

Comparison of Index Properties of Black Cotton Soil by adding Lime and Sugarcane Straw Ash

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Abstract – The object of this study is to compare the change in index properties of soil when lime and sugarcane straw ash added as a stabilizing material to Black Cotton soil or clayey soil. Lime and Sugarcane straw ash were mixed with soil sample by different proportions 3%, 6%, 9%, 12%, and 15% and different properties concluded and compared.

It is observed that case of lime significant decrease in Liquid limit from 64.50% to 34.11% and same nature i.e. decreases in Plastic limit observed. It decreased from 24.62% to 16.73% Results of this observed in form of reduction in Plasticity. The value of plasticity Index decreases from 39.88% to 17.38%. Another property of soil DFS also decreased significantly from 43.00% to 10.00%.

Also observed that in case of Sugarcane Straw Ash significant variation in Liquid limit decrease from 64.50% to 47.26%. The Plastic limit decrease from 24.62% to 20.84%. The Plasticity Index decrease from 39.88% to 26.42%. The value of DFS also decreased from 43.00% to 20.00%.

Index Terms – Lime, Sugarcane straw ash (SCSA), Index properties, DFS.

1. INTRODUCTION

Black Cotton soil cover about 20% of land area in India. Most of the Indian black cotton soil are rich in montmorillonite. It expands during the rainy season due to intake of water and shrink during summer season. These properties lead to damage the foundation of the building and road pavement. In this study the black cotton soil is brought from Jawaharlal Nehru Agriculture University, Adhartal Jabalpur (M.P.). Stabilizing material i.e. lime and sugarcane straw ash is procured from local market.

LIME-Lime has been one of the most prominent building material. Lime stabilization has been used in many projects like building foundation, highway construction etc. For the study lime is collected from shop in near Ghamapur, Jabalpur (M.P.). **SUGARCANE**- The sugarcane is found to be in agriculture sector. Sugarcane contains various chemical compositions which are also present in sugarcane straw ash. Sugarcane straw ash collected from sugar mill in Narsinghpur. Narsinghpur is situated near to Jabalpur (M.P.).

2. LITERATURE REVIEW

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3. METHODOLOGY

The Methodology comprise of collection of soil, Lime and SCSA from the desired locations as mentioned above. The black cotton soil used in this study is mixed with different percentage i.e. 3%, 6%, 9%, 12%, 15% with lime and with SCSA.

The laboratory test were conducted on original soil and sample prepared by adding different percentage of additives. Following test was performed on all the samples.

- 1) Grain size distribution.
- 2) Liquid Limit.
- 3) Plastic Limit.
- 4) Plasticity Index.
- 5) Differential free soil (DFS) test.

4. OBSERVATION AND CALCULATION

The Different properties of original soil sample: -

Table-1 Properties of the natural soil sample

S.NO	Parameters	Test value
1	Specific Gravity in g /cc	1.99
2	Liquid limit % (LL)	64.5
3	Plastic limit %(PL)	24.62
4	Plasticity Index %(PI)	39.88
5	Differential Free Swell % (DFS)	43.00
6	% finer to 75 μ	95.34
7	Soil classification	CH

Table-2 Index Properties of Soil

S.NO	Type of soil	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	DFS (%)
1	B.C. SOIL	64.50	24.62	39.88	43.00
	B.C. SOIL +3% LIME	44.17	22.10	22.07	30.00
	B.C. SOIL +3% SCSA	61.10	24.12	36.98	41.00
2	B.C. SOIL +6% LIME	39.58	19.23	20.35	25.00
	B.C. SOIL +6% SCSA	56.21	23.81	32.40	38.00
3	B.C. SOIL +9% LIME	37.88	18.27	19.61	24.00
	B.C. SOIL +9% SCSA	53.65	22.90	30.75	36.00
4	B.C. SOIL +12% LIME	35.43	17.52	17.91	21.00
	B.C. SOIL +12% SCSA	50.89	21.19	29.70	30.00
5	B.C. SOIL +15% LIME	34.11	16.73	17.38	10.00
	B.C. SOIL +15% SCSA	47.26	20.84	26.42	20.00

5. RESULTS AND CONCLUSION

When Lime is used with Black cotton soil Liquid limit decreased from 64.50% to 34.11%. Similarly, plastic limit decreased from 24.62% to 16.73%, plasticity index decreased from 39.88% to 17.38% and DFS decrease from 43.00% to 10.00% respectively.

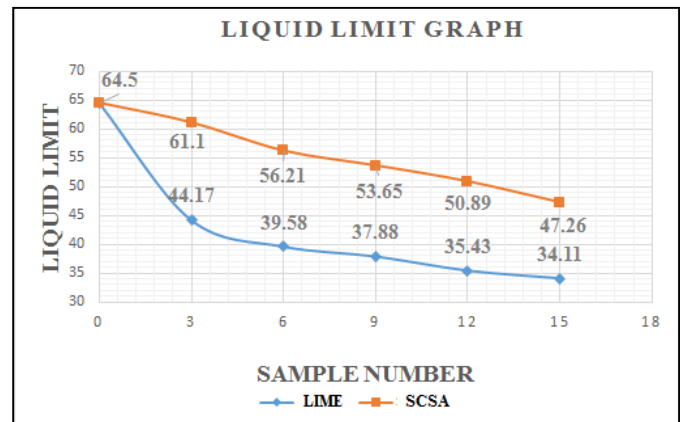
When SCSA is used with Black cotton soil Liquid limit decreased from 64.50% to 47.26%. Similarly, plastic limit decreased from 24.62% to 20.84%. Plasticity index decreased from 39.88% to 26.42% and DFS decrease from 43.00% to 20.00% respectively.

GRAPHICAL REPRESENTATION OF TEST RESULT

Based on these observations it can be assessed that lime is a better stabilising agent than SCSA.

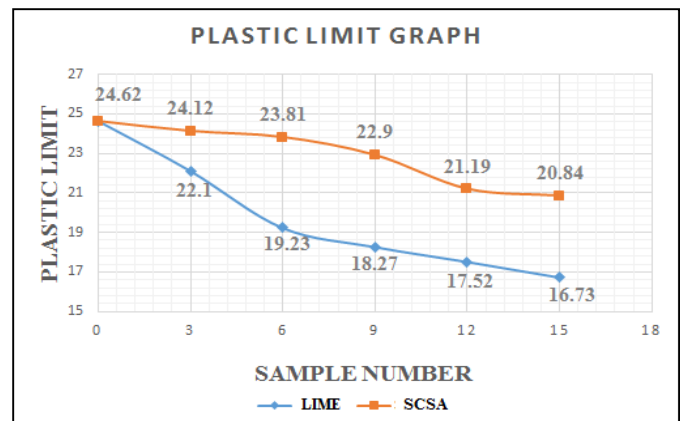
LIQUID LIMIT

Graph 1: Variation in Liquid Limit

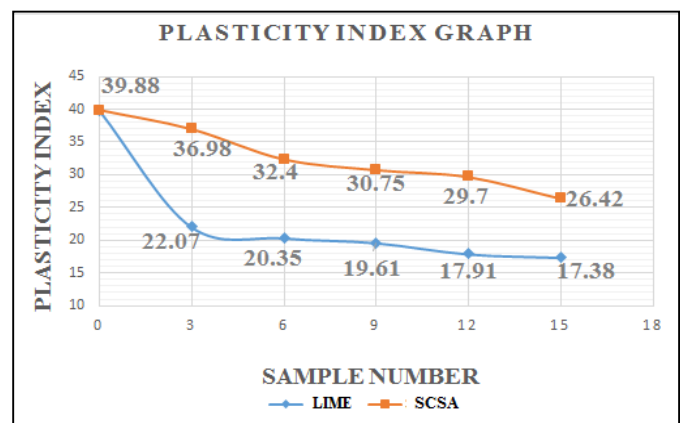


PLASTIC LIMIT

Graph 2: Variation in Plastic Limit

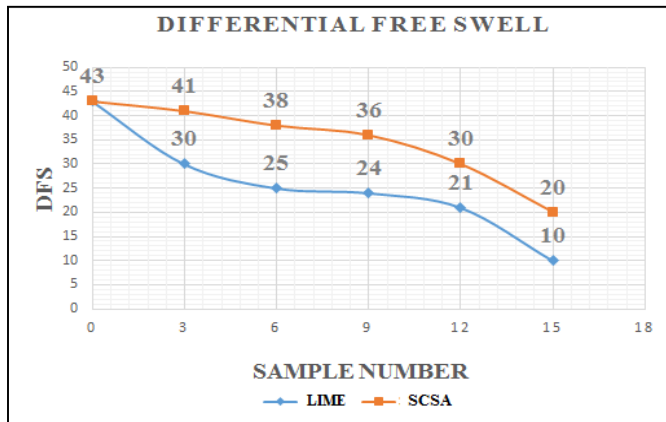


PLASTICITY INDEX



Graph 3: Variation in Plasticity Index

DIFFERENTIAL FREE SWEEL



Graph 4: Variation in DFS

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