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Soil stabilization using plain and treated coir fibres

Mohd.Edriss Aneel[1], Bibha Mahto[2], Jhalak Kaushik[3], Raj Kumar[4]

[1]PG Students, Civil Engineering, NIU, GREATER NOIDA, India,
[2]Assssistant professor, Civil Engineering, NIU, GREATER NOIDA, India,
[3,4] PG Students, Civil Engineering, NIU, GREATER NOIDA,

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Abstract - *India is one of the leading coir producing countries. Coir industry provides employment to people belonging to weaker sections of the society in rural and coastal areas. To protect the traditional coir industry and to make it possible to meet the challenges in structured development of the nation, the development of new products and new horizons of varied applications of the existing products is necessary. At present, Coir Geotextiles account for only a fractional share of the global market of Geotextiles. While the world focus is shifting to natural Geotextiles, India as a producer of Coir Geotextiles, has much to gain by using it for meeting the domestic as well as global demands.*

The objective of present work is to study physical properties of sub grade soil and coir geotextile fibre. The study pertains to ascertain the variation in index properties of soil when mixed with plain and treated coir fibre at different proportions To determine engineering properties of the soil mixed with plain and treated coir fibre at different proportions. To determine the variation in California Bearing Ratio (CBR) values at different percentage of plain and treated coir fibre. To study the effect of plain and treated coir fibre at different proportions on unconfined compression strength of the soil (UCS).So that that the present study will help out in ascertaining variation of the coir fibre length on the engineering properties of the soil.

Key Words: Soil, UCS, CBR

1.INTRODUCTION

Coir is derived from the excerpt of the fruit of the coconut tree "Cacos nucifera Lynn" grown in the tropical countries mainly for the high oil content of the endosperm (copra). The English word "coir" comes from the Malayalam word “kayaru”. Large production areas, in particular, can be found along the coastal regions in the wet tropical areas of Asia, in the Philippines, Indonesia, India, Sri Lanka, and Malaysia. Total world production of coconut increased substantially from nearly 35 million tons in 1980 to more than 50 million tons today. Yield varies from region to region with an average of 70 to 100 nuts and a maximum of 150 nuts per year. The kernel (copra, coconut water and shell) comprises 65% of the total weight, while the husk contributes only 35%. Despite their low trade value, the fibres provide significant economic support to populations especially to weaker sections in specific areas of the coir producing countries, for example in southern states of India viz., Kerala, Karnataka, Tamilnadu, Andhra Pradesh and also in the west and south of Sri Lanka.

Coir is a versatile natural fibre extracted from the fibrous husk that surrounds the coconut. The fibres are tough, strong and extremely resistant to fungal and bacterial decomposition. Fibre length varies from 0.3 mm to 250mm; but to an average ranges from100 mm to 200mm. Coir cross sections are highly elliptical and non uniform with average diameter 0.25 mm. In spite of low cellulose content, coir fibre has a very close fibre structure which account for its better durability compared to other natural fibres.

Coir being a biodegradable and environment friendly material is virtually irreplaceable by any of the modem polymeric substitutes. With the diversification of the products and evolvement of new technologies for the production of fibres, the export of coir products has been increased tremendously. Though the demand for coir geotextiles is increasing, the total coir exports from India comprises only less than 3% of it. The close involvement of the local governments, with the support of the public research institutions and private enterprises is required for innovation, manufacturing and marketing of coir.

2. LITERARURE REVIEW

Several authors have reported various successful improvement techniques of stablization using coir fibres

Brown et. al. [1] (as reported by Ling et al 2001) conducted a series of tests to study the effectiveness of a polypropylene geogrid in improving the performance of pavement, such as resistance to rutting, reflective cracking and fatigue cracking. They also reported that the geosynthetic reduced the rut depth by 20 % to 58 %.

Burd et al.[2] emphasised the importance of the friction shear characteristics in soil geosynthetic friction tests. Their work highlighted the importance of these parameters in overall behavior of reinforced unpaved road.

Schurholz [3] reported the durability of coir geotextile. According to him the coir geotextiles retain 20% of their original tensile strength after one year in incubator tests with high fertile soil. It was also observed that when natural fabrics were put in a shower room and kept wet for 167 days with conditions to simulate the traction effect while flooding, coir had almost no damage.

Mahmood et al.[4]Studied on the geotextile - soil interface shear behaviour carried out by Mahmood et al. (2000) concluded that the shear strength of organic clay - geotextile interfaces were increasing with the increase of geotextile tensile strength. Similar findings were obtained by Burd (1995) while performing FEM analysis on the frictional behaviour of soil - geotextile interface.

Jayaganesh et. al. [5] studied the load deformation characteristics of a two layer base course and sub grade system. It was concluded from the test results that as the thickness of the aggregate layer increases, the load carrying capacity of the pavement system also increases. Further, for a given thickness of the base course layer, the load carrying capacity increased with the inclusion of reinforcement. A geotextiles group of coir fibre placed properly does improve the performance of an unpaved road. The most effective location of the placing the inclusive element is at the interface between sub grade and sub base.

Koerner et. al. [6] conducting CBR test on specimen of soil and on soil-aggregate system. Reinforcement ratios were defined as the load resisted by the unreinforced and the reinforced specimens. Maximum reinforcement ratio multiplied by the actual CBR was turned as modified CBR. It was concluded that with the reinforced soil the CBR values were improved to a great extent.

Mohd Yussni Hashim et. al. [7] reviewed the mercerization parameter's effect on natural fiber and it composite mechanical properties enhancement. The mercerization parameters that will be stress in this paper are sodium hydroxide (NaOH) concentration, temperature and soaking duration

Balan[8] conducted accelerated durability studies on two varieties of coir yarn in different soil environment and burial conditions along with a SEM study. The results of this study revealed that the life of coir yarn is controlled by the type of embedment soil, climatic conditions, water content and organic content and type of coir used.Coir degrades at a faster rate in sand with high organic content followed by clay with high organic content/burial, sand finally saturated soft clay, where the degradation is the least. The overall life of coir is more than two/three years.From the above it was concluded that the degradation of brown coir, commonly used in manufacturing of coir geotextiles degrades least when in conjunction with soft saturated clay and the loss is about 20 % in 6 months.

3. CONCLUSIONS

Based on above literature review it could be concluded that The majority of works carried out in the field of coir geotextiles are related to erosion control and watershed management. Only a few works have been reported regarding the utilisation of coir geotextiles for roads and embankments and a systematic research work in this area is lacking. Non-woven and woven coir geotextiles available in early nineties have been characterized and limited published literature indicates that coir geotextiles has potential for ground improvement applications. Extensive research work is reported on use of oriented and randomly oriented geosynthetic reinforcements through triaxial testing. While this brought out the positive improvement of geotechnical behaviour of soils, little work is reported on the use of waste materials. The overview has brought out the need for a systematic investigation into the various aspects of reinforcement in particular considering the influence of types of waste fibre inclusions.

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