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ECO FRIENDLY AND VERSATILE COIR GEOTEXTILES

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ABSTRACT

The processing of coir has been made ecofriendly and involves minimum amount of drudgery due to the research works carried out by the Central Coir Research Institute of Coir Board during the past few years. This has added a new dimension to the development of coir products in the field of geotextiles as coir possesses high strength and biodegradability to add to its advantages over other natural and synthetic fibres. This paper-reports the works done by Coir Board to promote the use of coir geotextiles in the field of soil erosion control.

INTRODUCTION

India produces the best quality of coir fibre obtained from the plant Coconut (COCOS NUCIFERA). There are two kinds of Coir fibres available in India, viz., white fibre and brown fibre. White fibre is obtained by retting the matured green coconut husks in waters from 6 to 10 months. This fibre is free from toxic phenol materials which are usually present on the surface of the other quality of fibre known as brown fibre which is obtained without retting. The white fibre is mostly used for manufacture of Mats, Mattings and Carpets. Both the white fibre and brown fibre can be used for making geotextiles woven or non woven depending on the end uses. A wide variety of geotextiles ranging in densities from 400 to 1400 grams per sq.mtr. have been developed by Coir Board.

The physical and chemical properties of coir are given in Tables 1 & 2

Table 1: Physical Properties of Coir Fibre

1. Ultimates		
(a) Length in mm	:	0.6
(b) Diameter in micron	:	16
2. Single Fibres		
(a) Length in inches	:	6-8
(b) Density (g/cc)	:	1.40
(c) Tenacity (g/tex)	:	10.0
(d) Breaking elongation %	:	30
(e) Moisture regain at 65% R.H (%)	:	10.5
(f) Swelling in water (diameter)	:	5%

Table 2: Chemical Composition of Coir

Water solubles	:	5.25%
Pectin and related compounds	:	3.00%
Hemi-cellulose	:	0.25%
Lignin	:	45.84%
Cellulose	:	43.44%
Ash	:	2.22%
		100.00%

ECOFRIENDLY PROCESSING OF COIR

The ever increasing environmental concern has been taken care of by the Coir Board through its research wing namely CCRI by the development of ecofriendly technologies of :

(1) Retting and
(2) Effluent treatment arising out of retting

The husk retting which was being carried out in the lakes and lagoons polluting the water to increase the biological/oxygen demand was being considered as an environmental hazard. CCRI has developed a bacterial cocktail namely COIRRET which can carry out the retting, in concrete tanks and within a period of 72 hours of the fibres extracted mechanically by defibering machine. The effluent generated by the process can be safely treated by application of bleaching powder and alum so as to recycle the water. This process has been extended to various Co-operative Societies and it is being successfully implemented to contain the pollution arising out of retting. The process will certainly increase the availability of fibre in non-traditional areas and the quality of fibre will also be uniform throughout the country by the application of this process. By applying this process the country will also be able to meet ever increasing demand of coir Geotextiles producing the best quality of yarn available in the international market.

To reduce the noise pollution arising out of the powerlooms, CCRI has developed a semi-automatic loom which is quieter and economical. CCRI has also developed a small spinning machine on which a consistent good quality of yarn can be made. The machine can be operated conveniently like a sewing machine and the spinning can be carried out on it throughout the year whereas on the traditional spinning ratts, the lady spinner would have to walk to and fro about 15 kms a day and the yarn was available in pieces not in continuous length. Further, the spinning was not possible during the inclement weather because of lack of availability of space to walk for about 10 mtrs.

COIR PROCESSING

In the spinning of all the natural fibres and synthetic fibres a preparatory step is required during which the lubricants, moisture absorbing chemicals, antiseptics, emulsion of mineral oils are added for smooth spinning of fibre. Fortunately coir fibre does not need such preparation prior to its spinning. Thus there is no chemical on the yarn after it is spun from coir, whereas the other natural fibres and synthetics contain on their surface toxic chemicals which are hazardous and pollute the atmosphere. This gives coir and added advantage over natural/synthetic fibres. It can be laid straight on any surface for geotechnical purposes.

STUDIES CARRIED OUT BY THE COIR BOARD ON THE COIR GEOTEXTILES

Coir Board has carried out studies on the demonstration of coir geotextiles for soil erosion control

in various places in India. The details are given below :

1.	1992	: Kabini Canal Slope Protection, Karnataka. Brown coir fibre was used, it is performing well.
2.	1995	: 23rd kilometer of left bank main canal of Muvattupuzha Valley Irrigation Project near MC Road, Crossing between Muvattupuzha and Koothattukulam, Kerala. White coir (H26) netting was used, it is performing well.
3.	1995	: 24th kilometer of left bank main canal, Bund road near 2nd road crossing of Thodupuzha - Ramamangalam Road, Kerala. White coir netting (H2M5) was used, it is performing well.
4.	1995	: Housing complex of M/s Elight Gardnia, Thrissur, Kerala, White coir (H2M5) was used, it is performing well.
5.	1996	: Mudwall at the Rice Research Station, Mankompu, Kerala. Basket weave coir fabric was used to protect the Mudwall, it is performing well.
6.	1996	: Road slope at Upputhodu, Idukki, Kerala. White coir (H2M8) has been used, it is performing well.

All the above studies were carried out by applying coir geotextiles alongwith the grasses, viz., lemon grass, vetiver grass, depending upon the type of soil and steepness of slope. Further study is proposed to be carried out on the request of Konkan Railway to protect a highly steep slope against soil erosion and in Sikkim to protect the highly eroded slopes by the use of coir geotextiles. These studies will be undertaken in this year.

The details of the study carried out at Muvattupuzha are produced below :

Experiment

23rd kilometer of left bank main canal of Muvattupuzha Valley Irrigation Project near M.C. Road corssing between Muvattupuzha and Kuthattukulam, Kerala.

The area selected was highly eroded due to the high stream velocity at this point of the canal due to two major rainy seasons in a year.

The treatment with the vegetation turfing grass failed in this area because the seeds and the spriggings were getting washed away during the following monsoon since it takes a lot of time for the vegetation to take root. It was therefore felt necessary to protect the slope adequately till such time that the seeds broadcast over the slopes or the roots slips of grass dibbled into the slope take time to germinate, grow and take root. The coir geotextile helped to dampen the kinetic energy of the flowing water and kept both the soil and the root slips in their place. The technique is also cost effective in comparison to the vegetative turfing method. The fabric chosen for this purpose was having sufficient space for the proper dibbling of the grass. The strength of the coir nettings was monitored at regular intervals so as to understand the longevity of the material under natural conditions in the region. It has been found that the strength of the yarn was reduced to its half after a period of 6 months which indicates that the netting will last for about 5 years under the normal conditions in that region. The method of such estimation was followed as per the half life method usually adopted. It was assumed that after 10 half lives the fabric will be completely degraded and will be the part of soil. Based on these, it has been derived that the fabric will be totally degraded after 5 years under the normal conditions in the region. In the process the degradation products of the coir helped the good growth of the plantation for permanent consolidation of the soil on the slope.

The pH of the soil at the time of laying the geotextile in the region was 4.3 and the organic carbon percentage was 0.18. After the laying of coir geotextile on the slope the organic carbon percentage increased to 0.46. The growth of lemon grass was abundant in the area where the geofabric was laid. The length of the roots was found to be more than 1.5 ft and the leaves of the grass grew between 3 ft and 4 ft.

It was also found that the lemon grass did not grow so abundantly in the nearby area where it was planted without the aid of coir geotextiles. It was estimated that the growth in this area was 1/3 of the growth in the geotextile treated area. Even that growth was in patches, not homogeneous.

There was a marginal increase in the nitrogen and potassium content of the area where geotextiles were applied. However there was a substantive increase in the phosphorus content of the area which increased from 0.140 to 0.195%.

The above results indicate that coir geotextile has been successful in controlling erosion by establishing the vegetation in the erosion control area by protecting root slips of lemon grass as well as providing essential nutrients to the soils. Use of coir geotextile is economically viable and is an environmentally friendly method of protecting the slopes in the erosion prone areas.

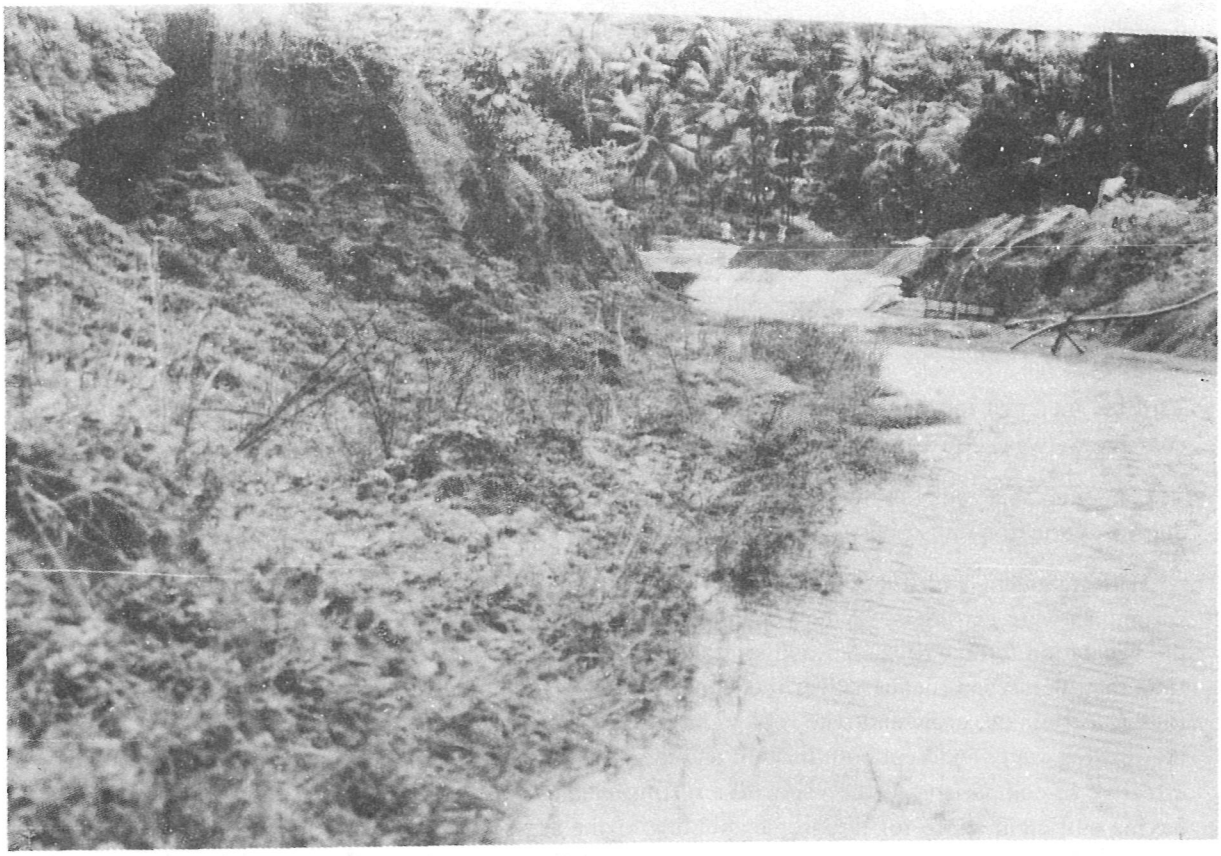

Photo 1: Muvattupuzha (Kerala) Left Bank Main Canal before Geotextile Treatment.

CONCLUSIONS

Coir geotextiles are processed in an economical ecofriendly way, and are also friendly to the nature. This gives then the advantages over and above the other kinds of fibres whether natural or synthetic. The areas of application have been limited, till this date, mainly in the field of soil erosion control. However, the other potential areas of application are, coir wick drains soil enforcement and filtration

Photo 2: Muvattupuzha (Kerala) Left Bank Main Canal after Geotextile Treatment.

for which experiments are proposed to be carried out by CCRI in the long run. There is no doubt that coir possesses an immence potential for its application as a geotextile in the coming century.

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