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Enhancement of Index and Engineering Properties of Red Soil by using Sugarcane Ash and Rice Husk Ash

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Abstract – *Red soil sample was collected from Bidadi, Karnataka .The collected sample was disturbed soil sample. Red soil sample was collected from Bidadi, Karnataka. It was collected at a depth of 1m below the ground surface and the obtained sample was disturbed soil sample. And the following laboratory tests were conducted-grain size analysis, compaction and shear strength characteristics test. Sugarcane ash poured to the soil sample at the following percentages (1%,2%,3%) and rice husk ash was added to the soil sample at the following percentages (1%,2%,3%) and it was found that geotechnical properties improved (shear strength characteristics increased, LL decreased). The optimum dosage was found to be 2% of sugarcane ash and 2% of rice husk ash.*

Key Words: Red soil, Sugarcane ash, Rice husk ash, Geotechnical properties.

1. INTRODUCTION

Red soil is formed by weathering of metamorphic rocks. It has better drainage capacity compare to other soils and also have higher iron, lime content, aluminum and high acidic nature. The texture of red soil varies from sandy to clayey, and majority being loams.

Red soil is the third largest soil group of India. It covers an area of about 10.6% of total area of country i.e. 3.5 lakhs square kilometre and found in the states of Tamil Nadu, Parts of Karnataka, Maharashtra, Andhra Pradesh, Madhya Pradesh, Orissa, Chhattisgarh, Jharkhand, South Bihar, West Bengal and Uttar Pradesh.

1.1 LITERATURE REVIEW

Karthik G et.al (2020): Conducted a study on Modification of Geotechnical Properties of Red soil by the Application of Wood Ash and GGBS. They showed that MDD increases and OMC decreases with Wood Ash content at 20% and GGBS content at 10%.

Dhamotharan R et.al (2018): They have done a experiment on Comparative Study on Black Cotton Soil Bricks using Fly Ash and Crusher Waste. They concluded that there will be increase in Compressive Strength and decrease in Water Absorption rate after adding Fly Ash and Crusher Waste in various percentages.

M. Sai Nandan et.al (2020): They had conducted a investigation on Stabilisation of Red Soil By using Coconut Coir Fibre and Rice Husk Ash. They used Coconut Coir Fibre and Rice Husk Ash as an admixture and they got the Optimum values by adding 15% of Rice Husk Ash and Coconut Coir Fibre.

1.2 OBJECTIVES

The aim of this study is to improve the geotechnical properties red soil by the addition of sugarcane ash and rice husk ash.

2. MATERIALS AND METHODOLOGY

2.1 Materials

Red Soil: The red soil sample was collected from Bidadi, Karnataka. The soil sample collected from site was disturbed sample and it collected at a depth of 1m below the ground surface.

Fig-1: Red Soil

Sugar Cane Ash: Sugar cane ash is the burnt waste material produced from juice centers near Bidadi, Karnataka.

Fig-2: Sugarcane Ash

Rice Husk Ash: Rice husk ash is the burnt waste material which is obtained from rice mills near Bidadi, Karnataka.

Fig-3: Rice Husk Ash

2.2 METHODOLOGY

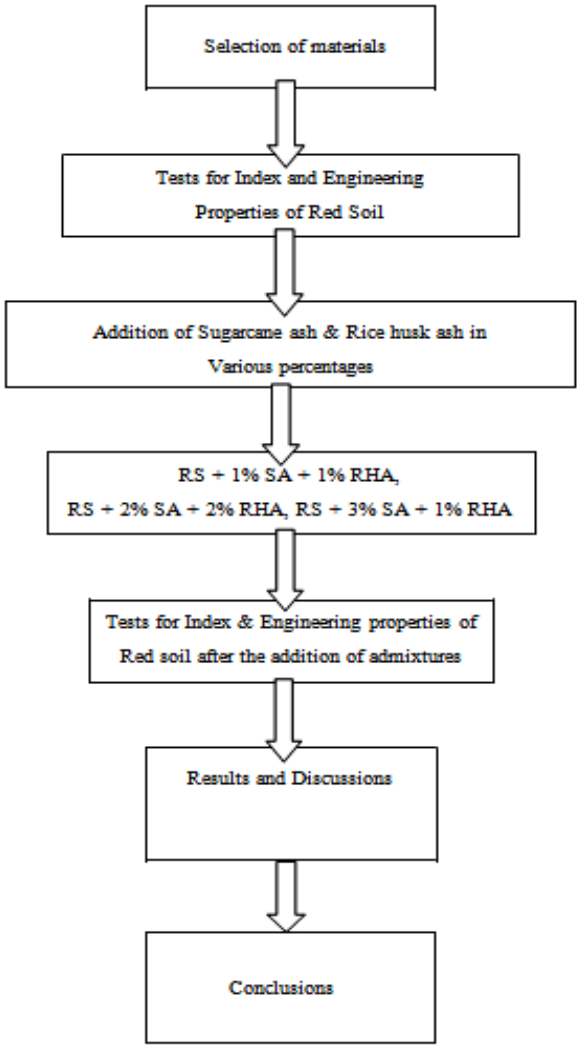

Fig-4: Methodology

3. Results and Discussions

3.1 Sieve Analysis

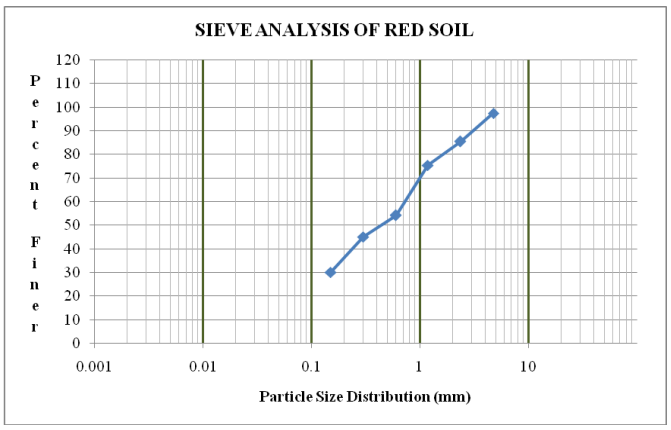

Chart – 1: Sieve Analysis of Red soil

3.2 Liquid Limit Test

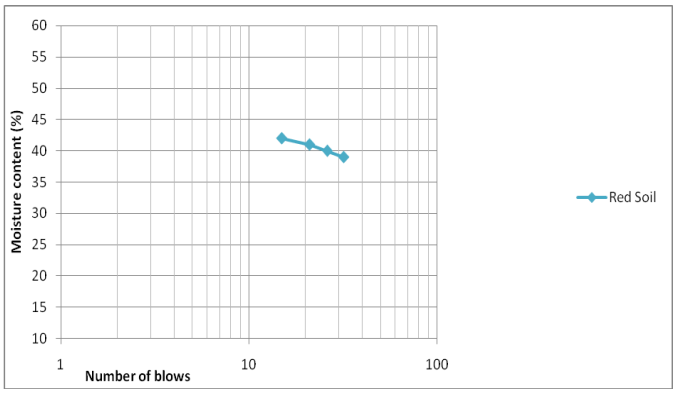

Chart – 2: Flow curve of Red soil

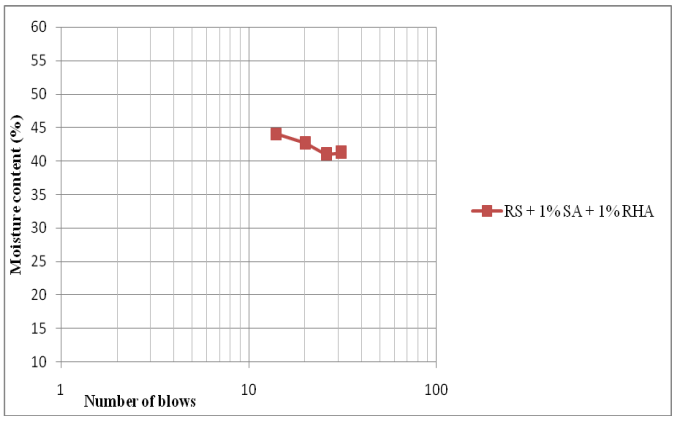

Chart – 3: Flow curve of RS+1%SA+1%RHA

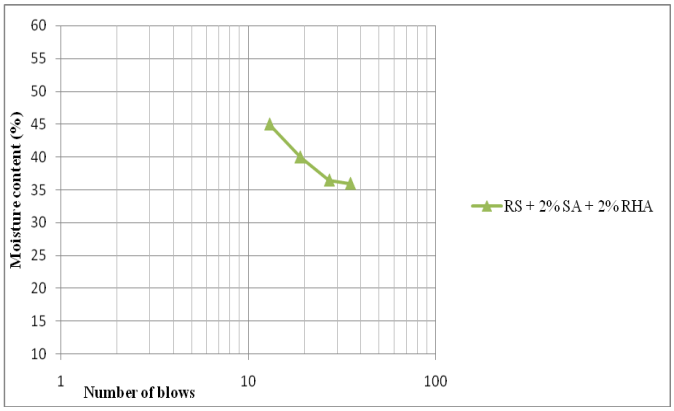

Chart – 4: Flow curve of RS+2%SA+2%RHA

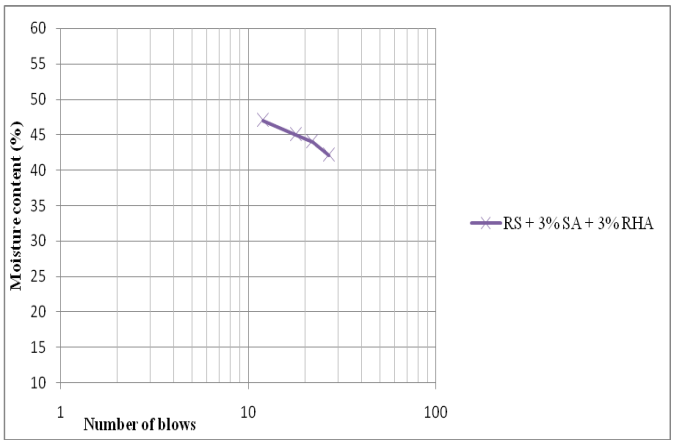

Chart – 5: Flow curve of RS+3%SA+3%RHA

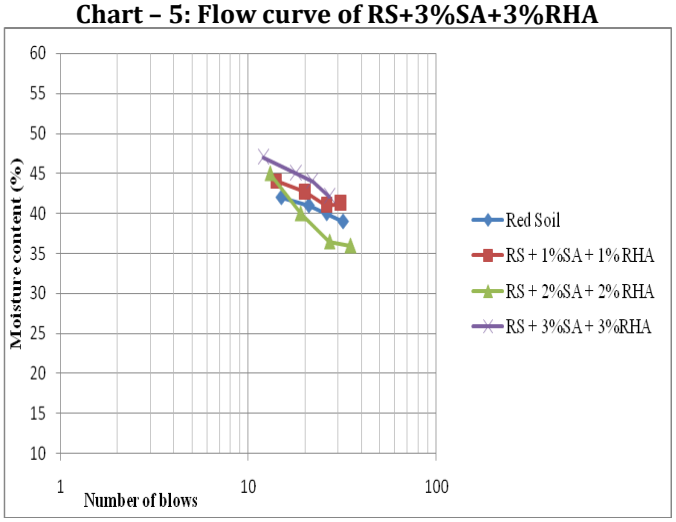

Chart – 6: Combined graph of Flow curve

3.3 Compaction Test

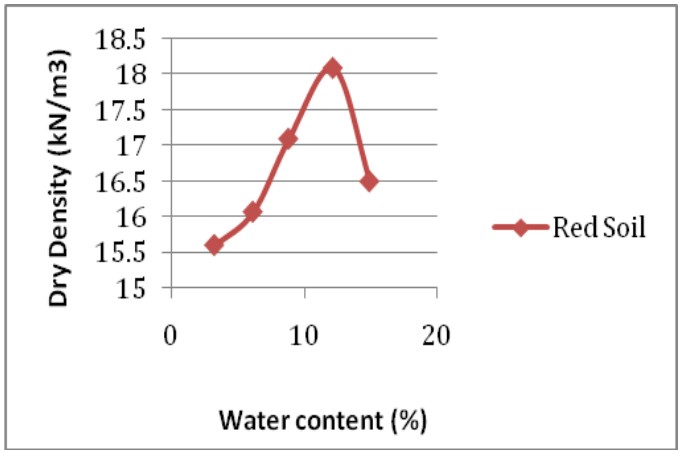

Chart – 7: Compaction curve of Red soil

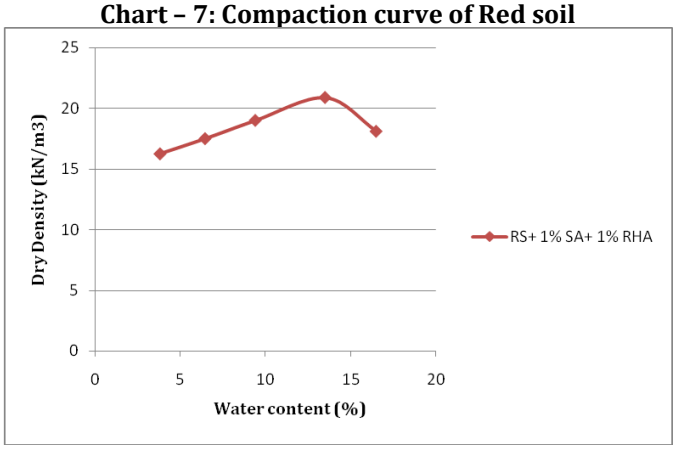

Chart – 8: Compaction curve of RS+1%SA+1%RHA

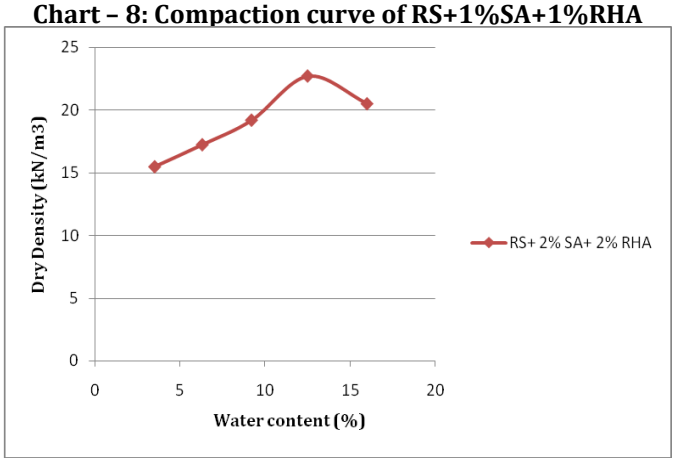

Chart – 9: Compaction curve of RS+2%SA+2%RHA

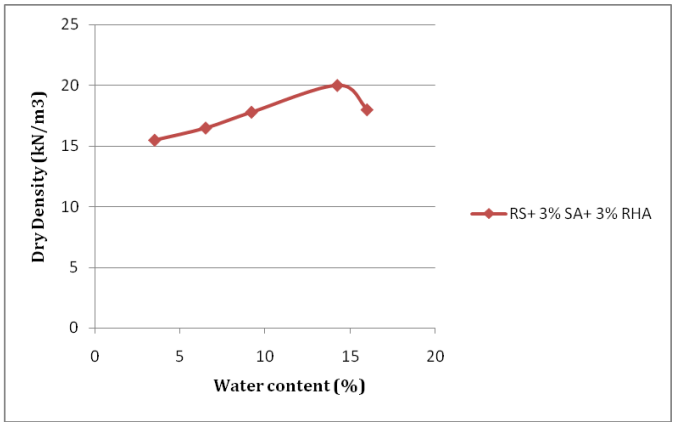

Chart – 10: Compaction curve of RS+3%SA+3%RHA

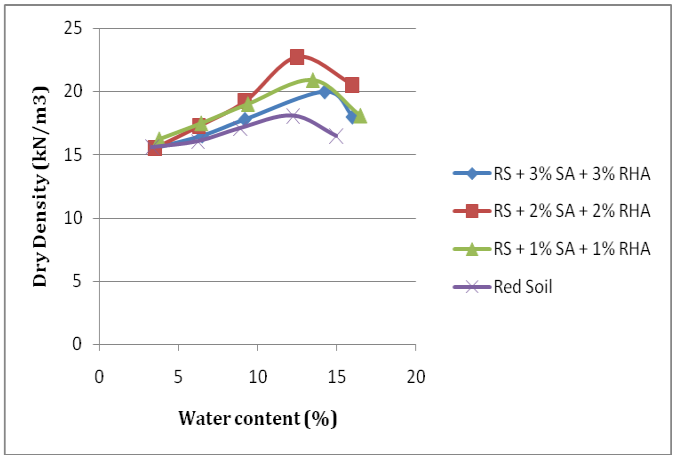

Chart – 11: Combined graph of Compaction curve

3.4 UCS TEST

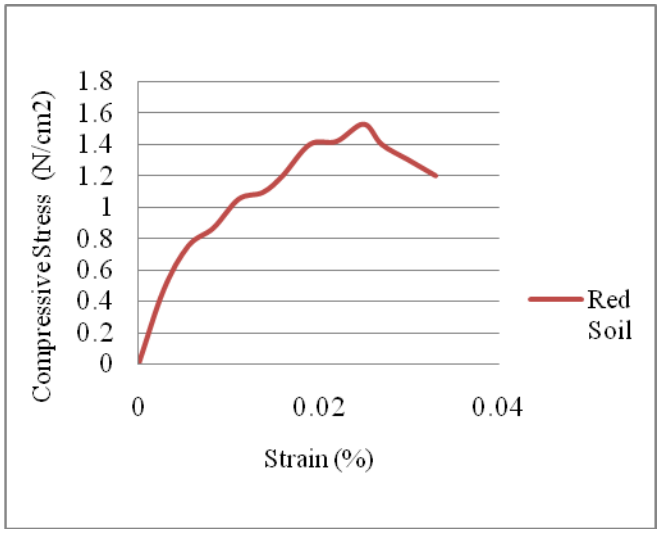

Chart – 12: Compressive Stress-Strain graph of Red soil

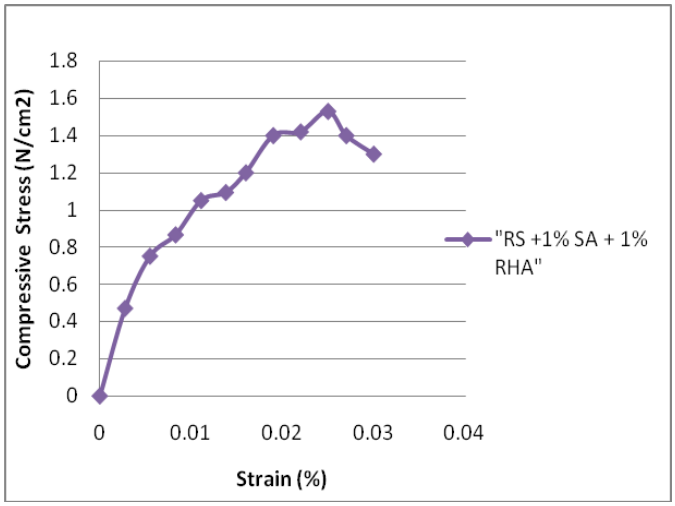

Chart – 13: Compressive Stress-Strain graph of RS+1%SA+1%RHA

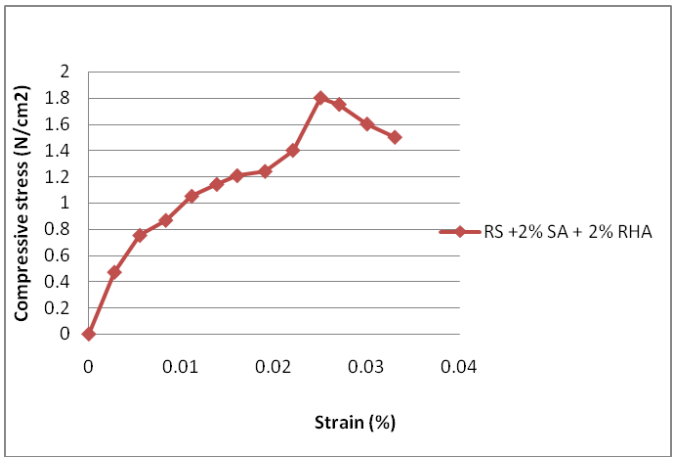

Chart – 14: Compressive Stress-Strain graph of RS+2%SA+2%RHA

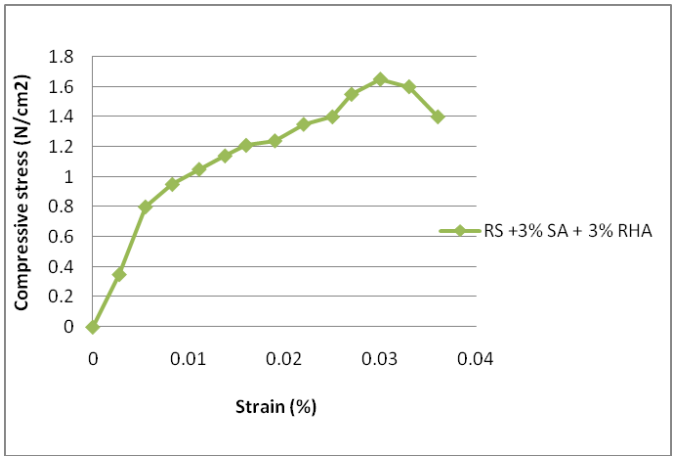

Chart – 15: Compressive Stress-Strain graph of RS+3%SA+3%RHA

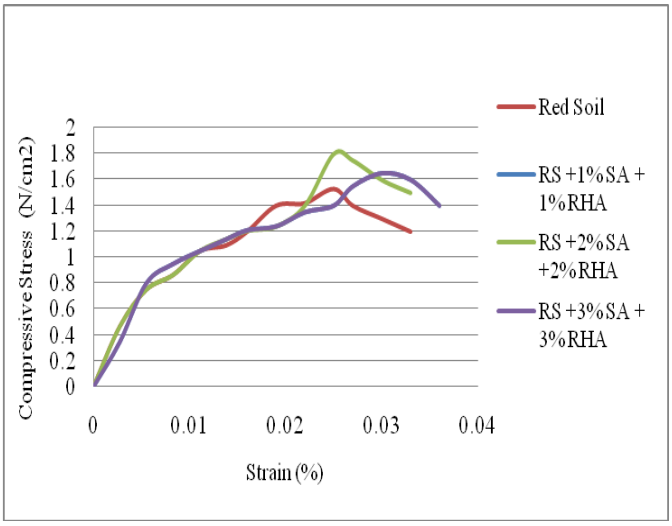

Chart – 16: Combined Compressive Stress-Strain graph

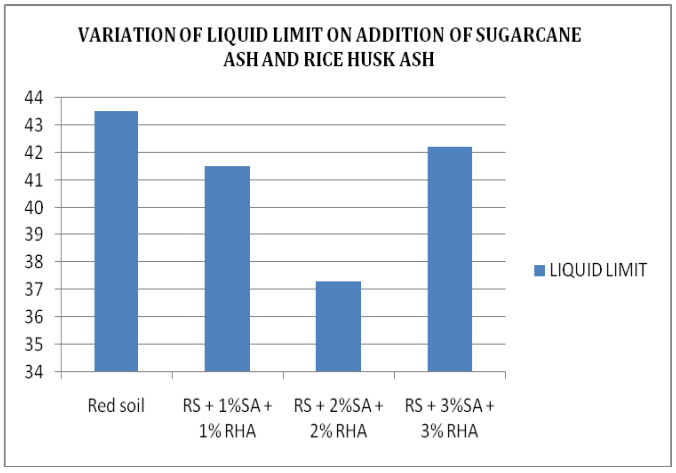

Chart – 17: Variation of LL on addition of Sugarcane ash and Rice Husk ash

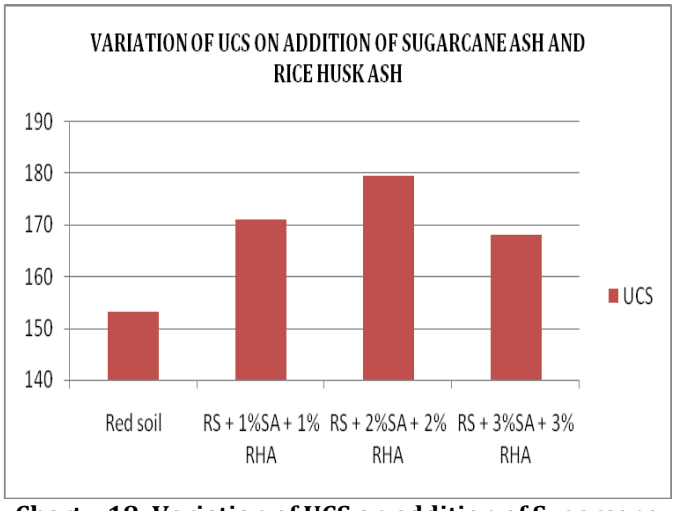

Chart – 18: Variation of UCS on addition of Sugarcane ash and Rice Husk ash

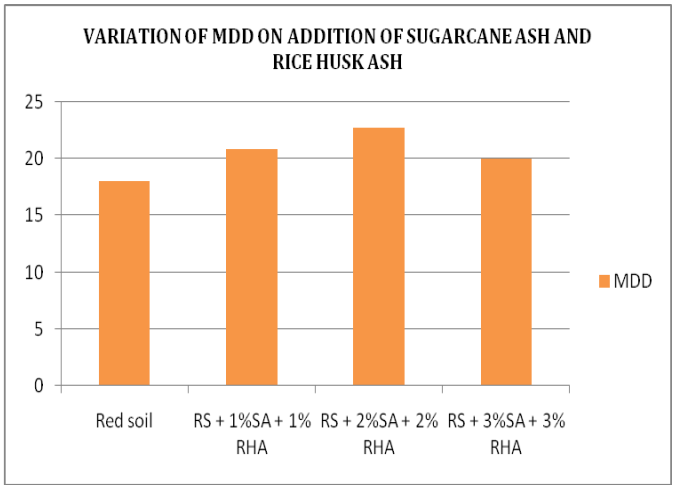

Chart – 19: Variation of MDD on addition of Sugarcane ash and Rice Husk ash

Table -1: Overall Test Results

Description	Red Soil	RS+1% of SA + 1% RHA	RS+2% of SA+ 2% RHA	RS+3% of SA+ 3% RHA
Specific Gravity	2.67	-	-	-
Liquid Limit (%)	43.56	41.00	37.00	42.00
Plastic Limit (%)	21.30	20.60	18.50	20.40
Plasticity Index (%)	22.26	20.40	18.50	21.60
OMC (%)	13.50	13.00	12.20	14.30
MDD (kN/m^3)	18.00	20.88	22.7	20.00
UCS (kN/m^2)	153.3	172.7	180.6	165.0
Cohesion, C (kN/m^2)	30	32.5	36.0	33.5
Angle of Internal friction (°)	18.00	16.00	15.10	18.20

4. CONCLUSIONS

Several experiments were performed after the detailed study and the following conclusions were made-

1. Addition of 2% of SA and 2% of RHA resulted in increased soil shear strength.
2. Upon the addition of 2% of SA and 2% of RHA to the red soil, LL values decreased from 43.56 to 37.00%.

3. Upon the addition of 2% of SA and 2% of RHA to the red soil, OMC values decreased from 13.50 to 12.20%. On further addition of admixtures, its values increased.
4. Upon the addition of 2% of SA and 2% of RHA to the red soil, MDD values increased from 18 to 20kN/m^3. On further addition of admixtures, its values decreased.
5. Upon the addition of 2% of SA and 2% of RHA to the red soil, UCS values increased from 153.3 to 180.6kN/m^2. On further addition of admixtures, its values decreased.
6. So the final conclusion is that the optimum dosage to be added to red soil to improve its geotechnical properties is 2% of SA and 2% of RHA.

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