

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 5, May 2018

Soil Stabilization Using Kota Stone Slurry In Pavement

Arun Pratap Singh Rathore¹, Karan Parbhakar²

P.G. Student, Department of Civil Engineering, Career Point University, Kota, Rajasthan, India ¹

Assistant Professor, Department of Civil Engineering, Career Point University, Kota, Rajasthan, India²

ABSTRACT:The problem of disposal of the industrial waste resulted into the investigation of potential of industrial waste in stabilizing the black cotton soils. The treatment of black cotton soils by using the stone slurry waste is very simple, pollution controlling and also solves disposal problem. The stone slurry waste taken from the stone cutting plant, stone slurry rich in calcium oxide. The study describes the effectiveness of stone slurry waste to stabilize the black cotton soils. The stone slurry waste was mixed with black cotton soils in different proportion and investigates the effect of stone slurry waste on strength, compaction and CBR properties of black cotton soils. The basic properties: direct shear, compaction and CBR were determined. The results shows that the addition of stone slurry waste has significant effect on the black cotton soils, which shows the effectiveness of this industrial waste in stabilizing the black cotton soils.

KEYWORDS:Stabilization, Kota Stone Slurry, Black Cotton Soil, Strength, CBR.

I. INTRODUCTION

The disposal of waste material is a big problem in developing country. Due to lack of land required for disposal technique. The sub situation of these waste material in the form of stabilization is a modern approach by which waste material can be advantageously used. The idea behind the technique of soil stabilization used in its study is that finer particles of soil are replaced with coarser particles of stabilization material so that a composite having interlocking between the partials from resulting in a material with better geotechnical properties. In India the expensive soil is available in about 20 – 25 % land area, which includes major portion of Madhya Pradesh and Andhra Pradesh of India. The alternate swell and shrink in the expensive in soil, due to wet and dry session, causes the deferential settlement in structure founded of them. This results the structural damage of the structures in the form of micro cracks on the surface. The kota stone slurry waste were mixed with the black cotton soil in different proportion and investigate the effect of stone slurry waste and cement on strength, compaction and CBR properties of the black cotton soil. The basic properties: direct shear, compaction and CBR were determined. The result shows that the addition of stone slurry waste has significant effect on the clayey soil, which shows the effectiveness of this industrial waste in stabilizing the black cotton soil.

II. LITERATURE REVIEW

Mousa f. atom & magdi el-emam,(2011), using cutting stone slurry waste as a stabilizing material with cohesive soil. Result indicate that mixing the cohesive soil with cutting stone slurry waste increase dry density and decreased optimum water content also increase direct shear and unconfined strength significantly due to addition of stone slurry to cohesive soil.

AL zboon&mahasneh,(2009), the use of stone sludge as water source in concrete production has insignificant effect on compression strength, while it has sharp effect on slump values.

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 5, May 2018

Misra et al,(2008), the author using stone slurry powder in soil stabilization, production of bricks, tiles, mortars and self compacting concrete.

Pappu et al, (2007), to effectively utilize these waste as a raw material, filler, binder and additive in developing alternate building material, used in road construction, concrete, asphalt, aggregate cement.

Binici et al, (2007), compressive strength and sulphate resistance of concrete increased with increase percentage of slurry dusts replacement with fine sand aggregates.

Katz and kovler,(2004), production of controlled low strength material by using dignificant amount of stone powder (20-25%), with some cementing or pozzolanic potentials as a fly ash and cement kiln dust.

III. EXPERIMENTAL INVESTIGATION

Experiments were done to determine geotechnical characteristics of Kota stone slurry as a reinforcing material. Physical and chemical parameters of the Kota stone slurry were given. The engineering property of unreinforced Kota stone slurry was measured.

3.1 MATERIAL USED

To study the behaviour of black cotton soil, Kota stone slurry are mixed in different proportion. Before the mixing of Kota stone slurry the physical and chemical parameters are studied to understand the behaviour of material. 15 % kota stone slurry in black cotton soil.

1. Kota Stone Slurry:- .About 50 Kg Slurry sample collected from RICCO Industrial Area, near Automobile market.
2. Black Cotton Soil:- About 200 kg Soil sample taken from the Nayakhera, Bundi road kota

3.2 ENGINEERING PROPERTIES OF BLACK COTTON SOIL, KOTA STONE SLURRY, MIX SPECIMEN

Some of the following Engineering properties are found by laboratory test which shone in table 3.1

Table 3.1 Engineering Properties of black cotton soil , Kota stone slurry

Parameters	Black Cotton Soil	Kota Stone Slurry
Specific Gravity	2.44	2.35
Liquid Limit (%)	41.41	27.36
Plastic Limit (%)	18.46	10.53
MDD (kg/cm ³)	1.755	1.635
OMC (%)	17.4	17.1
Colour	Red – Brown	Grey Dirty White
IS Classification	CI	CL

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 5, May 2018

The Kota stone slurry is mixed at 15% by weight of black cotton soil. The liquid limit and plastic limit for this mix specimen is 27.36% and 10.53% respectively determined, which is less than to black cotton soil values.

3.3 Standard Proctor Test

The object of testing is to find out the maximum dry density and optimum moisture content of mix specimen. The mix specimen is prepared by 15% Kota stone slurry in black cotton soil. The test results of mix specimen are showing in Table 3.2.

Table 3.2 – Standard Proctor test for black cotton soil and 15% slurry

Particulars	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Cont. No	41	10	11	7	15
Wt. of Cont.	27.3	28.3	27.1	27.5	28.3
Wt. of Cont. + Wet Soil	54.1	59.5	66.3	72.5	88.6
Wt. of Cont. + Dry Soil	51.4	55.6	60.4	65	77.5
Wt. of Water	2.7	3.9	5.9	7.5	11.1
Wt. of Dry Soil	24.1	27.3	33.3	37.5	49.2
Water Content	11.203	14.286	17.718	20	22.561
Dry Density	1.676	1.752	1.734	1.676	1.585

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

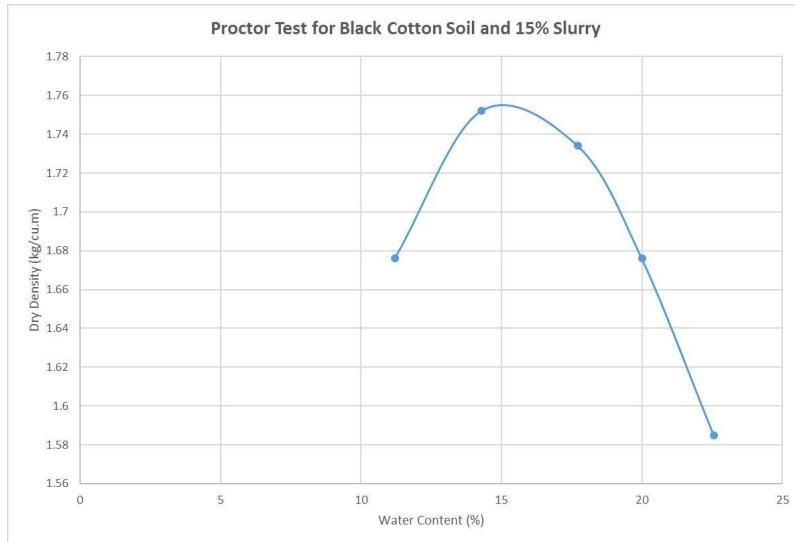


Fig. 3.1 – Standard Proctor Test for Black Cotton Soil and 15% Slurry

From fig. 3.1, it shows that the blue curve is having MDD and OMC, 1.676 kg/cm³ and 23.1% respectively for 15% Kota stone slurry with black cotton soil mix specimen.

3.4 Unconfined Compressive Strength

The object of testing is to determine the shear strength parameter of clay and 15% Kota stone slurry by loading axially cylindrical specimen the observation and calculation of UCS test is shown in Table 3.3.

Table 3.3 – UCS Test for 15% kota stone slurry wit black cotton soil

Dial Gauge Reading		Proving Ring Reading		Strain	Corrected Area	Stress
0	0	0	0	0	11.341	0.000
50	0.05	1.3	1.664	0.006579	11.416	1.430
100	0.1	1.4	1.792	0.013158	11.492	1.530
150	0.15	7	8.96	0.019737	11.569	7.597
200	0.2	11	14.08	0.026316	11.648	11.859
250	0.25	14.4	18.432	0.032895	11.727	15.419
300	0.3	16	20.48	0.039474	11.807	17.016
350	0.35	17.4	22.272	0.046053	11.889	18.378
400	0.4	19	24.32	0.052632	11.971	19.929

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 5, May 2018

450	0.45	19.4	24.832	0.059211	12.055	20.208
500	0.5	20.2	25.856	0.065789	12.140	20.894
550	0.55	20.4	26.112	0.072368	12.226	20.952
600	0.6	21	26.88	0.078947	12.313	21.415
650	0.65	21.2	27.136	0.085526	12.402	21.465
700	0.7	21.3	27.264	0.092105	12.492	21.411
750	0.75	21	26.88	0.098684	12.583	20.956

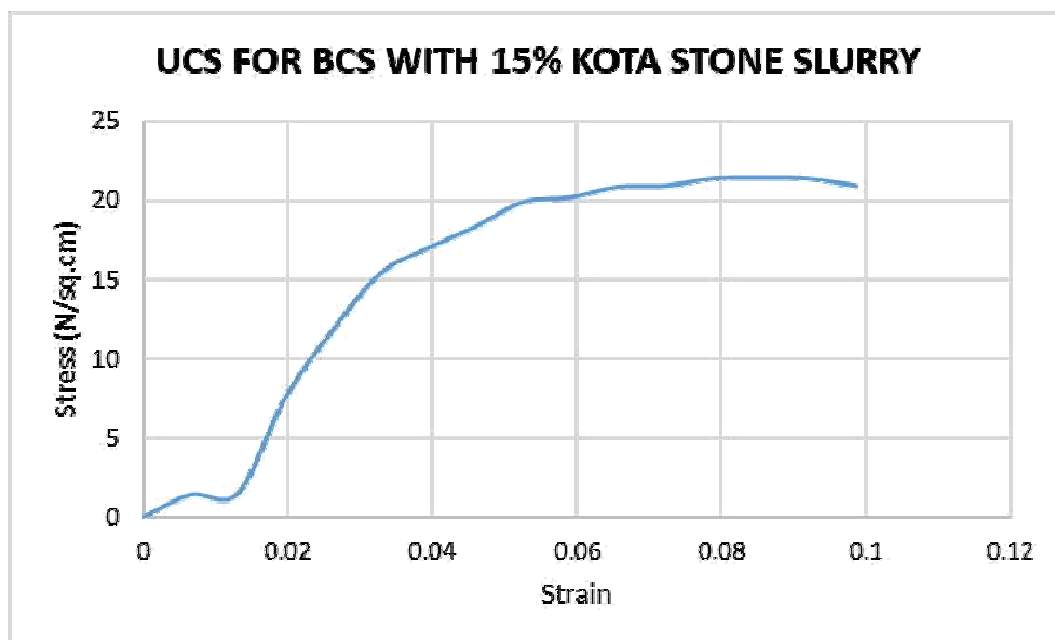


Fig. 3.2 – UCS for BCS with 15% Kota Stone Slurry

From Table 3.3, it is shown that when 15% Kota stone slurry is added in black cotton soil, the shear strength is increased 34.43% to shear strength of the black cotton soil.

IV. DISCUSSIONS ON TEST RESULTS

The black cotton soil changes its behaviour due to Kota stone slurry. The Kota stone slurry is a low plasticity material and black cotton soil is an inorganic clay of medium plasticity. The plasticity of black cotton soil decreases with increasing the amount of Kota stone slurry. The maximum dry density and optimum moisture content is 1.676 kg/cm³ and 10.53% determined for 15% Kota stone slurry mix specimen. The shear strength is also varied with 15% KSS and black cotton soil mix specimen. The maximum shear strength is observed for black cotton soil with 15% Kota stone

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 7, Issue 5, May 2018

slurry, which is 13.539 N/cm^2 . When 15% KSS with black cotton soil mix specimen, the value is 23.10% increased form black cotton soil with 15% Kota stone slurry mix specimen.

V. CONCLUSIONS

The black cotton soil is inorganic clay of medium plasticity soil. With 15% percentage of Kota stone slurry, the black cotton soil changes its behaviour from inorganic clay of medium plasticity to inorganic clay of low plasticity (CI to CL) and the plasticity index of black cotton soil decreases 10.81%. The maximum dry density of black cotton soil is 1.676 kg/cm^3 determined but when fibre is mixed in 15% Kota stone slurry with black cotton soil mix specimen the maximum dry density is less than to 1.725 kg/cm^3 . The black cotton soil is having 07.983 N/cm^2 shearing strength, but this strength is improved by adding 15% Kota stone slurry in black cotton soil. The mix specimen 15% Kota stone slurry with black cotton soil is having 10.732 N/cm^2 shear strength which is 34.43% more than to shear strength of the black cotton soil. Hence, it is a cleared that the 15% Kota stone slurry used to improve the shear strength parameter of black cotton soil.

REFERENCES

- [1] "Evolution of Strength and Stiffness Response of Coir Fibre Reinforced Soil", G. L. Sivakumar Babu, A. K. Vasudevan, ISSN – 1755 – 0750, E-ISSN – 1755 – 0769, 2007.
- [2] "Stabilization of Black Cotton Soil Using Coir Pith", International Journal of Technology Enhancements and Emerging Engineering Research, Vol – 3, ISSUE – 08, ISSN 2347 – 4289.
- [3] "Use of Bottom Ash in the Replacement of Fine Aggregate for Making Concrete", Dilip Kumar, Asish Gupta – E – ISSN – 2277 – 4106, P – ISSN – 2347 – 5161.
- [4] "A Study on Engineering Behaviour of Black Cotton Soil and its Stabilization by Use of Lime", Brajesh Mishra, (IJSR) ISSN (Online): 2319-7064 (2013).
- [5] "Experimental Study on Stabilization of Black Cotton Soil with Stone Dust and Fibers", K. Suresh and V. Padmavathi, Apsara Sultana, IGC 2009.
- [6] "Improvement in CBR Value of Soil Reinforced with Jute Fiber", H. P. Singh, M. Bagra, ISSN: 2319-8753, August 2013, IJIRSET.
- [7] Mousa F, atom & Madi El- Emam, (2011), "Soil Stabilization Using Stone Slurry Waste Recovered from Cutting Stone Process in Rock Quarries", Journal of Soil Waste Technology and Management, V. 37, No.2.
- [8] Mirsa A, Gupts R and Gupta R.C. (2008), "Utilization of marble slurry in construction material". Stonedgr India- July.
- [9] "Soil Mechanics and Foundations Engineering", K. R. Arora.
- [10] "Development of Flooring Tiles form Kota Stone Waste and Study of Their Physical Properties", Rajni Lakhani and Priyanka Tomar, CSIR – Central Building Research Institute, Roorkee., 1 – June – 2014.