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CHARECTERSTICS OF EXPENSIVE SOIL BY USING WASTE KOTA STONE SLURRY

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Abstract*— Expansive soils are widely conveyed around the world, and are a wellspring of extraordinary harm to foundation and structures. The disturb far reaching soils has been set down everywhere throughout the world. The soil devours water and expand in storm additionally in summer it diminish because of the gasification of water. The focal point of study is attainability of mechanical waste like kota stone slurry as soil adjustment material. To compute the impact of kota stone slurry on list properties of dark cotton soil, various research center investigations have been directed on dark cotton soil tests blended with various extent like 0%, 4%,8%,12%,18%,20% of kota stone slurry by weight of dry soil. The express development of enterprises of kota stone produces risky waste materials at an immense sum which makes a major issue to the people encompassing them just as goes about as a poison, so it influences the natural arrangement of the earth. There is exceptional improvement in the list properties of the black cotton soil on expansion of kota stone slurry into it. The test outcomes uncover that the compaction parameters, fluid breaking point, pliancy file, most extreme dry thickness, California bearing proportion expanded with an expansion in kota stone slurry content. The most ideal blend of 16% Kota Stone Slurry by dry load of costly soil.

Keywords*— Black cotton soil, soil stabilization, Kota stone slurry. California bearing ratio, standard proctor test, plasticity index.

I. INTRODUCTION

Expansive soil is a kind of clayey soil having montmorillonite mineral, which grows when interacts with water and therapists when the water dissipates. This dirt is commonly found in parched and semi-dry locales of the world. A great deal of harms happen on structures established on this kind of soil. The harms typically show up as breaks in, structures, trench beds and linings, asphalts, lifting of water supply pipeline and sewerage lines and so on. Various creative procedures are there for development on this kind of soil. Physical and substance change of soil utilizing strong squanders like fly ash,rice husk cinder, marble dust, phosphogypsum, granulated impact heater slag,red mud, squander tyre,etc.(Muntohar and Hantoro 2000, Pandian et al.2001, Swami 2002,Phanikumar and Sharma 2004, Kalkan 2006, Degirmenci et al. 2007, Cokca et al. 2009,Sabat and Nanda 2011,Patil et al. 2011) is one of them.Utilisation of strong squanders thusly shields the earth from debasement as well as improves the building properties of the far reaching soil.

Along these lines, the conceivable utilization of mechanical waste, for example, kota stone slurry, will extensively lessen the expense of development and just as diminish or wipe out the ecological risks brought about by such waste. Substantial bits of marble waste can be utilized as bank or asphalt material, and kota stone slurry can be utilized as added substances in certain enterprises (paper, cement, ceramic etc.).

III. MATERIALS USED

2.1 Materials used

2.1.1 Soil

The Expansive soil which is used to study was obtained from near collectorate office baran district Rajasthan at a depth of 1.5m from ground level.Various tests have been performed to determine the index as well as the engineering properties of the parent soil by IS specifications.

Table1. Geotechnical properties of the untreated BC soil

S.No.	Property		Value
1	Specific gravity		2.56
2	Liquid limit %		63.74
3	Plastic Limit %		26.74
4	Soil Classification	Gravel %	5.0
		Sand %	12.0

		Sand %	21.0
		Clay %	62.0
5	D.F.S.%		64.71
6	O.M.C.%		19.70
7	M.D.D.%		1.72
8	CBR(Soaked)		1.71

2.1.2 KOTA STONE SLURRY

It is the by-product of the kota stone industry which is generated during cutting and grinding of kota stone. The literature reveals that waste generation is approximately 40% of the total kota stone handled per annum. The waste is produced from the industries in the form of both solid and slurry. Table 2 shows the properties of kota stone slurry.

Table2. Chemical composition of Kota stone slurry

Component	Wt%
Calcium oxide	37.30
Magnesium oxide	4.13
Sodium oxide	1.21
Potssium oxide	0.40
Aluminium trioxide	1.37
Ferrous oxide	0.86
Titanium oxide	0.05
silica	24.90
Loi	31.94

Figure.1: Kota stone slurry

IV.LABORATORY INVESTIGATION

laboratory studies were carried out on the samples of Black cotton soil, Black cotton soil+ Kota stone slurry mixes.

Liquid limit Liquid limit test was conducted on Black cotton soil, Black cotton soil with different % Waste kota stone slurry mixes using Casagrande's liquid limit apparatus as per the procedures laid down in IS: 2720 part 4 (1970).

Plastic limit Plastic limit test was conducted on soil,Black cotton soil ,Black cotton soil with different % kota stone slurry as per the specifications laid down in IS: 2720 part 4 (1970).

California bearing ratio Test The California bearing ratio tests were conducted on ,Black cotton soil ,Black cotton soil with different % waste kota stone slurry mixtures as per IS 2720 part 16 (1979). The test was conducted under a constant strain rate of 1.25mm/min. The proving ring reading is noted for 50 divisions, and loading was continued until 3 (or) more readings are decreasing (or) constant. The test was conducted at Optimum moisture content. The samples were tested in soaked condition.

Differential Free Swell Test Differential Free Swell (DFS) is a parameter used for the identification of the Black cotton soil. For the determination of the differential free swell of a soil, 20g of dry soil passing through a 425µ size sieve is taken. One sample of 10g is poured into a 100c.c capacity graduated cylinder containing water, and the other sample of 10g is poured into a 100c.c capacity graduated cylinder containing kerosene oil. Both the cylinders are kept undisturbed in a laboratory. After 24 hours, the settled volumes of both the samples are measured

Standard Proctor Test In geotechnical engineering, soil compaction is the process in which a stress applied to a soil causes densification as air is displaced from the pores between the soil grains. It is an instantaneous process and always takes place in partially saturated soil. The Proctor compaction test is a laboratory method of experimentally determining the optimal moisture content at which a given soil type will become most dense and achieve its maximum dry density.

V.RESULTS AND DISCUSSION

The experimental results reveal that the free swelling index,liquid limit and plastic limit of the soil decreases with addition of Kota stone slurry, maximum dry density of soil increased from 1.72 g/cc to 2.01 g/cc by addition of 16% of Kota stone slurry where as, Optimum Moisture Content decreased from 19.7% to 14.2%. Also, CBR value of soil increased from 1.71 to 5.31 by the addition of Kota stone slurry. The variation of liquid limit, plastic limit, OMC, MDD and CBR with Kota stone slurry are present in figure(2-6)

Proportion	Liquid limit	Plastic limit	Plasticity index
BC Soil	63.74	26.74	36.99
BC Soil+4% KSS	58.62	22.95	35.67
BC Soil+8% KSS	53.85	21.05	32.79
BC Soil+12% KSS	46.71	19.67	27.04
BC Soil+16% KSS	41.73	17.86	23.87
BC Soil+20% KSS	38.55	17.02	21.53

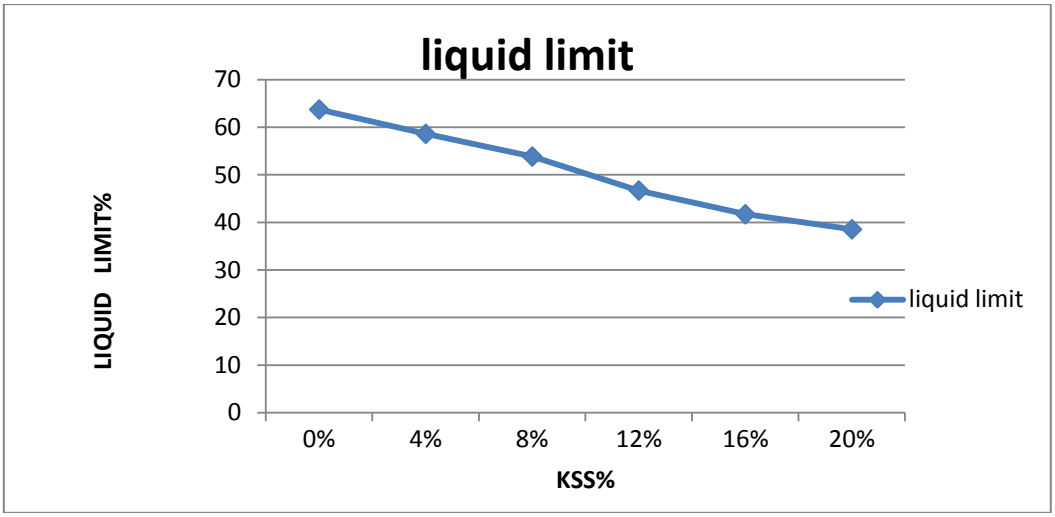


Figure. 2 Variation of Liquid limit with Kota stone slurry

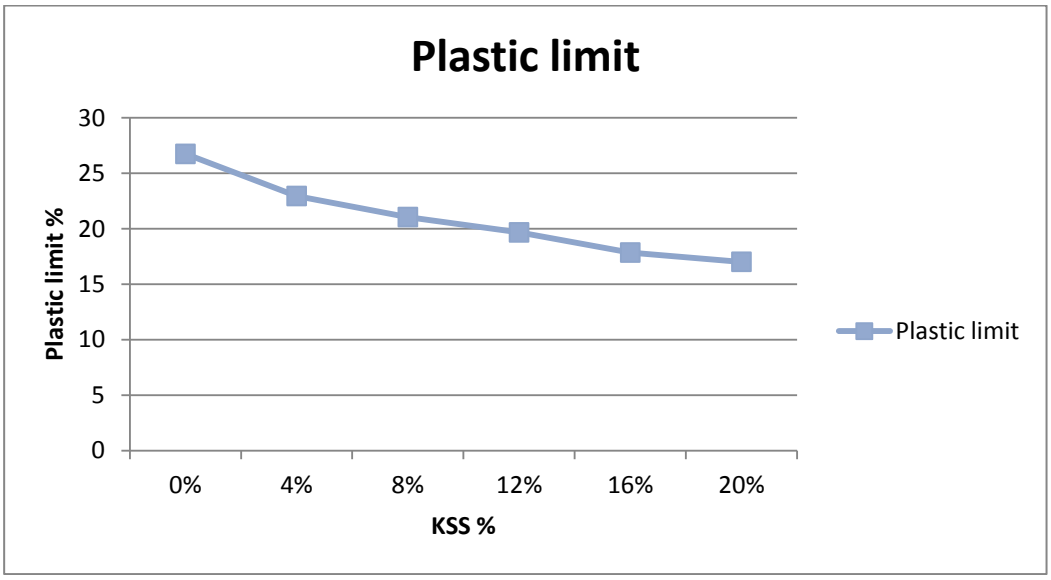
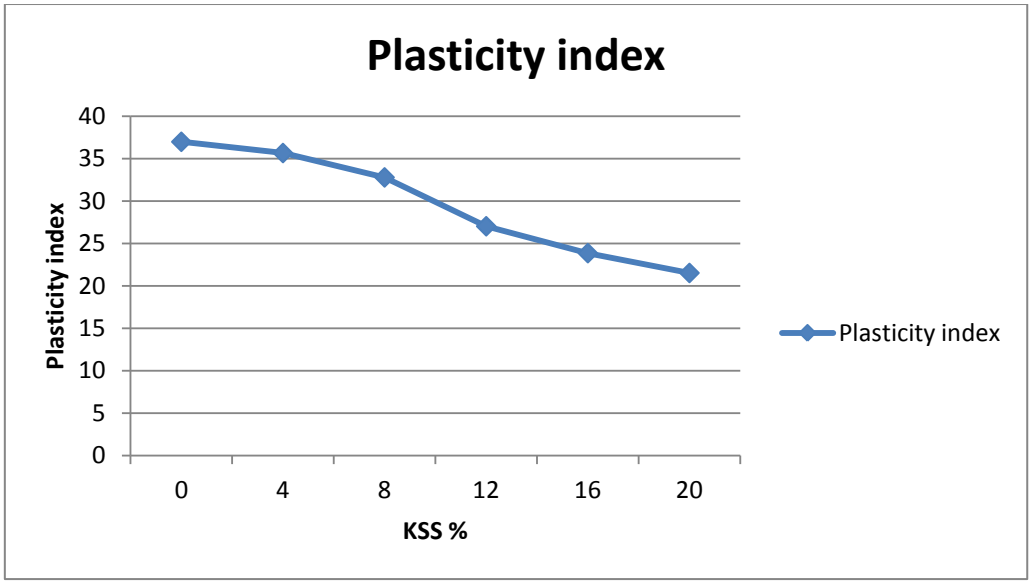


Figure.3 Variation of Plastic limit with Kota stone slurry



Plastisity index

Proportion	OMC VALUE
BC Soil	19.7
BC Soil+4% KSS	18.1
BC Soil+8% KSS	16.4
BC Soil+12% KSS	15.7
BC Soil+16% KSS	14.2
BC Soil+20% KSS	14.8

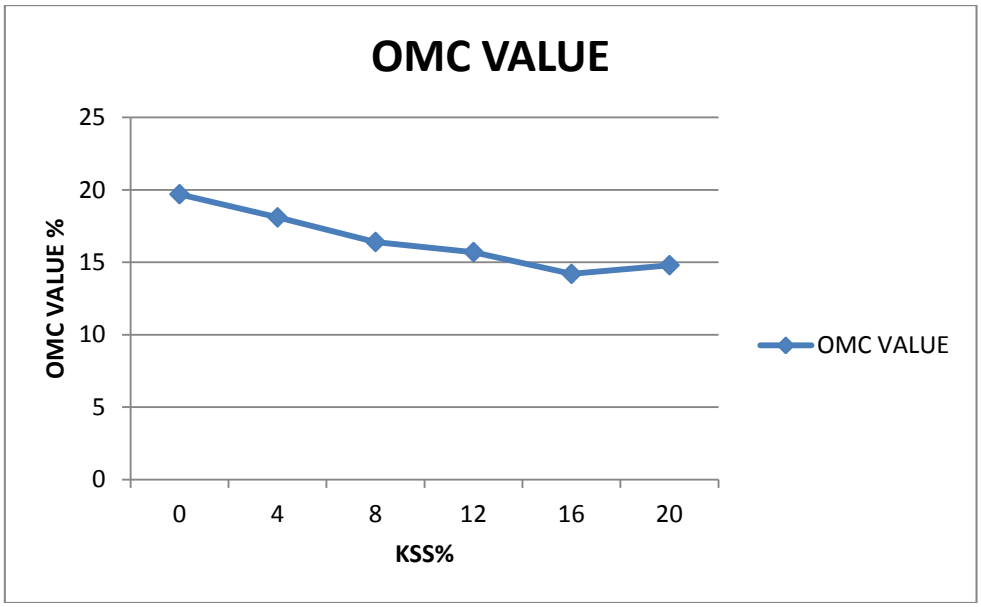


Figure.4 Variation of OMC with Kota stone slurry

Proportion	MDD VALUE
BC Soil	1.72
BC Soil+4% KSS	1.79
BC Soil+8% KSS	1.85
BC Soil+12% KSS	1.93
BC Soil+16% KSS	1.99
BC Soil+20% KSS	1.92

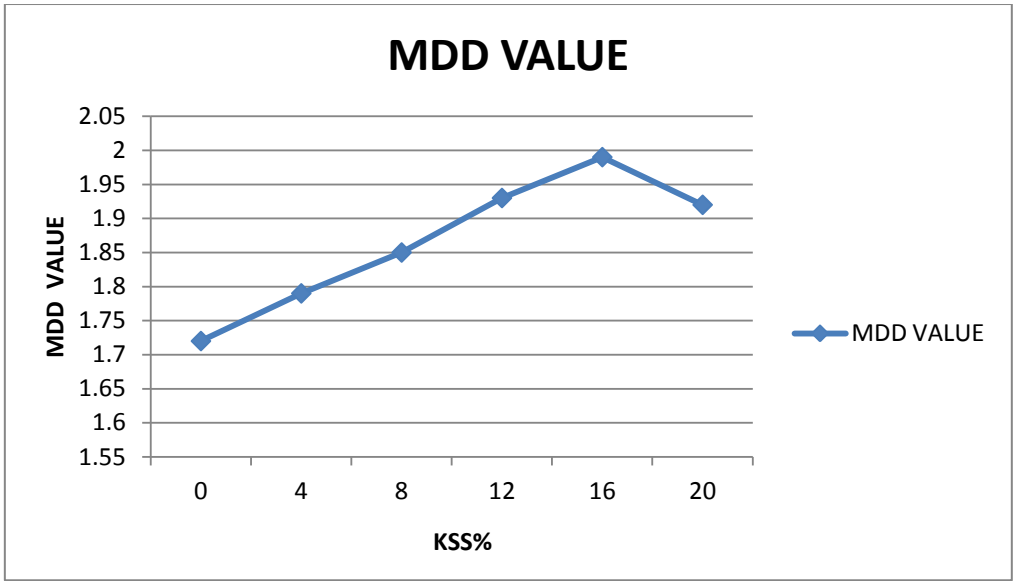


Figure.5 Variation of MDD with Kota stone slurry

Proportion	CBR Value
BC Soil	1.71
BC Soil+4%kss	2.16
BC Soil+8%kss	3.87
BC Soil+12%kss	4.67
BC Soil+16%kss	5.31
BC Soil+20%kss	4.21

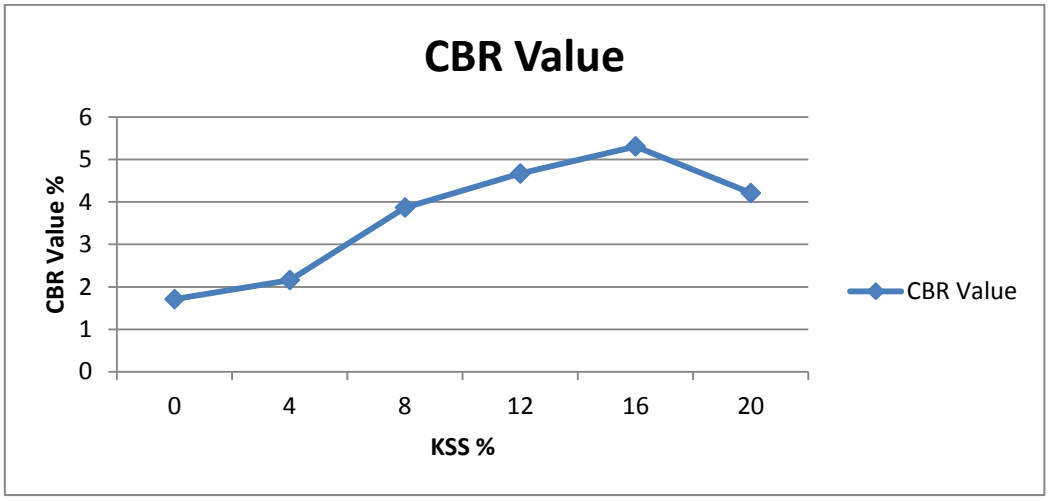


Figure.6 Variation of Soaked CBR with Kota stone slurry

Proportion	UCS VALUE
BC Soil	1.76
BC Soil+4% KSS	1.81
BC Soil+8% KSS	1.87
BC Soil+12% KSS	1.95
BC Soil+16% KSS	2.01
BC Soil+20% KSS	1.97

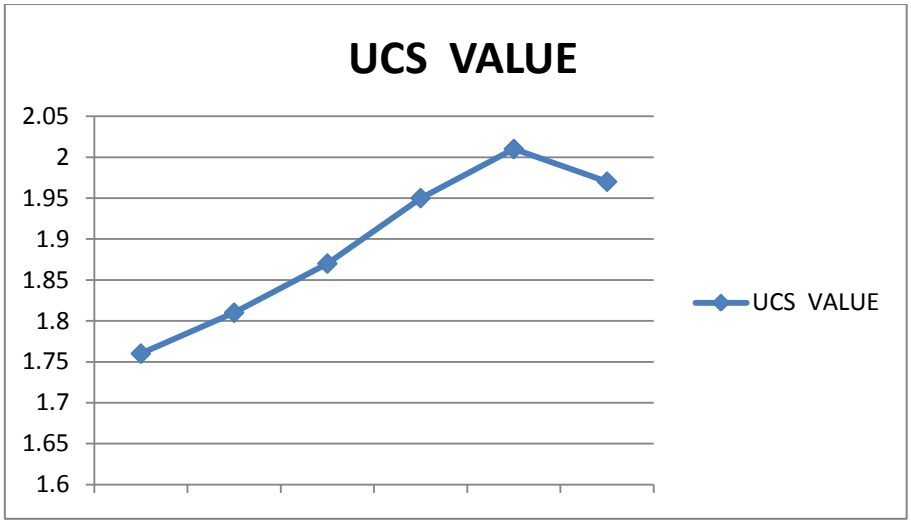


Figure.7 Variation of UCS with Kota stone slurry

VI. CONCLUSIONS

Following conclusions are drawn from the study

- It was observed from the laboratory test results that The liquid limit values of the samples are decreasing with the inclusion of kota stone slurry into the BC soils. It has been found that the liquid limit decreased from 63.74% to 38.5% on adding of 0% to 20% kota stone slurry into it. the liquid limit of the BC soil has been decreased by 39.59% on the addition of 20% Kota stone slurry when compared with the untreated BC soil.
- There is significant reduction in The plastic limit values from 26.74% to 17.02% .The plastic limit was decreased by 57.10% on adding 20% Kota stone slurry. Further increase of Kota stone slurry the value of MDD is decreased.
- The OMC value goes on decreasing from 19.7 to 14.8 irrespective of the percentage of addition of Kota stone slurry stabilized expansive soil.OMC was decreased by 30.96% on adding 16% Kota stone slurry.
- The MDD value increased from 1.72g/cc to 1.99g/cc and MDD increased by 13.56% on adding 16% Kota stone slurry when compared with the untreated BC soil. Further increase of Kota stone slurry the value of MDD is decreased.
- The Soaked CBR value increasing from 1.71% to 5.31% of the expansive soil increased up to 16% addition of Kota stone slurry. Further addition of Kota stone slurry decreased the soaked CBR of the expansive soil.CBR value increased by 67.79% on adding 16% Kota stone slurry when compared with the untreated BC soil.
- The UCS value of increasing from 1.76% to 2.01% of the expensive soil increased up to 16% addition of kota stone slurry. Further addition of kota stone slurry decreased the UCS value of expensive soil. UCS value increased by 12.43% on adding 16% Kota stone slurry when compared with the untreated BC soil.

Thus it was observed that the addition of the optimum mix of 84% soil and 16% of waste kota stone slurry improved the OMC,MDD and CBR properties of the soil. Hence, the addition of 50 percentage of soil and 50 percentage of Kota stone slurry improved the properties of liquid limit, and plastic limit of the BC soil.

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