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Effect of Rice Hush Ash on Lime Stabilized Black Cotton Soil

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Abstract

Due to the massive growth of Infrastructure projects, conventional construction materials are diminishing day by day or found short in supply at various locations in the country. On the other hand, large quantity of waste materials produced from the different industries like flyash, ggbs, rice husk ash, paper mill slag, etc. creates a potential negative impact on the environment causing air pollution, water pollution affecting the local ecosystem, and hence safe disposal of these waste materials is required. Utilizing some of these materials as alternative materials for the construction in no doubt is a best solution. Hence an attempt is made to justify the use of rice husk ash by mixing it with lime for stabilization of black cotton soil. This paper highlights the effectiveness of using rice husk ash (RHA) as a pozzuolanae to enhance the lime treatment of soil. Laboratory test results presents the influence of different mix proportions of lime and RHA on compaction, strength properties of soil. It is observed that, addition of RHA enhances not only the strength development but also the durability of lime stabilized soil.

1. Introduction

Black cotton soils are problematic in nature due to its swelling – shrinkage property posing damaging effects on the structure constructed. We need to improve the overall performance of the soils by some means. In the present paper an attempt is made to improve the engineering properties of soil by using rice husk ash in combination with lime. Vidarbha is a major rice producing region of Maharashtra and hence ash of the same is opted for the proposed work and lime is also easily available in the market.

Soil: Soil for the proposed experiments was collected from Dighori area of Nagpur and XRF test was carried out to know the composition. Following Table 1 present the chemical composition of the soil sample collected;

Table 1

Constituent	Concentration (%)	Constituent	Concentration (%)
SiO₂	46.48	P ₂ O ₅	0.09
Al₂O₃	15.17	NiO	0.01
MgO	2.42	CuO	0.01
Fe ₂ O ₃	11.57	ZnO	0.01
SO₃	0.02	SrO	0.01
TiO ₂	1.56	ZrO ₂	0.04
K ₂ O	0.96	BaO	0.03

Rice Husk Ash: Rice Husk for the proposed work was collected from the rice mill near Bhandara and was uncontrolled burning was done on open area near mill, color of ash after burning was whitish grey. Composition of the RHA was determined by conducting XRF test at Indian Bureau of Mines, Nagpur and same is presented here in Table 2;

Table 2

Constituent	Concentration (%)	Constituent	Concentration (%)
SiO₂	91.48	P ₂ O ₅	0.48
Al ₂ O ₃	1.87	Na ₂ O	0.58
MgO	0.39	MnO	0.11
Fe ₂ O ₃	0.98	SO ₃	0.22
CaO	1.29	SrO	0.006
TiO ₂	0.11	ZrO ₂	0.022
K ₂ O	2.33	BaO	0.012

Testing and Result: Soaked California Bearing Ratio (CBR) test was carried out on the soil samples mixed with lime and lime-RHA after 7,14,28 days curing and results of the same are tabulated below in Table.3 and Table .4 for lime and lime-RHA respectively;

Table 3

Test Sample	CBR (Soaked) (%)			
Curing Period (Days)	0	7	14	28
Virgin Soil	0.94			
Soil+2.5% lime	1.17	1.58	1.84	2.53
Soil+5% lime	1.49	2.12	3.25	5.48
Soil+7.5% lime	1.67	2.49	3.43	5.03

Table 4

Test Sample	CBR (Soaked) (%)			
Curing Period (Days)	0	7	14	28
Soil+2.5% lime+5% RHA	1.35	2.12	3.17	4.23
Soil+2.5% lime+10% RHA	1.77	3.34	5.01	6.68
Soil+2.5% lime+15% RHA	1.84	3.37	5.05	6.73
Soil+2.5% lime+20% RHA	1.83	3.25	4.87	6.49
Soil+5% lime+5% RHA	3.85	7.54	11.3	15.1
Soil+5% lime+10% RHA	4.27	10.1	15.2	20.2
Soil+5%lime+15%RHA	4.34	11.7	17.6	23.4
Soil+5% lime+20% RHA	4.33	11.4	17.1	22.8
Soil+7.5% lime+5% RHA	3.78	7.44	11.1	14.8
Soil+7.5% lime+10% RHA	4.18	9.35	14	18.7
Soil+7.5% lime+15% RHA	4.29	10.8	16.3	21.6
Soil+7.5% lime+20% RHA	4.28	10.5	15.9	21.2

2. Conclusion

Lime content increased from 0% to 7.5% at an increment of 2.5%, it is observed that optimum dose of lime was 5% at which CBR increased from 0.94 to 5.48% after 28 days curing. RHA was added to lime-soil mix at 5%, 10%, 15% and 20% by weight and it is found that Soil + 5% lime + 15% RHA is the recommended combination at which CBR after 28 days curing was 23.4%. Hence it can be said that, substantial increase in CBR value was observed due to incorporation RHA to soil-lime mixture and hence RHA a good stabilizer.

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