# *COIR GEOTEXTILES*

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Coir is a biodegradable organic fibre material which is coarse, rigid and strong. The constituents of coir have been found to be mostly cellulose and lignin. Coir fibre is weather resistant and resistant to fungal and bacterial decomposition. The rate of decomposition of coir is much less than any other natural fibre. These characteristics are attributed due to the high lignin content in the fibre. Coir in the form of woven mesh mattings or non woven stitch bonded blankets are used in engineering applications in the geotechnical field.

Geotextiles, one among geosynthetics like geogrids, geonets, geomats, geocomposites etc. used in civil engineering applications are polymeric. These products have a long life and do not undergo biological degradation, but are liable to create environmental problems in the long run. Due to growing awareness to preserve environment, use of biodegradable natural material has gained popularity. The natural fibre, coir, which has been used in geotextiles for the past 20 years, has already proved its worth. While geosynthetics dominate all spheres of application, the natural organic fibre, coir have now proved their mettle to match with geosynthetics.


Woven coir netting / Mesh matting used as geotextiles

Coir geotextiles are made from coconut fibre extracted from the husk of coconut. Like other polymeric counterparts, coir geotextiles are developed for specific application in civil engineering like erosion control, ground improvement, filtration, drainage, river bank protection, road pavements, slope stability etc. This biodegradable and environment friendly material is virtually irreplaceable by any of the modern synthetic substitutes.

The process involved in obtaining geotextiles from the raw material, husk of coconut is:

1. Retting the coconut husks, which means soaking in water for 8-10 months to remove certain natural chemicals from the husk to enable proper defibring.
2. Extraction of fibre either manually or with the help of a machine.
3. Spinning of yarn.
4. Weaving to obtain the desired geotextiles.

Modern day practices have speeded up the process for retting with agents and the fibre is extracted mechanically.

How it is being laid is, first selecting the type of coir geotextiles from site assessment, forming the required gradient, anchoring and laying the geotextiles in rolls or grids, in the direction of water flow, trenching the bottom portions, placing the seedlings of required plant species with necessary fertilizer and irrigating the laid area. Rolls of the coir matting were first anchored firmly in the trench and then unrolled along the slope. A minimum overlap of 15 cm is given between adjacent ones. Anchoring of the matting was with mild steel staples spaced to form 2m grids. If the soil is organic, additional fertilizers are not necessary.

Geotextiles give maximum protection to the soil beneath until the grass takes root and provide permanent vegetation. After the soil is thus stabilized, the netting decomposes and provides nourishment to the grass growing in the soil.


Thodu bund with coir netting

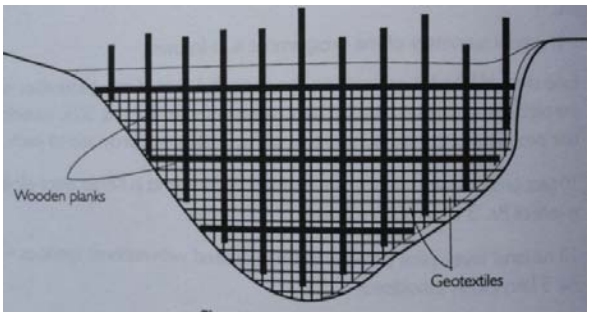
Thodu bund after growth of vegetation

## Applications

**Erosion Control:** The destructive effect of rain increases with the steepness of the slope of the surface. The rate of detachment of soil particles and its transportation depends on the erodability of the soil and the kinetic energy of rain drops. Wind too causes such erosion. Geotextiles are used extensively in

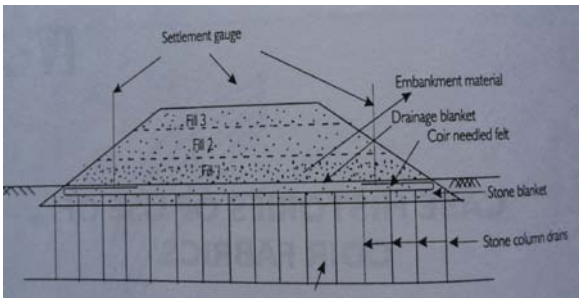
erosion control works. The ultimate objective of it is to establish a dense network of root system and vegetable cover. The high tensile strength of coir fibres protects steep surfaces from heavy flows and debris movement. Geotextiles are permeable textile fabrics used to prevent the soil from migrating, while maintaining the water flow.

**Rainwater Harvesting:** In a rain shadow area behind the kambam region of Tamilnadu, rainfall is low compared to other parts of Kerala. However the intensity of rain is very heavy causing severe erosion. The soil profile consists of sandy silt for a depth of 1.25m followed by disintegrated rock. Owing to the terrain and the soil type, the rainwater is being lost, water percolation to the ground is very less. Rainwater is disposed off through wide and deep gullies to the nearby streams and thus avoids percolation. This leads to scarcity of ground water in this region due to which no bushes or even shrubs grow here. Here, gullies are plugged using coir geotextiles as in figure below to improve percolation of water to the ground.




Gully plugging using geotextiles

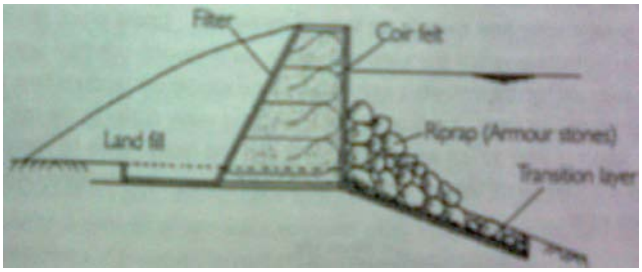
**Stabilization of embankment:** In the picture below, the embankment material was spread over the geotextile blanket and compacted in layers. This construction is very effective in reducing the time for settlement




Cross section of embankment where coir geotextiles are used

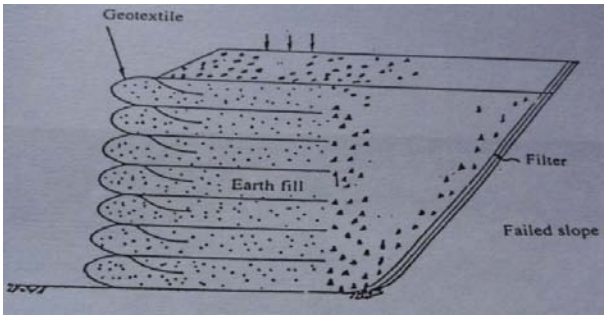
**Canal Bund Protection:** In the left bank main canal of Muvattupuzha Valley Irrigation Project near M.C.Road crossing between Muvattupuzha and Koothatukulam, the stretch of canal bund at 2320 km was one of the most highly eroded portions due to high stream velocity during rainy seasons. Here turfing grass protection for stability of the bund was found unsuccessful. The soil was found acidic with pH value 4.3. Since no other protection was effective, geotextiles were used for the bund with lemon grass (roots 45 cm long and leaves 1m) was found to be the choice of vegetation and the coir fabric was very conducive to its growth. It was assumed that complete degradation will take place in 5 years. It was very successful in the control of erosion.

**River Bank Protection/Seashore Protection:** The problem is to maintain the alignment by prevention of erosion of a river bank due to flooding and sea shore due to wave/tidal action. There is need to provide energy dissipation of the wave force without removal of concrete blocks as seen in figure below. The provision of geotextiles can be used successfully for this purpose and the excess pore water on receding of waves can be removed without washing out the soil. In river banks the planting of a suitable fabric within the soil permit easy flow of water without the removal of soil particles as also induces vegetation growth on the embankment.

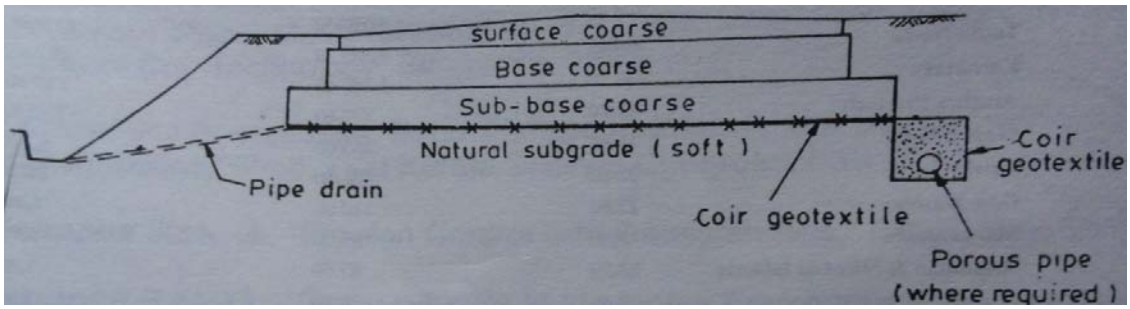



Coastal protection using geotextiles

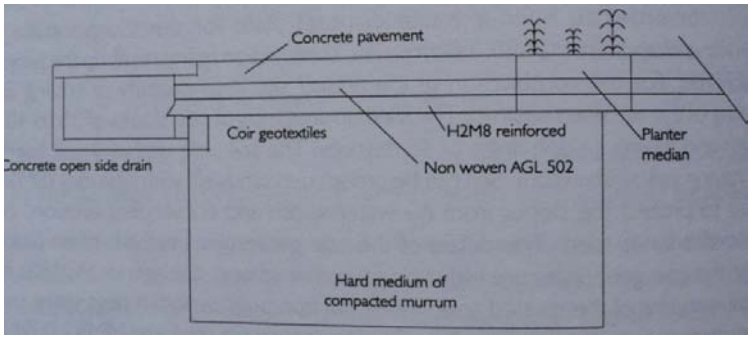
**Reinforcement:** The tensile strength of coir netting and the friction between coir and the soil are the properties which help in its applications in slope stability problems. Different layers of fill material can be wrapped around and coir netting act as reinforcement for the earth fill and will not allow any shear force to develop. This allows greater heights of fills to be built than would otherwise be possible.




**Road Pavements:** In road pavements, unsatisfactory performance of roads is due to poor quality of subgrade, improper drainage, insufficient thickness and inferior quality of pavement. All these factors can be mitigated by placing the closely knitted geotextile on the weak subgrade between the subgrade and the sub base, thus preventing intermingling of the soils and the granular sub base and improves drainage, thereby the sub grade stiffens and become stronger on consolidation, due to self weight of pavement above, construction rolling and traffic loads thus increase the strength of the pavement.



**Ground Improvement:** Coir geotextiles used for ground improvement will help to undergo ground deformation without rupture and slip. Le Meridian Hotel in Cochin was constructed on a developed marshy land near one of the canals in Cochin region. Original paddy field was developed by ground improvement methods using hard murrum in layers of 15 cm thick for a height of 1.5 to 2 m. As in the picture below, coir geotextiles has been used in the approach road to the hotel, composite coir geotextiles having polypropylene net on top and bottom reinforced with woven coir at bottom was used above the compacted murrum as a drainage layer. It is intended to carry away the water from the medians to the open drains provided on either side of the road. Composite coir geotextile was taken below the road as well as the median and ends on either side to the open drains. Above the geotextiles, 300 mm thick macadam compacted in layers and M15 concrete 20 mm thick over the above macadam was used for the pavement and the road pavement is functioning effectively since then.




Cross section of road (Hotel Le Meridian)

Tests conducted showed that natural fibre like cotton degrades in six weeks, jute in eight weeks, coir still retained 20% of its strength even after one year.

Coir geotextiles are used extensively in various applications successfully in various countries. Coir industry in India supports around half a million people belonging to weaker sections in the rural population. Wide use of this material will be a promise to the coir industry.

The Kerala State Coir Corporation Ltd. Kerala and the coir are implementing agencies.

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