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(57) Abstract :
Stabilization of Black Cotton Soil is studied by using terrazyme. Black Cotton soils are highly clayey soilsnature (montmorillonite clay mineral). The moisture changes in Black Cotton Soils, compressibility and last- plasticitynature can be greatly improved with the addition of terrazyme. This paper includes the evaluation of soil propertieslike optimum moisture content, dry density and strength parameter (California bearing ratio valve). Differentquantities of terrazyme (% weight) are added to the BC soil and the experiments conducted on these soil mixes. Theresults show that the use of terrazyme has increased the CBR values i.e., the strength of soil to a great extent.

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FORM - 2

THE PATENTS ACT, 1970

(39 OF 1970)

THE PATENTS RULES, 2003

COMPLETE SPECIFICATION

(Section 10; rule 13)

STUDY ON THE INFLUENCE OF TERRAZYME AS A STREGTHENING AGENT FOR BLACK COTTON SOIL

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The following specification particularly describes the invention and the manner in which it is to be performed:

STUDY ON THE INFLUENCE OF TERRAZYME AS A STREGTHENING AGENT FOR BLACK COTTON SOIL

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Field and background of the invention

Emerging trend of using waste material in soil stabilizing or soil strengthening is being operational all over the world in the present days. The main reason behind this trend is the excessive production of waste like fly ash, plastics, rice husk ash (RHA) which is not only hazardous but also creating deposition/disposal problems. Using some of these waste materials in construction practice will reduce the problem to a great extent.

The history of stabilization of soil has a long background with hundreds of research results. Several research results with waste materials such as fly ash, plastics; rice husk ash has also be published with their benefits Stabilized Sub-Grade Soil containing Copper slag and fly ash and Sensitivity Analysis of Sub-Grade Soil CBR.

Fly ash is a coal combustion by-product – a finely divided residue resulting from combustion of coal in power plants. In the thermal power stations, coal is pulverized into fine powder and pumped into the boiler along with compressed air. Coal powder is fired to generate heat, which in turn produces steam to run the turbine. After burning, the coarse ash or 'bottom ash' gets collected below the boiler. The finer particles of coal are collected in the Electro-Static Precipitators (ESP). Copper slag is a by-product extracted during the process of smelting. In the process of smelting, the impurities become slag and floated in the top surface of the molten metal which will be quenched in water produces angular granules and disposed as wastes. Copper slag is in black color and granular in shape has less than 1% moisture the specific gravity of slag was 3.2 and the grain size mostly between 2.36 mm to 1.18 mm which very closely matches with sand property. Mostly the composition of copper slag contains oxides of copper, iron and silica.

Here mainly three materials were used, namely

1. Black cotton soil.

2. Copper slag

3. Fly ash

PREPARATION OF SAMPLES:

Specimen for testing the CBR has done by taking the soil mass of about 5 kg, which was passed through a sieve of size 4.75mm. OMC which we had gotten from standard proctor test will added in the soil mass and mixed thoroughly until lumps vanishes. keep the CBR mould ready by fixing it to base plate and spacer disc of size 3,7cm will be placed at the bottom of the mould , after being mixed the soil mass is poured in CBR mould which is having a size of dia 15 cm and height of 17.5cm and it will compacted in three layers by giving 25 blows for each layer for light compaction. After compacting the second layer collar will be placed and compacting third layer is carried collar .post compacting the 3rd layer the collar will be removed and the extra part of soil mass is trimmed until it gets to smooth surface. Reinforcement is done at certain depth from top of the specimen.

Table 1 Physical properties and chemical composition of fly ash

Physical Properties	
Specific gravity	2.27
Loss on ignition	11.8%
Chemical Composition	
Silica (SiO2)	58.3%
Alumina (Al2O3)+Iron oxide (Fe2O3)	26.3%
Calcium oxide (CaO)	2.2%
Magnesium oxide (MgO)	0.3%

The following tests were conducted in the laboratory for this project work.

1. Specific gravity test-The specific gravity test was conducted as per **IS:2720 (part-3sec-1)-1980**. The test was conducted for BC soil.

2. Grain size analysis-The grain size analysis test was conducted as per **IS:2720 (part-4)-1985**. This test was conducted on BC soil.

3. Atterberg's limits-In this test, three tests were conducted namely, liquid limit, plastic limit, and plasticity index, as per **IS:2720 (part-5) 1985.**This test was conducted for BC soil.

4. Compaction Test-The test was conducted as per **IS: 2720(part-7)-1980** this test was conducted for BC soil.

5. California Bearing Ratio Test- Standard test apparatus & technique existing for CBR test was use in current work **(IS:2720(part 16)-1979**, "Laboratory test of CBR") this test were idea for un-soaked condition for light compaction result.

Table 2 Shows the physical properties of Black Cotton soil.

Sl.no	**Parameters**	**Parameters**
1	Specific gravity Gs	2.6
2	Atterberg's limits %	
	Liquid limit	0.7275
	Plastic limit	18.269
	Plasticity index	17.5

3	Sieve analysis%	
	Sand	30.5
	Silt	44.3
	Clay	24.5
	Effective particle size *(D10) mm*	0.275
	(D30) mm	0.69
	(D60) mm	61.8
	Coefficient of uniformity (*Cu)*	11.45
	Coefficient of curvature *(Cc)*	0.88
4	Optimum moisture content	14
5	Maximum dry density Kn/m^3	15.901
6	IS classification	CH & MH

Table 3 CBR values of Fly ash mixing with Black cotton soil with different percentages

S.No.	Description	CBR values	
		Penetration 2.5mm	Penetration 5.0mm
1.	Soil	28	17
2.	Soil + 5% fly-ash	29.32	24.12
3.	Soil + 10% fly-ash	31.4	28.3
4.	Soil + 15% fly-ash	32.7	31.41
5.	Soil + 20% fly-ash	33.2	32.6
6.	Soil + 25% fly-ash	38.3	36.5

Table 4 CBR values of Copper slag mixing with Black cotton soil with different percentages

S.No.	Description	CBR values	
		Penetration 2.5mm	Penetration 5.0mm
1.	Soil	28	17
2.	Soil + 5% Copper slag	19.23	17.01
3.	Soil + 10% Copper slag	21.41	17.32
4.	Soil + 15% Copper slag	22.8	18.6
5.	Soil + 20% Copper slag	23.3	19.5

6.	Soil + 25% Copper slag	23.9	19.9

Table 5 CBR values fly ash, Copper slag and mixture of fly ash and copper slag with Black cotton soil with different percentages.

S.No.	Description	CBR values	
		Penetration 2.5mm	Penetration 5.0mm
1.	Soil	28	17
2.	Soil + 5% fly-ash + 5% Copper slag	38.6	35.2
3.	Soil + 10% fly-ash + 10% Copper slag	39.01	36.2
4.	Soil + 15% fly-ash + 15% Copper slag	42.1	37.2
5.	Soil + 20% fly-ash + 20% Copper slag	45.37	39.61
6.	Soil + 25% fly-ash + 25% Copper slag	45.7	43.1

Table 6 CBR values of Fly ash, Copper slag and mixture of Fly ash and Copper slag with Black cotton soil at a 5%

Sample	Penetration	
	2.5mm	5.0mm
Soil	28	17
Fly ash	29.32	24.02
Copper slag	19.32	17.01
Soil +fly ash +copper slag	38.6	35.2

Table 7 CBR values of fly ash, Copper slag and mixture of fly ash and copper slag with Black cotton soil at a 10%

Sample	Penetration	
	2.5mm	5.0mm
Soil	28	17
Fly ash	31.4	28.3
Copper slag	21.41	17.32
Soil +fly ash +copper slag	39.01.	36.2

Table 8 CBR values of fly ash, Copper slag and mixture of fly ash and copper slag with Black cotton soil at a 15%

Sample	Penetration	
	2.5mm	5.0mm
Soil	28	17
Fly ash	32.7	31.4
Copper slag	22.8	18.6
Soil +fly ash +copper slag	42.1	37.2

Table 9 CBR values of fly ash, Copper slag and mixture of fly ash and copper slag with Black cotton soil at a 20%

Sample	Penetration	
	2.5mm	5.0mm
Soil	28	17
Fly ash	33.5	29.5
Copper slag	23.3	19.5
Soil +fly ash +copper slag	45.37	39.6

Table 10 CBR values of fly ash, Copper slag and mixture of fly ash and copper slag with Black cotton soil at a 25%

Sample	Penetration	
	2.5mm	5.0mm
Soil	28	17
Fly ash	38.3	36.5
Copper slag	23.9	19.9
Soil +fly ash +copper slag	45.7	43.1

For this project the samples are prepared for following proportions.

1. The experimental tests were conducted on black cotton soil, by using different percentage of copper slag and fly ash.

2. A series of tests for untreated and treated soils using copper slag and fly ash as a stabilizer are determined .The tests such as compaction, CBR ,are done.

3. The CBR tests will be conducted with and without admixtures on black cotton soil. Specimen for testing the CBR has done by taking the soil mass of about 4.5 kg, which was passed through a sieve of size 4.75mm. OMC which we had gotten from standard proctor test will added in the soil mass and mixed thoroughly until lumps vanishes. keep the CBR mould ready by fixing it to base plate and spacer disc of size 3,7cm will be placed at the bottom of the mould, after being mixed the soil mass is poured in CBR mould which is having a size of dia 15 cm and height of 17.5cm and it will compacted in five layers by giving 25 blows for each layer for light compaction. After compacting the fourth layer collar will be placed and compacting fifth layer is carried collar.post compacting the 5th layer the collar will be removed and the extra part of soil mass is trimmed until it gets to smooth surface. Reinforcement is done at certain depth from top of the specimen

We Claim

1. We Claim that the strength of the black cotton soil without any admixtures is up to 28%.

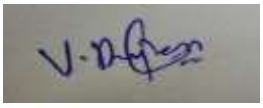
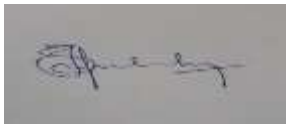
2. We Claim that at 5% of fly ash, copper slag and mixture of the both fly ash and copper slag with black cotton soil, CBR value is increased up to 29.32%, 19.32% and 38.6%.

3. We Claim that at 10% of fly ash, copper slag and mixture of the both fly ash and copper slag with black cotton soil, CBR value is increased up to 31.4%, 21.41% and 39.01%.

4. We Claim that at 15% of fly ash, copper slag and mixture of the both fly ash and copper slag with black cotton soil, CBR value is increased up to 32.7%, 22.8% and 42.1%.

5. We Claim that at 20% of fly ash, copper slag and mixture of the both fly ash and copper slag with black cotton soil, CBR value is increased up to 33.5%, 23.3% and 45.3%.

6. We Claim that at 25% of fly ash, copper slag and mixture of the both fly ash and copper slag with black cotton soil, CBR value is increased up to 38.3%, 23.9% and 45.7%.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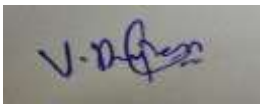
ABSTRACT
Stabilization of Black Cotton Soil is studied by using terrazyme. Black Cotton soils are highly clayey soilsnature (montmorillonite clay mineral). The moisture changes in Black Cotton Soils, compressibility and last- plasticitynature can be greatly improved with the addition of terrazyme. This paper includes the evaluation of soil propertieslike optimum moisture content, dry density and strength parameter (California bearing ratio valve). Differentquantities of terrazyme (% weight) are added to the BC soil and the experiments conducted on these soil mixes. Theresults show that the use of terrazyme has increased the CBR values i.e., the strength of soil to a great extent.

Keywords- Black Cotton Soil, California Bearing Ratio (CBR), Compaction Factor, Soil Stabilization, Terrazyme.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