

An Experimental Study on The Behavior of Rice Husk Ash, Polypropylene Fiber and Bamboo Leaf Ash Treated on Expansive Soil Subgrade

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Abstract- This experimental work is investigate the behavior of rice husk ash, polypropylene fiber and bamboo leaf ash on expansive soil (black cotton soil). In this expansive soil superstructure with heavy load like multi storied building, dam, bridges, retaining stricture, pavement etc are damaged by settlement of soil (expansive soil).they make uneven and uniform small and deep settlement .the settlement causes crack, uniform settlement, tipping settlement, differential settlement. In experimental study black cotton soil mix with different % of rice husk ash 4% 6% 8% and mix with polypropylene fiber 0.5% 0.75% 1% . For bamboo leaf ash also 4% 6% 8% mix with black cotton soil. Engineering properties of black cotton soil liquid limit, plastic limit, shrinkage limit, and differential free swell test are performed. The result show black cotton soil with various % of Rice husk ash liquid limit is decreases and plastic limit also decreases with increasing % of RHA. Shrinkage limit of black cotton soil is increasing with increasing % of RHA in black cotton soil. For polypropylene fiber Black cotton soil mix with % of 0.5% 0.75% 1% liquid limit of black cotton soil is decreases and plastic limit also decreasing. For shrinkage limit is increases when increasing % of PPF in black cotton soil. DFS value is decreasing with increasing % of RHA PPF and BLA in black cotton soil.

Keywords- RHA , PPF, BLA (Bamboo leaf ash) LL(liquid limit) PL(plastic limit) DFS (Differential free swell) shrinkage limit .

I. INTRODUCTION

India is agricultural and underdeveloped country. In India 70% of population are depending on agriculture for their livelihood. This agriculture is important sector for Indian economy. Agriculture contributes about 17% to the total GDP (gross domestic product) agriculture sector also provide employment to over 60% of the population. This huge amount of crops production create huge agriculture wastes like crop residues, weeds cover, leaf litter, saw dust, rice husk, bamboo leaf ash, forest waste and many more. If soil changes his

volume contact or sensitive with moisture generally we can say that it's expansive soil. This soil affected in constriction of any superstructure and substructure stability on expansive soil. Hence it becomes very essential for Geotechnical engineer to appropriately identify and characteristic such soil. Expansive soil characteristic swell by absorption of water during raining season and shrink in summer when water is evaporates out. In this expansive soil superstructure with heavy load Like multi storied building, dam, bridges, retaining stricture, pavement etc are damaged by settlement of soil (expansive soil).they make uneven and uniform small and deep settlement .the settlement causes crack, uniform settlement, tipping settlement, differential settlement. . Rice husk ash has many applications due to its various properties. A pozzolanic is a powder material, which when added to the cement in a concrete mix reacts with the soil. Polypropylene is synthetic fiber for this study it has been chosen due its low cost, hydrophobic and chemically inert nature .the polypropylene is semi rigid in nature. The polypropylene contain good chemical resistance good fatigue resistance and good heat resistance .physically the polypropylene in appearance tough transparent and having integral. The use of bamboo leaf ash as supplement can contribute to reduction in cost and environmental hazard associated with production as well as waste pollution caused by the littered bamboo leaves.

II. MATERIALS

- BCS (Black cotton soil)
- RHA (Rice husk ash)
- PPF (Polypropylene fiber)
- BLA (Bamboo leaf ash)

III. METHODOLOGY

The aim of experiments to identify the properties of black cotton soil enhance by using stabilization materials like Bamboo leaf ash, Polypropylene fiber and Rice husk ash. To determine the engineering properties of black cotton soil

liquid limit, plastic limit, DFS (Differential free swell test) shrinkage limit.

List of experiment perform-

- Liquid limit test (IS: 2720 PART 5) 1985
- Plastic limit test (IS: 2720 PART 5) 1985
- Shrinkage limit test
- DFS (Differential free swell) test (IS: 2720 PART-XL)-1977

IV. SAMPLE PREPARATION

For experimental study sample preparation BCS (Black cotton soil) mix with different % of RHA (Rice husk ash) PPF (polypropylene fiber) and BLA (Bamboo leaf Ash).

- The expansive soil (Black cotton soil) mixes with RHA (Rice husk ash) 4%RHA+BCS 6%RHA+BCS and 8%RHA + BCS.
- For PPF (polypropylene fiber) mix with Black cotton soil 0.5%PPF, 0.75%PPF and 1%PPF.
- For BLA (Bamboo leaf ash) mix with Black cotton soil 4% BLA, 6% BLA and 8% BLA.
- All experiments are performed according to IS code specification.

V. RESULT AND DISCUSSION

5.1 LIQUID LIMIT TEST

Liquid limit of BCS (Black cotton soil) is 68.3%. In 4% of RHA liquid limit of Black cotton soil 63.54 %. In 6% of RHA liquid limit of Black cotton soil 59.8% and 8% of RHA liquid limit of black cotton soil 50.2%. With increasing % of RHA in black cotton soil liquid limit of black cotton soil is decreasing. When PPF (0.5%, 0.75%, 1%) mix with black cotton soil liquid limit also decrease. In 0.5% of PPF liquid limit of Black cotton soil 66.2 %. In 0.75% of PPF liquid limit of Black cotton soil 64.7% and 1% of PPF liquid limit of black cotton soil 61.2%. When BLA (Bamboo leaf ash) (4%, 6%, 8%) mix with black cotton soil liquid limit also decrease. In 4% of BLA liquid limit of Black cotton soil 65.3 %. In 6% of BLA liquid limit of Black cotton soil 61.3% and 8% of PPF liquid limit of black cotton soil 52%.

Table 1 liquid limit of BCS + (RHA PPF BLA)

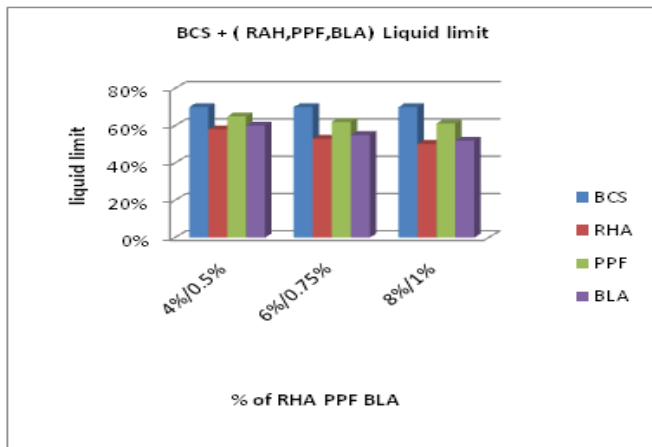
Sample	Liquid limit %
BCS	68.3%
BCS +(4% of RHA)	63.54%
BCS +(6% of RHA)	59.8%
BCS +(8% of RHA)	50.2%
BCS +(0.5% of PPF)	66.2%
BCS +(0.75% of PPF)	64.5%
BCS +(1% of PPF)	61.2%
BCS +(4% of BLA)	65.3%
BCS +(6% of BLA)	61.3%
BCS +(8% of BLA)	52%

5.2 PLASTIC LIMIT TEST

When RHA (4%, 6%, and 8%) mix with black cotton soil plastic limit is decrease with increasing % of RHA in black cotton soil plastic limit of black cotton soil is decreasing. In 4% of RHA Plastic limit of Black cotton soil 32.4%. In 6% of RHA plastic limit of Black cotton soil 28.4% and 8% of RHA plastic limit of black cotton soil 23.8%. When PPF (0.5%, 0.75%, 1%) mix with black cotton soil plastic limit also decrease. In 0.5% of PPF plastic limit of Black cotton soil 36%. In 0.75% of PPF plastic limit of Black cotton soil 34% and 1% of PPF plastic limit of black cotton soil 31.3%. When BLA (Bamboo leaf ash) (4%, 6%, 8%) mix with black cotton soil plastic limit also decrease. In 4% of BLA plastic limit of Black cotton soil 34.1%. In 6% of BLA plastic limit of Black cotton soil 30.83% and 8% of PPF plastic limit of black cotton soil 25.17%.

Table 2 Plastic limit of BCS + (RHA PPF BLA)

Sample	Plastic limit %
BCS	38.26%
BCS +(4% of RHA)	32.4%
BCS +(6% of RHA)	28.4%
BCS +(8% of RHA)	23.8%
BCS +(0.5% of PPF)	36%
BCS +(0.75% of PPF)	34%
BCS +(1% of PPF)	31.5%
BCS +(4% of BLA)	34.1%
BCS +(6% of BLA)	30.83%
BCS +(8% of BLA)	25.17%



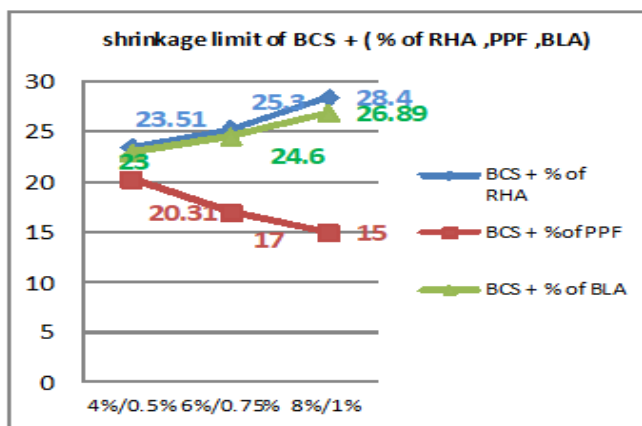
Graph 1 liquid limit of BCS + (RHA PPF BLA)

5.3 SHEINKAGE LIMIT TEST

When RHA mix with BCS shrinkage limit is increase Soil particle make bond between RHA particle because its pozolanic behavior and BLA (Bamboo leaf ash). Result show that RHA and BLA treated soil absorb more water to change it semi solid state to solid state. Loss of moisture will not result in any more volume reduction.

Table 3 Shrinkage limit of BCS + (RHA PPF BLA)

Sample	Shrinkage limit %
BCS	22%
BCS +(4% of RHA)	23.51%
BCS +(6% of RHA)	25.3%
BCS +(8% of RHA)	28.4%
BCS +(0.5% of PPF)	20.31%
BCS +(0.75% of PPF)	17%
BCS +(1% of PPF)	15%
BCS +(4% of BLA)	23%
BCS +(6% of BLA)	24.6%
BCS +(8% of BLA)	26.89%



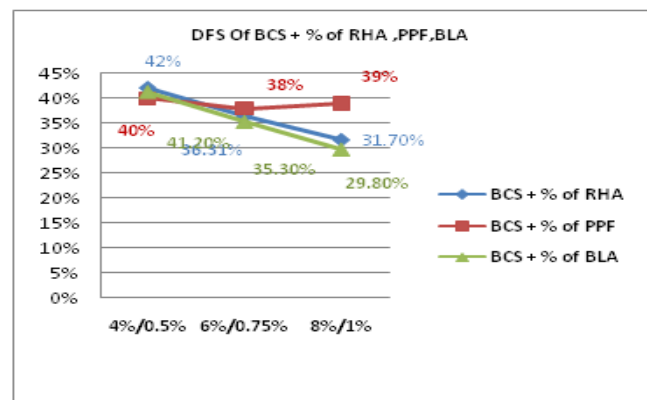
Graph 2 Shrinkage limits of BCS + (RHA PPF BLA)

5.4 DFS (Differential free swell) Test

To determine the shrinkage limit of the soil the value of shrinkage limit is used for understanding the swelling and shrinkage properties of cohesive soils. It is used for calculating the shrinkage factors which helps in the design problems of the structures made up of the soils or/and resting on soil. It gives an idea about the suitability of the soil as a construction material in foundations, roads, embankments and dams. DFS test result show that swelling of black cotton soil is decreasing with increasing the % of RHA, PPF and BLA in reinforced soil. RHA 4% swells 42%, in 6% swelling 36.31% and in 8% swelling result 31.70% reducing. PPF 0.5% Swelling shows 40%, 0.75% PPF swelling shows 38% and 1% PPF Swelling. BLA (Bamboo leaf

Table 4 DFS of BCS + (RHA PPF BLA)

Sample	DFS %
BCS	31%
BCS +(4% of RHA)	42%
BCS +(6% of RHA)	36.31%
BCS +(8% of RHA)	31.70%
BCS +(0.5% of PPF)	40%
BCS +(0.75% of PPF)	38%
BCS +(1% of PPF)	37.8%
BCS +(4% of BLA)	41.2%
BCS +(6% of BLA)	35.3%
BCS +(8% of BLA)	29.8%



Graph 3 DFS of BCS + (RHA PPF BLA)

VI. CONCLUSION

The results show that engineering properties of Black cotton soil is enhancing using stabilization by RHA PPF BLA. RHA (Rice husk ash) and BLA (Bamboo leaf ash) pozzolanic material in black cotton soil and make strong bond between black cotton soil particles and RHA Bamboo leaf ash particles .these bonds responsible to increasing properties of black cotton soil.

- Liquid limit of black cotton soil is decreasing with increasing % of RHA (Rice Husk Ash) PPF (Polypropylene fiber) and BLA (Bamboo leaf ash).
- Plastic limit of black cotton soil is also decreasing with increasing % of RHA PPF and BLA (Bamboo leaf ash).
- For shrinkage limit of black cotton soil is increasing with increasing % of RHA AND Bamboo leaf ash. But in case of PPF shrinkage limit is decreasing.
- In Differential free swell test of black cotton soil swelling is decreasing with increasing % of RHA PPF and Bamboo leaf ash in Black cotton soil.
- The results show that engineering properties of Black cotton soil is enhancing using stabilization by RHA PPF and BLA.

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