MANIFOLD POTENTIALS OF COIR GEOTEXTILES*

U.S. Sarma and M. Kumararaja
Central Coir Research Institute, Kalavoor - 688 522., Alleppey

Introduction

Application of Textiles today no longer restricts to human consumption i.e. apparel and household usages. It has entered into the unusual field of agriculture and civil engineering as input materials for certain applications, as a technological answer to the needs of civil engineers, agriculturists and architects in close association with textile engineers and manufacturers, who have been able to identify industrial textiles of woven and non-woven structure to meet the need of specific problems.

Basically, in addition to the popular usage in erosion control applications the coir geotextiles can be considered for most other applications where geosythetics are used except in reinforcing applications where the primary requirements are durability and long term strength.

Geosynthetics

In foreign countries the plastic materials are being used for geotextiles. It has been established beyond any doubt that plastics are one of the major toxic pollutants of our time. They pollute environment both during their production and disposal. Som e of constituents like ethylene oxide, benzene, vinyl chloride are known to cause cancer, birth defects, damge to the nervous and immunity systems to adversely affect the blood and the kidneys. Further, they are inflammable to vitiate the air & earth.

Once a plastic is produced, the harm is done once and for all. Plastics defy any kind of attempt at disposal, be it through recycling, burying or land filling. When one recycles a hazard, one creates a hazard. Since plastics do not undergo bacterial decompositon, landfilling will mean preserving it for ever. When burnt, plasfics release a hast of poisonous chemicals including dioxin, the most toxic substance known to science. Recycling if not done under extreme care, it results from exposure to the fumes, the skin desease and respiratory problems. Plastics slowly degrade in the presence of U.V. light and acid rains and if they are used as geotextiles, slow release of toxic seepage will mix with rain water and will contaminate the water source. Further the waste mass will impede the flow of ground water as well as obstruct the free movement of roots of plants thereby affecting the soil's biological balance and organic processes.

Why to promote the use of coir geotextiles?

With the improvement of technology in the processing of coir fibre starting from their extraction, spinning, weaving and finishing, various forms of coir geotextiles can be assembled to cater for a number of applications such as erosion control, slop stabilisation and soft soil consolidation applications. Most applications involving coir geotextiles depend upon the initial membrane action which is easily provided due to its high tensile strength. In most cases the gradual decrease in strength due to decay is compensated by the gain in strength of the soil underneath & strength requirement becomes unimportant. The separation, filtration and drainage function of coir geotextiles will also be unhindered

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by loss of strength or decay of fibres which is a very slow process. Therefore, it is important that for filtration and drainage applications, long term strength and durability are not the criterions to look for. By the time decay sets in within six months of installation the soil gets strengthened. Later on the decayed structure will also act as a filter cake to perform separation, filtration and drainage functions.

Coir geotextiles simulate the salient proportion of vegetation which control the erosion, like vegetation cover, coir geotextiles intercept and store rainfall. The composition of the products imparts a roughness to run down in much the same way as vegetation stems. Buried coir geotextiles simulate the root effect and due to their biodegradability they act as a mulch also. Their effectiveness is immediate, unlike vegetation which may take year to more to reach the stage of growth where it becomes effective in reducing soil erosion rates.

Coir fabrics swell when they get wet. This causes them to fill the open areas and produce a fine mesh fabric which will filter the soil from water passing through them. In side-by-side testing the stabilisation fencing compares from favourably with conventionally manufactured close weave fabrics.

As the coir geotextiles biodegrade over time it is highly probable that their effectiveness diminishes. But by that time the establishing vegetation becomes more protective. As they bio degrade, there are no harmful substances left in the environment, indeed the addition of organic matter is beneficial for soil fertility. Finally and probably to most interest to the end uses, the coir geo textiles are considerably more cost effective than their synthetic competitors, if a solution to soil erosion control and vegetation establishment is required.

The heavier construction of coir geotextiles when well seeded on the soil surface provide physical protection for the young seedlings against desiccation and wind-rock as well as moisture retention. This is of great value where climatic conditions may result in slow plant establishment.

Natural, pleasing to the appearance, coir fabric can thus be used successfully in most applications where more expensive chemically treated synthetic fabrics are now used.

Individual fibre of coir are from 0.01 to 0.04 inches in length and from 12 to 25 micron in diameter ie. the ratio of length to the thickness if only 35. The cell wall is thick but rather irregularly so; in consequence the lumen has an irregularly indented outline. The points terminate abruptly and are not sharp and there appear to be large number of forecanals penetrating the cell wall. On the surface, the fibre bundles are occasionaly covered with small lens shaped silicified stegmata about 15 micron in diameter. Coir gives the following micro chemical reactions.

1. With iodine and sulphuric acid - golden colour with Aniline sulphate - intense yellow colour Scheveitzer's reagent does not attack the fibre.

These reactions indicate that coir is a heavily lignified fibre. Accordingly to Schlesinger coir contains 20.6% of hydroscropic moisture. The physical and chemical properties of coir are given in the following tables.

Table

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

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%

Further Studies

1. River Bank Erosion Protection

An experimental project is being taken up with calcutta Port Trust (CPT) to assess the value of coir geotextiles for river bank protection against the onslaught of waves to curb slope erosion. Earlier the bituminised jute, (100% take up) was used for root protectiion.

The material weighted 850 gm/m2 and it was calimed to have the pore size of 150 microns. The experimental stretch was 100 m long. A layer of riprap was placed over the jute and this was over-laid by rock armour.

During our discussion with the Chief Hydraulic Engineer, it was suggested that the coir geotextiles may not require the bitumen coating which is again a river water pollutant and it will consolidate the slope keeping its profile intact. Six samples of coir geotextiles of various constructions have been forwarded to CPT for evaluation and the suitable material will be utilised in the near future.

2. Experimental study on coir reinforced retting mud wall protection

An experimental study has recently been undertaken at Moncompu to use the coir geotextile as a reinforcing agent for the mud walls on the canal.

3. Soil Erosion Control in Gangtok

Gangtok is a sinking town where the soil erosion problem is increasing day by day. Recently the development authorities of the town has shown considerable interest in the application of coir geotextiles and Coir Board extending its technical expertise to protect the soil erosion areas in the near future.

Recommendations

The great opportunity which coir industry has got to introduce a range of geotextile products in the market should be utilised at the earliest and carefully. The materials should strictly confirm to the international standards existing for the geotextiles for the specific uses. There is an urgent need of developing a testing laboratory as per the ASTM specification so as to test the materials in our country itself. Coir Board has already envisaged the establishment of a geotextile lab at CCRI and efforts are on in this direction. If the present situation of hate towards the geosynthetics is not utilised properly a golden opportunity will be lost when the biodegradable synthetics will flood the market.

Coir Industry was petting an annual sales of 1000 crores of which 800 crores was realised through domestic sales and 200 crores from exports. The export of Coir Geotextiles is increasing slowly, eventhough the domestic market for coir geotextile is still untapped. It is worthy to mention here that Konkan Railway Corporation Ltd., had sought 6000 m2 of coir geotextile to firm up the tunnels along the rail route. The interest shown by the Govt. of Sikkim and Calcutta Port Trust prove the increasing potential of Coir Geotextile in domestic market.

As a joint venture, the trade and Coir Board will have to establish the different uses of coir geotextile in the following fields which will boost the domestic and export markets.

1. Road embankments
2. Road reinforcements
3. Rail embankments
4. Water course beds
5. River embankments
6. Land Scaped areas
7. Mining fields and waste dump areas
8. Dams
9. Air fields
10. Golf Courses
11. Ski slopes and Ski lift tracks
12. Erodable Sea Shores
13. Noise control banks and filterations
14. Defence installations
15. Cutting and hill side slopes
16. Soil stabilisation and horticulture applications.

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