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Review on Improving the capacity of black cotton soil by using different materials example bio-enzymes and bagasse ash, etc.

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ABSTRACT

Soil is the main part of foundation; it is very important to build strong and durable structure. If soil is not stable then, there may cause failure of structure. In the black cotton soil has very low bearing capacity and high swelling and shrinkage characteristics it forms a very poor foundation, that cannot be affordable, India is largest area which occupied by black cotton soil. India is agriculture country which is comes in top ten countries in the world it contributes many times through the agricultural field. India consists of 30-40% of Black cotton soil. In Maharashtra Western produces sugarcane in large scale and bagasse formed by sugarcane. And to improve the strength of soil the stabilization (making more stable) of soil by conducting experiments on Black cotton soil by replacing bagasse ash (4%, 8%, 12%, 16%, 20%). Another the material mixed in black cotton soil is bio-enzyme (Terrazyme) with different dosages of 250ml/2m³, 250ml/1.5m³, 250ml/1m³, 250ml/0.5m³ respectively. Due to this the strength of soil increases.

Keywords: Black Cotton Soil, Soil Stabilization

1. INTRODUCTION

With the increasing population the land occupation of land is increased for urbanization of country due which the construction work is going in large scale due that the land required more and due to that the construction is going in black cotton soil and to provide better foundation in black cotton soil the stabilization is done normally it is done by using fly ash, calcium chloride, sodium chloride etc. But some have bad effect and to avoid that bad effect the bagasse ash and Bio-enzyme are the latest techniques used for stabilization, because bagasse ash is made by burning of sugarcane waste and it is containing fibrous material having pozzolanic in nature which improves the physical properties of Black cotton soil and in bio-enzyme the different test is conducted due to this the unconfined compression strength value increased from 40.25 % to 73.33%

2. LITERATURE REVIEW

2.1) Srinivas Ganta, Amit Kadaba Sheshadri (Oct 2016) it is concluded from his study in market different types of chemical mixtures available in that the one is Bio enzyme which is best for using as admixture. It mixes in different amount like 200ml/1.5m³, 200ml/2m³, 200ml/2.5m³, 200ml/3m³ and different test are conducted like CBR test, Atterberg's test, Compaction test, UCS test. And then the appropriate value will be found which improves the different properties of soil like compressive strength, shear strength.

2.2) K Shimola (December 2018) It conclude that the different percentage of bagasse ash is added in black cotton soil as admixture and the different test conducted on soil like 'Atterberg's limits test', 'compaction test', 'unconfined compression test'. It finally concludes that the 16% dosage of bagasse ash for mixing is desirable for improving shear strength and dry density and compressive strength and for reducing plasticity index.

2.3) Maitray Parikh, Avi Bhadiyadra, Meet Viradia, Ratna Jadwani (2018) it is concluded that from his study. That the paper mill sludge ash uses as admixture in black cotton soil to improve property of soil like compressive strength, shear strength, and to improve the ne quantity to mix ash is. Very important so by taking the test like CBR, plastic limit test, compression test, etc. And through that soil become suitable for construction.

2.4) Vinod B R, Harish C, Shobha R (April 2018) concluded from his study that the strength can be improved by using caustic soda, fly ash, cement. By conducting compressive strength test under UTM, the blocks prepared by size e 20×10×10cm are cured for 14, 21, 28 days and conducted test and then it concludes that the compressive strength of black cotton soil blocks reinforced with caustic soda and two layers of geo-grid improves maximum compressive strength after 28 days curing. Same occurred when soil is stabilized with fly ash and cement.

2.5) Tiza Michael, Sitiesh Kumar Singh, Anand Kumar (September 2016) It is concluded from his study that the black cotton soil is improving strength by using waste material like copper slag, Brick dust, ceramic dust, polyvinyl waste, mixes these wastes and then they are conducted test like CBR test, UCS test, etc. Through this the appropriate percentage of mixing is find out which gives appropriate increased strength.

3. METHODOLOGY

3.1. Bio- enzymes

First collected black cotton soil, Then some quantity of bio-enzyme (Terrazyme). Then made various samples, some samples kept untreated and remaining samples mixed with different quantities of Terrazyme. After that the remaining samples of soil mixed with four different terrazyme dosages. Tested all the samples on 0 days, 7, 14, 21 and 28 days respectively. At last, compare the test results both numerically and graphically.

- (a) Grain size distribution analysis: - The particles with size larger than 75 μm (retained on sieve no. 200), the particle sizes are determined by "Sieve Analyses"
- (b) Dosage of Terrazyme: - The dosages selected are as follows 250ml/2m³, 250ml/1.5m³, 250m/1.0m³ and 250ml/0.5m³ is carried out with and without the Terrazym
- (c) CBR Test: - CBR test is performed to determine the CBR value. To ascertain the behaviour of soil under soaked conditions and un-soaked conditions. Black cotton soil was treated with four dosages of the bio-enzyme (Terrazyme) at optimum moisture content 23%. CBR moulds were prepared with different dosages by standard proctor method and kept by covering plastic bags for testing on different day.
- (d) Unconfined Compression Test: - Unconfined Compression is performed to determine the shear strength of the soil. Unconfined Compression samples are placed kept for a curing period of 0, 7, 14, 21 and 28 days

3.2. Sugar cane bagasse ash

Black cotton soil was collected at depth of 1m below ground level. The bagasse was dried in sunlight for 24 hours and burnt to get ash. Ash formed was collected and sieved using 425-micron sieve to get fine powdered ash

- (a) Grain size distribution analysis: - The soil is sieved through 2.36 mm sieve is stored in the container
- (b) Treatment of Soil Sample with Different Proportions of Bagasse Ash: - Bagasse ash is added to soil in proportions of 4%, 8%, 12% and 16% and tests are conducted Stabilizing agent bagasse ash.
- (c) Standard Proctor Compaction test: - Compaction is the procedure of minimizing air voids in soil.
- (d) Unconfined Compression Test: - The unconfined pressure test is by a wide margin the most well-known technique for soil shear testing since it is one of the quickest and least expensive strategies for estimating shear quality.

3.3. Paper mill sludge ash

The sludge is burned at 800°C, and volatile ash can contain reactive silicon and Aluminium (in the form of methane) as well as lime (Cao), which chemically contributes to the components of Portland cement.

- (a) Free swell index: - This test is useful to consider swelling properties of soil IS: 2720(part 40) -1985- Methods of a test for soils: Determination of the free swell index of soil.
- (b) Liquid limit test: - This test is essential to determine the liquid limit of soil using Casagrande apparatus IS: 2720(part 5) -1985- Methods of a test for soils: Determination of liquid and plastic limit.
- (c) Plastic limit test: -. This is crucial to know plastic properties of black cotton soil by different water contents. "IS: 2720(Part 5) - 1985-Methods of a test for soils "Determination of liquid and plastic limit" is taken as standard.
- (d) Proctor Compaction Test: - This test is crucial to check subgrade strength, compaction properties and water retaining traits of soil.
- (e) California Bearing Test: - This test is keen to determine CBR value of soil either in undisturbed or remoulded condition CBR value shows Subgrade strength of the soil sub base which is useful to know whether to add any material or not for stabilization.

3.4. Fly ash, caustic soda, cement

Soil was taken 1m below the surface level. The soil was air dried and the lumps in the soil is crushed. Then it is compacted or powdered.

- (a) Grain size distribution analysis: - The soil can pass through 425-micron sieve. 2) OMC and MDD are determined.
- (b) The mould of 20x10x10cm is taken and mould was placed over the smooth flat base plate.
- (c) The Black Cotton soil was stabilized using the admixture Caustic soda at different percentages of 5,10 and 15.
- (d) water mixed to the soil has obtained in the OMC of 22% to maintain the MDD of 16.2KN/m³
- (e) Bricks were made without geo-grid with single layer of Geo-grid and with two layers of Geo-grid.
- (f) The stabilized soil is placed in the mould in layers and each layer is compacted thoroughly.

- (g) The extra soil is removed with the help of spatula, to get perfect and smooth shape.
- (h) The casted brick is removed from the mould carefully to maintain the shape.
- (i) These bricks are kept for air curing for 14, 21 and 28 days. 11) These bricks were taken for the UTM test respectively. 12) The above procedure was repeated using Cement and Fly ash as admixtures.

4. CONCLUSION

- (a) Bio-enzyme is the chemical and it is available in the market and it take only 7 days to give strength to the black cotton soil and also the cost of construction of foundation work reduced as we can afford.
- (b) As we know bagasse ash are formed in very large scale at the sugar industry and it is very easy process to stabilize the black cotton soil with the bagasse ash but only the problem is how much amount we have to add bagasse ash that is find out here is 16% of weight of soil is appropriate value which give good shear strength and compressive strength.
- (c) Paper mill sludge ash is coming from as name mentioned from the paper mill as bagasse ash the sludge ash is also ash but for using this sludge ash, we need to conduct more experiments like CBR, plastic limit test, compaction test, etc. From this the concluded that the CBR value increasing with adding more % of paper sludge ash up to certain limits.
- (d) The stabilization of soil is based on result of the tests conducted on blocks (200×100×100mm), with reinforced and unreinforced Geo-grid and this test conducted using caustic soda and from that we conclude that the maximum compressive strength of black cotton soil is obtained by adding 15% of caustic soda in soil block which having two layers of Geo-grid and after 28 days curing of the blocks.
- (e) The different material which is waste but we can use as admixture to improve strength of black cotton soil and in this the material which is used as admixture is as follow copper slag, brick dust, ceramic dust, polyvinyl waste, etc. On this the test are conducted and improves strength of soil and also protect from growing of waste produced by industries.

5. REFERENCES

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