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A Study of CBR value for Black Cotton Soil with Kiln Dust and Plastic Strips

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Abstract - *The soil stabilization is any process which improves the physical properties of soil such as increasing shear strength ,bearing capacity etc. which can be done by use of controlled or addition of admixtures like cement kiln dust, lime, plastic strips and waste material like fly ash, biogases ash, RBI Grade 81 etc. This new technique of soil stabilization can be effectively used to meet the challenge of society to reduce the quantities of waste, producing useful material from non useful material waste material. The use plastic bottle and cement kiln dust as soil stabilizer is an economical utilization since there is scarcity of good quality soil for embankment. This project involves the study on possible use of plastic bottle and kiln dust for soil stabilization. In this project the different test is conducted such as California bearing ratio and compaction. The cement kiln dust is used in different percentages such as 5%, 10%, 15%, 20% and 25%.the strips also used in different percentages as 0.5%,1%,1.5%,2% and 2.5%. From this project t has been observed that the California bearing ratio value has been increased for addition of 0.5% plastic strips of size 2cmx4cm and in compaction the California bearing ratio value has increased at 20% of cement kiln dust addition. It has been observed that the increasing in cement kiln dust in the soil tends to increase in the dry density of soil.*

***Key Words*: Cement kiln dust, Black Cotton Soil, Soil Stabilization, California Bearing Ratio, and Compaction**

1. INTRODUCTION

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1.1 Materials

1.1.1 Black Cotton Soil

In India, expansive soils are called as Black Cotton soil. The name "Black Cotton" as an agricultural origin. Most of these soils are black in colour and are good for growing Cotton. All the black soils are not expansive soils and all the expansive soils are not black in colour. These soils passed high strength in summer and decreased rapidly in winter. The soil has a swelling property due to the presence of montmorillonite mineral. The swelling soils of India have their origin in subaqueous decomposition of basalt rocks or weathering In-Situ. It is very necessary to discuss about the Engineering behavior of soils. From this information civil structures can be prevented from the damages causing Expansive soils. Black soils are highly argillaceous and are relatively rich in Caco3.

1.1.2 Cement Kiln Dust

Cement kiln dust (CKD) is a fine, powdery material, portions of which contain some reactive calcium oxide, depending on the location within the dust collection system, the type of operation, the dust collection facility, and the type of fuel used. CKD consists of four major components: unreacted raw feed, partially calcined feed and clinker dust, free lime, and enriched salts of alkali sulfates, halides, and other volatile compounds.

1.1.3 Plastic Strips

Plastic and materials made with plastic have become the integral part of our day to day life in various stages and also in various forms, but then, the disposal and dumping of the used and unwanted plastic has become a major threat for the civilized society, as the production and usage of new plastic and plastic associated materials are not in balance with its recycling recycled plastic products status. Plastic bottle and plastic bags recycling has not kept pace with the dramatic increase in virgin resin polyethylene Terephthalate (PET) sales and the aspect of reduce, has emerged as the one that needs to be given prominence. The general survey shows that 1500 bottles are dumped as garbage every second. PET is reported as one of the most abundant plastics in solid urban waste whose effective reuse/recycling is one of the critical issue which needs immediate attention.

1.2 Methodology

In the present investigation following tests have been conducted according to the specification of IS: 2720

- Specific Gravity.
- Liquid limit.

- Plastic limit.
- Sieve analysis
- Compaction.
- California Bearing Ratio.

1.3 Objectives

- Determination of Geotechnical properties of black cotton soil
- Determination of CBR value for varying percentage of cement kiln dust mix.
- Determination of CBR value for varying percentage of waste plastic strips of different size in BC soil

2. Result and Discussion

2.1 Properties of soil

Sl No.	Soil characteristics	Description
1	Liquid limit	53%
2	Plastic limit	25%
3	Specific gravity	2.24
4	Maximum dry density	1.2 g/cc
5	Optimum moisture content	11.5%
6	CBR	1.53%

2.2 Standard Proctor Test on Soil with Kiln Dust

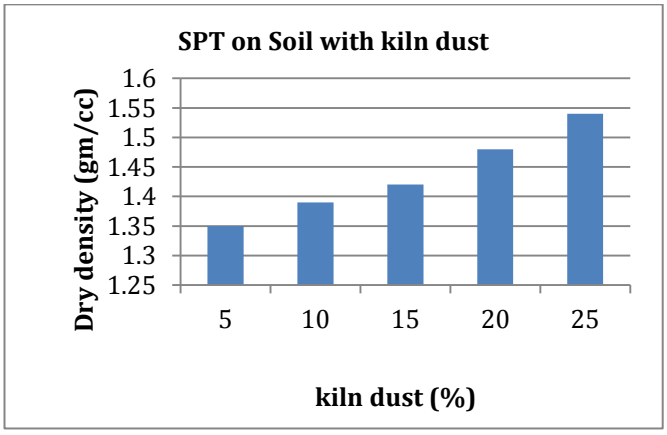

Fig 1

MDD is increasing and finer particles of CKD are increasing Percentage. When CKD is used as soil stabilizing additive, Soil particles become large-sized clusters, resulting in texture change. The enlarged particle size causes the void ratio to increase. This increase in void ratio reflects the decrease in MDD and increase of moisture content for the Soil-CKD mixture. Increases in percentage of CKD the MDD has increased from 1.35 to 1.54 gm/cc.

2.3 California Bearing Ratio on Soil with Kiln Dust

Size of plastic strips with CBR value for 0.5%

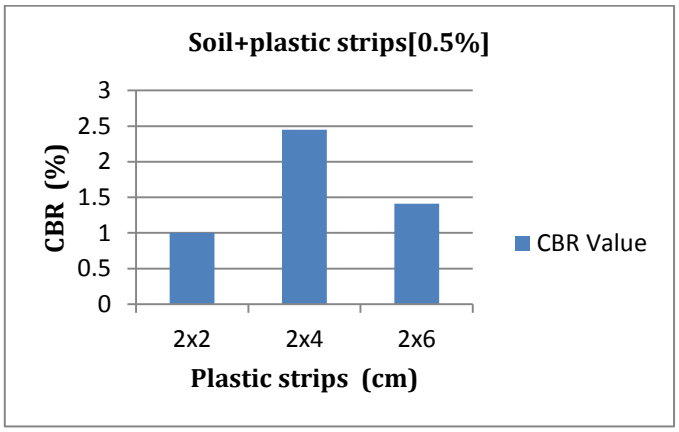

Fig 2 variation of CBR value for 0.5 %

As per the above Fig 2 the California bearing values for the addition of 0.5% of plastic strips. The CBR value has higher value for 2x4 strips of (2.49%) , has compared to 2x2 strips and 2x6 strips.

Plastic strips with CBR value for 1%

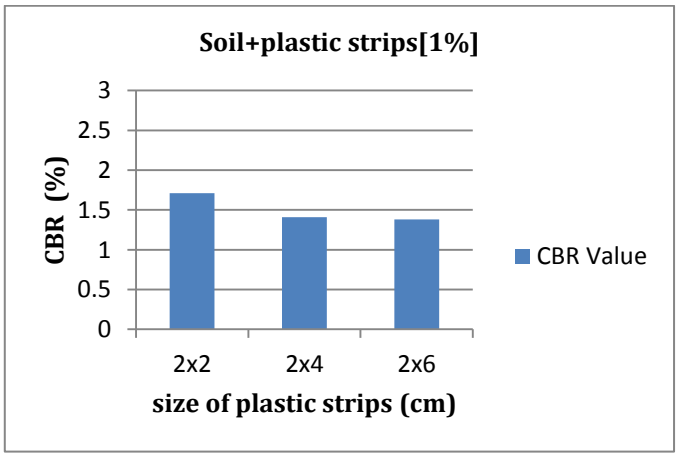

Fig 3 variation of CBR value for 1 %

From the above Fig 3 it has been observed that among the three sizes of strips 2x2, 2x4, 2x6 the CBR value of the 2x2 size plastic strips has the higher value of 1.71%, when the soil is mixed with strips of 1% by the mass of soil. Further increase in size the value has been decreased.

Plastic strips with CBR value 1.5%

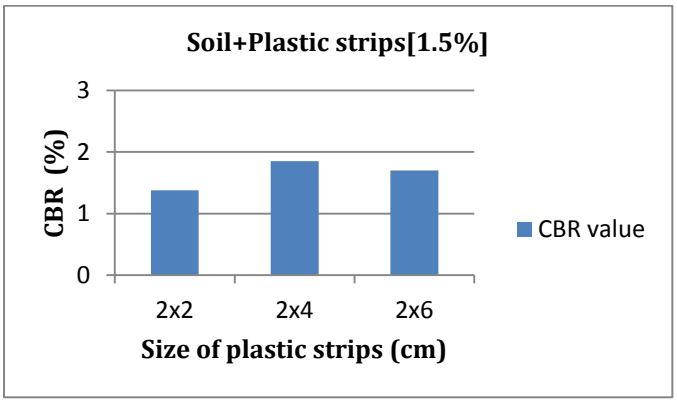

Fig 4 variation of CBR value for 2 %

It has been observed from the above Fig 4 when the soil is mixed with the 1.5% of plastic strips of size 2x4 is the higher CBR value of 1.85%.

Plastic strips with CBR value for 2%

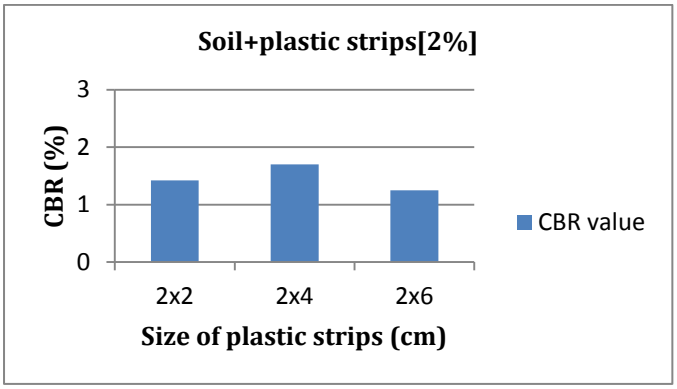

Fig 5 variation of CBR value for 1.5 %

From above Fig 5 the CBR value 1.7% increased of a size 2x4 of plastic strips, compared the other sizes of CBR value with size of 2x2 and 2x4 has decreased.

Plastic strips with CBR value for 2.5%

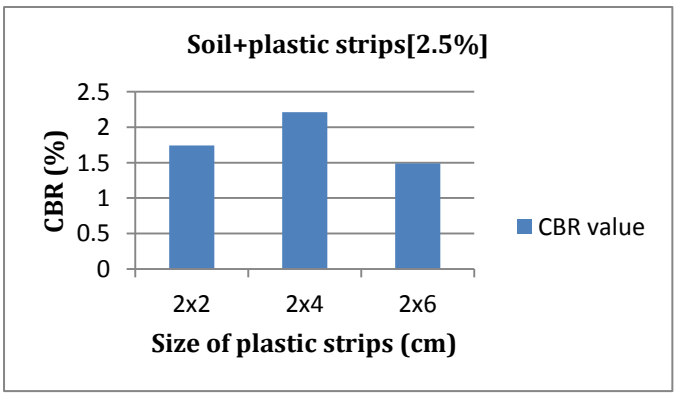

Fig 6 variation of CBR value for 2.5 %

From the above Fig 6 the CBR value of the plastic strips of size 2x4 is higher when compared to the other sizes of plastic strips. It indicate that the increasing in size of plastic strips with increasing in CBR value. The CBR value has been decreased due to increase in size of plastic strips from 2.21% to 1.49%. The addition of varying percentage of plastic strips (0.5, 1, 1.5, 2, 2.5 %) of size (2x2, 2x4, 2x6 cm). The 2x4, size has higher CBR values almost in all percentage of plastic strips addition.

3. CONCLUSIONS

- Using Plastic bottles as a soil stabilizer is an economical and gainful utilization since there is scarcity of good quality soil for embankments and fills.
- The maximum value of CBR is 2.88 % with addition of 20% kiln dust in the black cotton soil.
- The CBR value has higher value for all percentage of plastic strips for 2x4 cm size strips.
- The CBR is having higher value for o.5 % of plastics strips of size 2x4 cm is 2.45%.
- It can also be concluded that the addition of cement kiln dust has increased the dry density of black cotton soil.
- This project is to meets the challenge of society to reduce the quantities of plastic wastes.

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