FROM TREE TOP TO FIBRE.
The husk of the felled coconut is deftly separated from the nut on upright iron shafts. Large quantities of fresh husk are transported overland or through canals in huge boats to shallow lakes and back waters. Here the husk is retted under water for up to ten months before they are beaten out to form the fine golden hued coir fibre. The coir fibre thus obtained is spun into yarn by women on traditional spinning wheels called ‘ratts’. It is this yarn that forms the warp and weft of the geotextile.

AN UP-TO-DATE ON COIR
Coir fibre is one hundred percent natural, eco-friendly and bio-degradable. Keralites, the people from the southwestern tip of the Indian peninsula, had known about its wonderful properties from the earliest times of recorded history. It blended well with his daily life, providing both labour and returns. The strength of the woven coir rope was trusted deeply even on the high seas. Seafaring catamarans were held together with little more than the coir rope. The same rope bound the coconut wood beams of his roof and he slept on a comfortable bed woven crisscross with coir yarn. The cradles of his babies were suspended from the rafters by coir rope. In the utmost test of strength and trust, wild elephants were hauled up from the pit traps by jumbo coir ropes.

THE PHYSICAL AND CHEMICAL PROPERTIES OF COIR FIBRE

<table>
<thead>
<tr>
<th>PHYSICAL</th>
<th>CHEMICAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>6-8&quot;</td>
</tr>
<tr>
<td>Density</td>
<td>1.4 gm/cc</td>
</tr>
<tr>
<td>Pectin and related compounds</td>
<td></td>
</tr>
<tr>
<td>Tenacity</td>
<td>10 g/tex</td>
</tr>
<tr>
<td>Breaking elongation</td>
<td>30 %</td>
</tr>
<tr>
<td>Swelling in water</td>
<td>5% of diameter</td>
</tr>
<tr>
<td>43.44%</td>
<td></td>
</tr>
<tr>
<td>Ash</td>
<td>2.22 0/0</td>
</tr>
<tr>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Cellulose</td>
<td></td>
</tr>
<tr>
<td>Hemi cellulose</td>
<td>0.25%</td>
</tr>
<tr>
<td>Lignin</td>
<td>45.84%</td>
</tr>
<tr>
<td>Water solubles</td>
<td>5.25 %</td>
</tr>
</tbody>
</table>

GEOTEXTILES
They are generally made from fibrous material of various substances in the form of individual fibres, filaments, yarn, tapes etc.
COIR AS A GEOTEXTILE

Woven coir yarn nets with varying densities serve successfully as slope stabilisation agents prior to revegetation. Other major applications of coir geotextiles are soil engineering, erosion control, soil reinforcement and several more. Coir geotextile has very high tensile strength, water absorption capabilities and ability to break up run off top soil. Coir also promotes new vegetation by absorbing water and by preventing the top soil from drying out. Coir geotextile absorbs solar radiation just as natural soil unlike geosynthetic materials. They provide good soil support for up to 5 years enough time for natural vegetation to take over. The heavier grades can be used on embankments on slopes with little or no vegetation. Other applications are ski slopes and as a bottom reinforcing material in water courses. Natural degradation of coir is slower under water since micro-organisms are usually less active.

After serving the purpose, this low cost geotextile need not be painstakingly removed due to its ecofriendliness and bio-degradability. Coir disintegrates leaving only humus. Coir geotextile currently enjoys a high demand from ecology conscious nations across the world.

<table>
<thead>
<tr>
<th>Application</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Stabilization of soil slope</td>
<td>Reinforcement, erosion control</td>
</tr>
<tr>
<td>2. Reinforced soil wall</td>
<td>Reinforcement, drainage</td>
</tr>
<tr>
<td>3. Stabilization of road</td>
<td>Filtration, drainage, separation, reinforcement, confinement</td>
</tr>
<tr>
<td>4. Rail – roads, track bed stabilization</td>
<td>Filtration, separation, reinforcement, confinement</td>
</tr>
<tr>
<td>5. Embankment on soft soil</td>
<td>Filtration, separation, reinforcement, erosion control</td>
</tr>
<tr>
<td>6. Land fills</td>
<td>Filtration, drainage, separation, protection, encapsulation</td>
</tr>
<tr>
<td>7. Erosion control on slopes</td>
<td>Erosion control confinement</td>
</tr>
<tr>
<td>8. Land reclamations</td>
<td>Filtration, separation, reinforcement</td>
</tr>
<tr>
<td>9. River bank protection</td>
<td>Filtration, separation, erosion control</td>
</tr>
</tbody>
</table>

From the above table, it can be seen that there is a great diversity of functions when it comes to different applications. It can be seen that most functions can be met by the use of coir geotextile. In the rare case where the bio-degradability period of the coir is below that of the period of function, a second installation of coir geotextile is more easier, economical and eco friendly than the initial use of a different, high cost substitute.

Further, a fibre based materials with good mechanical properties and resistance to microbes would be more suitable as a geotextile. The lignin content in a fibre determines the resistance to microbial attack. Here also, the coir geotextile with a lignin content of about 46% scores heavily above jute (12%) and leaf fibre (10%)

COIR GEOTEXTILES

Coir geotextiles can be classified as woven and non-woven based on the method of manufacture. These can be further reclassified as below.
A. WOVEN GEOTEXTILES

a) Coir mesh mattings of two shaft weave
   This is the simplest form of coir geotextile and is manufactured on traditional hand looms using 2 shaft weaving techniques. Used primarily for erosion control applications, these are available in 10 varieties with fixed quality specifications stipulated by the Bureau of Indian Standards. These 10 varieties are made available for different intensities of rainfall, types of soil, slopes of surface etc.

b) Coir woven fabrics with loop construction
   Primarily used for soil stabilisation, this type is woven in rolls using the technique of loop mat weaving

c) Coir bags made with latex backed coir matting
   This type is used mostly to control sea erosion and as a substitute for huge granite boulders which involve high labour and transportation costs. Designed to withstand powerful waves, thick ribbed matting with latex backing is used for this application. The bags are stitched with the latex facing inwards. The usual bag size is 6 ft x 4 ft

B. NON-WOVEN GEOTEXTILES

a) Coco logs
   Shaped like a wooden log, Coco Logs are coir fibres thickly filled inside tube shaped coir netting. The diameter of the Coco Log varies from 15 to 50 cms and come in lengths of 2 to 6 meters. These are mainly used for absorbing the impact of waves in erosion prone areas.

b) Coir fibre beds
   Here mesh mattings are stitched together to form a pouch and then filled with coir fibre. The ends are stitched to form fibre beds, the thickness of which vary from 10 to 25 cms as per the requirement. They are mainly used as wave energy dissipaters.

c) Coir needle felts
   These are pads made by interlocking coir fibre through needling. These felt pads can be used for low cost acoustic control, air & water filtration and thermal insulation.
APPLICATION OF COIR GEOTEXTILES

Different applications where coir fabrics can be used in an effective and cost efficient way are:-

a) Erosion treatment
b) Sub-base layer in road pavement
c) In drain works
d) Slope stability problems
e) Rail track stabilisation

COIR NETTING FOR EROSION TREATMENT

Erosion consists of loosening, migration and transportation of soil particles. A heavy thunder storm may drain out upto 90% of the rainfall as run-off. A grassed area with traditional landscaping will absorb only 20% of the rainfall. Coir matting, however, is effective in keeping the soil intact. When it is sown over coir netting, it gives immediate protection to the soil. The roots take a firm hold and give a permanent vegetation. The netting also retards the run-off water, and serves to hold the seeds and soil intact, effectively checking erosion during heavy seasonal rains.

The other benefits provided by the matting include.

1) Shielding of the soil against wind & rain impact and storm water run-off, preventing rilling and gullying.
2) Offering a secure condition for seed germination by acting as a barrier against wind, rain and birds.
3) Retention of the moisture by capillary storage and evaporation control, helping seed germination and seedling growth.
4) Absorption of solar radiation and maintenance of ideal temperatures for plant growth.
5) Turf reinforcement against rutting and general wear and tear.

HOW TO LAY COIR GEO TEXTILES
1. Level the area
2. Do first seeding of grass tamp and compact surface soil
3. Lay the geotextile in rolls or grids in the direction of water flow
4. Secure top and bottom ends of the netting
5. Peg down the netting using staples
6. Do second seeding
7. Irrigate the slope
The Spanish connection: The credit for naming the three-eyed nut goes to the Spaniards. To them, these looked like the two eyes and nose of a monkey. "Coco" in old Spanish slang means "Monkey Face".

All botanists are unanimous in their opinion that the home of the original coconut is in a region between Northern Sumatra and Eastern New Guinea - most probably the now submerged shelf of the Papuan land. From there, Polynesian sailors, credited with great navigational skills, must have brought it further through the straits of Malacca and the Bay of Bengal.

Hence quite a few eyebrows are bound to be raised if anyone says that the coconut is alien to India.

The Sea faring Arabs of old called the coconut the "Indian Nut". So did John of Montecorvino and Marco Polo, both belonging to the 13th century AD. Hence quite a few eyebrows are bound to be raised if anyone says that the coconut is alien to India.

Geotextiles provide an excellent and economical medium for stabilizing rail beds. The inclusion of geotextile reinforcement in the sub-track layers prevents mud pumping and loss of ballast into soft subgrade. Geotextiles also help in distributing loads, thereby avoiding concentrated deformation of subgrade below the track. High expenditure related to labour and material has urged the railway engineers to seek more innovative and cost-effective ways to improve sub-grade stability.

RAIL TRACK STABILISATION

In reinforcement of the fill/embankment and construction for greater heights, geotextiles have also been tested that the coir net itself has a good tensile strength. Both these properties result in the coir net being used as a tensile member in the sub-base layer of road pavement. Geotextiles often fulfill more than one of the above functions. Typical combinations are:

1. Separation: When placed between different materials such as fine soil and gravel which have a tendency to mix when they are squeezed together or subjected to load, a geotextile can act as a separator. Here its function is to prevent the mixing of the two materials so that each of them can retain individual properties.

2. Reinforcement: The reinforcement functions of a geotextile can be classified into two subcategories such as tensioned membrane and as a tensile member.

3. Protection: A geotextile protects a material when it nullifies or distributes stresses and strain to the protected material. This can be for (i) Surface protection as in the case of surface erosion, (ii) Interface protection as in the case of cracked pavement/asphalt overlay system to relieve reflection cracking.

4. Support: Placed between a water-tight membrane (geomembrane) and a material containing void spaces, the function of a geotextile is to prevent puncturing or bursting of the membrane over the void.

5. Fluid transmission: A geotextile can collect and convey considerable flow of a fluid within its own plane towards an outlet, thus draining the soil in which it is placed.

6. Filtration: A geotextile acts as a filter since it allows fluids to pass through it in the normal line of flow while preventing the soil particles from being carried away by the fluid current.

Geotextiles can perform one or more functions to improve the hydraulic and/or the mechanical behaviour of a structure. The basic functions which can be incorporated under a given application are:

- Separation, filtration, drainage, etc.
- Separation and sealing
- Separation and reinforcement
- Separation and protection
- Separation and filtration

Closely knitted coir fabric acts as an interface between the sub-grade and the secondary granular sub-base, improving the sub-grade. The granular sub-base can be spread over the coir matting and may be rolled with a light or medium roller.

USE OF COIR IN DRAIN WORKS

As stated earlier, geotextiles often fulfill more than one of the above functions. Typical combinations are:

1. Separation
2. Reinforcement
3. Protection
4. Support

Hydraulic Functions

FUNCTIONS OF GEO TEXTILES IN ROAD CONSTRUCTION

SUB-BASE LAYER IN ROAD PAVEMENT