition of molasses and lime is suitable to attain the optimum strength.

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