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A Review on Strengthening of Black Cotton Soil using Sisal Fiber and Coconut Fiber

Madhulika Singh[1], Prof. Ajeet Saxena[2]
[1]*MTech Scholar,* [2]*Assistant Professor, Radharaman Engineering College, Bhopal*

Abstract: ***The research is aimed to compare the behaviour of black cotton soil reinforced with sisal and coconut fiber also referred as coir. The soil used is black cotton soil collected from Arera Colony Area of Bhopal District (M.P). An attempt is made to improve improvement in the CBR value of soil due to the addition of sisal fiber and coconut fiber and also the combination of above two. The topic was considered by keeping in mind the stabilization of black cotton soil for construction purposes.***
Keywords: Black Cotton soil, Sisal fiber, Coconut fiber, Stabilization, CBR.

I. INTRODUCTION

A large part of Central India and a portion of India are covered with black cotton soils. These soils have high swelling and shrinkage attributes and amazingly low CBR esteem and shear quality. Hence, there is need for improvement of these properties. The act of utilizing strengthened earth has been settled in soil building calling. The concept of reinforcing soil masses with natural fibers like sisal fiber, coconut fiber, coir fiber, banana fiber, polypropylene fiber, etc. is a relatively new development to improve the properties of soil. The present study is aimed at determining the behaviour of black cotton soil reinforced with sisal and coconut fiber in a random manner. The soil used is a type of black cotton soil collected from Arera Colony Area of Bhopal District (M.P). The fibers are cut to a length 2 cm and mixed randomly with soil in varying percentages (2%, 4% and 6%) by dry weight of soil and compacted to maximum dry density at optimum moisture content. It is desirable from an engineering standpoint to build upon a foundation stabilization of ideal and consistent density. Thus, the goal of soil stabilization is to provide a solid, stable foundation. The standard fiber-reinforced soil is defined as a soil mass that contains randomly distributed, discrete elements, i.e. fibers, which provide an improvement in the mechanical behaviour of the soil composite. Fiber reinforced soil behaves as a composite material in which fibers of relatively high tensile strength are embedded in a matrix of soil. Shear stresses in the soil mobilize tensile resistance in the fibers, which in turn imparts greater strength to the soil.

The objective of the study is to understand the behaviour of soil-fiber interaction of sisal fiber and coconut fiber and a combination of both fiber reinforced soils.

II. LITERATURE SURVEY

A. Mr. Kilabanur Promod et al (2017) Black cotton soil is very delicate to the occasional variety which makes trouble the structures that are manufactured over it. Structural designing foundations particularly asphalt experience the ill effects of untimely disappointment. Balancing out dark cotton soil with substance, bond, modern waste, geo-materials, filaments and so forth have observed to be successful in enhancing the quality of the dark cotton soil. In the present investigation an endeavor is made to consider the impact of sisal fiber and bond with dark cotton soil. In show work, analyze were directed by supplanting dark cotton soil with the different level of sisal fiber from 0.2 to 1.2% by keeping the 5% of bond as consistent, Compaction and Strength characteristics test are Made. Due to the expansion of sisal filaments to the soil there is a transcendent increment in the quality of soil. It is watched that the UCS esteem of typical soil has been expanded from 73.81 KN/m2 to 148.81 KN/m2to for multi day condition. Likewise, the UCS esteem is expanded even on account of drenching condition for 7 days and 14 days from 186.79 KN/m^2 to 273.39 KN/m^2 individually. By and large, it can be presumed that fiber strengthened soil can be thought to be great ground change strategy extraordinarily in designing activities on powerless, extensive soils.

B. Anitha S. et al. (2018) conducted a study on a project in which an attempt is made to find out the improvement of strength in black cotton soil mixed with varying percentage of coconut coir and lime by conducting a series of Unconfined compression strength (U.C.C) and California bearing ratio (C.B.R) tests. The results show that CBR and UCC values of soil-coir fiber mix increases with increasing percentage of fiber.

C. Sachin D. et al. (2016) determines the geotechnical properties of soil collected from Chittenahalli and effectiveness of 30% fly ash and coconut fibers (0.25%, 0.5%, 0.75% & 1% by weight of solids) on strength of soil. It is found that 30% fly ash and 0.50% coconut fiber mix is optimum mix based on strength criteria. Addition of coconut fibers does not change the swelling properties of fly ash soil mix, but it restrains the shrinkage behavior of fly ash soil mix. • Addition of coconut fibers to 30% fly

ash and soil mix resulted in improvement of UCS from 186.45 kN/m2 to 240.2 kN/m2 at third day and 274.12 kN/m2 to 581.7kN/m2 at fourteen days of curing respectively as fibers content varies from 0% to 0.5% by weight of fly ash soil blend. Also at this fiber content the mix shows 20.62% improvement in soaked CBR. • It can be concluded that 30% fly ash in black cotton soil with 0.5% coconut fibers is considered as the best mix to achieve the strength.

D. Abhishek Ray (2016) Sisal fiber is treated with antacid for the change of the fiber properties subsequent to being dewaxed and taken after by vacuum broiler drying. Keeping in mind the end goal to measure every one of the impacts on the sisal fiber composite because of the antacid (here KOH) treatment, different describing investigations, for example, XRD, SEM, FTIR and 3 point flexural tests are done. Because of the treatment, the change on the surface of the fiber is seen because of the decrease of the debasements, lignin content and so on, which is affirmed by FESEM examination an expansion in fiber quality is likewise acquired which might be because of better fiber-grid linkage. Abatement in level of crystallinity is seen amid XRD examination. Anyway, an expanded physical and mechanical properties is seen because of the salt treatment on the sisal fiber. Ideally 3% treated example turns out to be the example of decision.

E. Zaimoglu et al. (2015) studied Optimization of consistency limits and plasticity index of fine-grained soils modified with polypropylene fibers and additive materials. Author observed that the polypropylene fibers and additive materials can be used to improve the plasticity index of fine-grained soils. Most effective material for decreasing the liquid limit and plasticity index of the samples were fly ash, polypropylene fiber respectively.

III. METHODOLOGY

In this research CBR test is conducted on the soil samples. This test determines whether the soil sample is appropriate for pavement of subgrade soil. According to (IS 2720 Part 16 1980), CBR is the ratio of force per unit area required to penetrate as soil mass with a plunger of 50 mm dia. at 1.25 mm/minute. For the procedure 5kg of soil sample is taken mixed with water. Compaction is done by rammer at 56 blows. The value obtained at 2.5 mm is considered as the CBR value of the soil. The proving ring constant for this experimental apparatus was given to be 35.21 N.

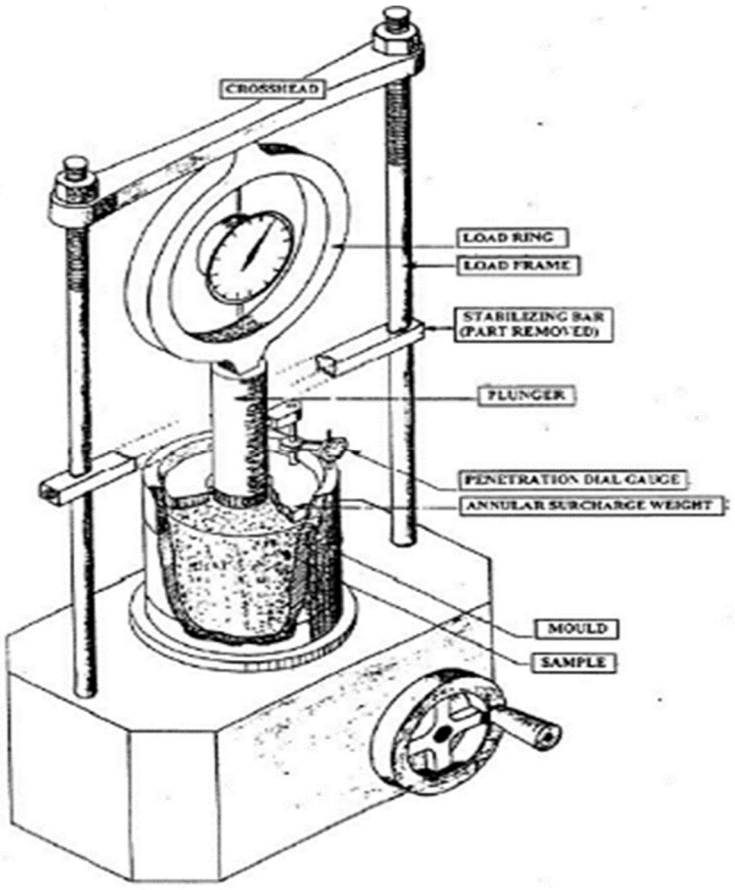
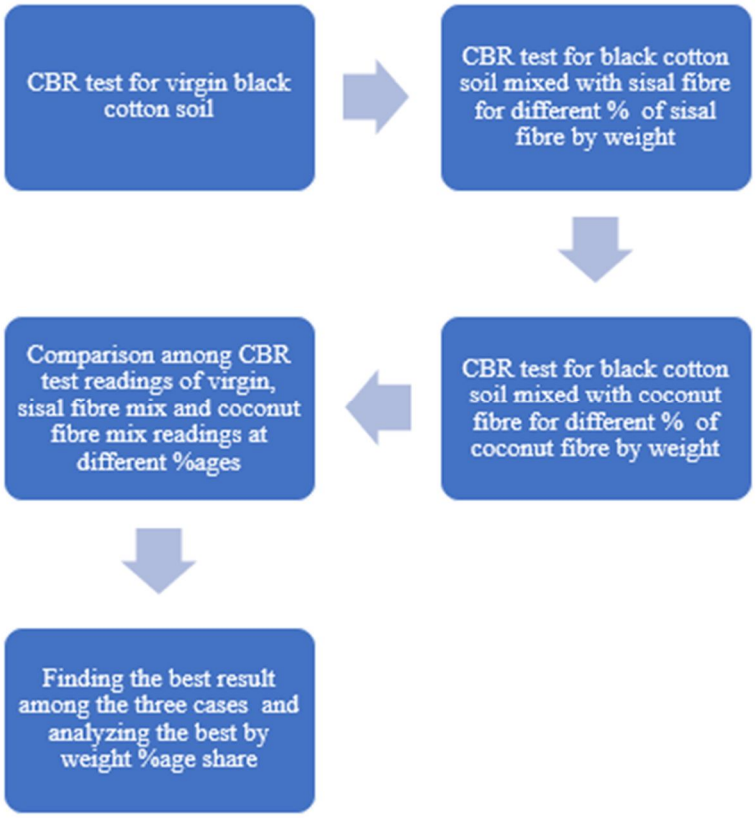


Fig. 1: CBR Apparatus

Table 3.1: CBR Values with its subgrade strength

S. No.	CBR Value (%)	Subgrade Strength
1	3% and less	Poor
2	3% -5%	Normal
3	5% -15%	Good

Flow Chart of the Study



IV. RESULT AND DISCUSSION

From above literature, many researchers studied about soil stabilization and gave their results on the same. In this research an attempt is made to stabilize soil by addition of sisal fibre and coconut fibre and a combination of the same with varying percentages. The main aim is to understand the behaviour of soil-fiber interaction with the above-mentioned mixtures and to find out optimum moisture content.

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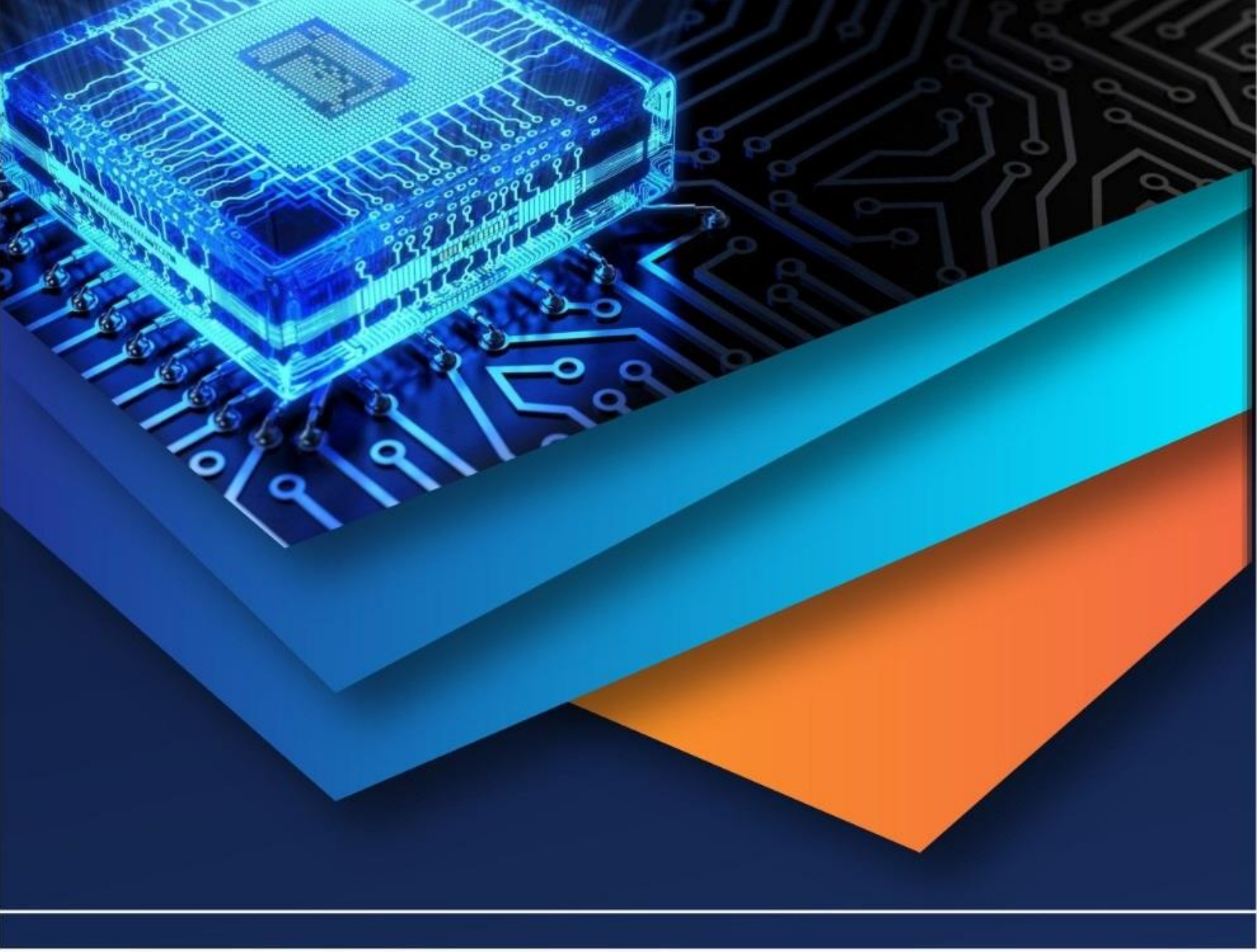

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