

ISSUE 5

# COIR VOX

A Bulletin from NCRMI on Kerala Coir

August 2023



## EMBANKMENT PROTECTION OF PONDS USING COIR GEOTEXTILES

COIR POLYMER COMPOSITES  
FOR FURNITURE  
APPLICATIONS



DISCOVERING  
THERMAL  
CONDUCTIVITY

AN INDIGENOUS SETUP FOR  
COIR MAT'S INSULATING POTENTIAL

PUBLISHED BY

NATIONAL COIR RESEARCH & MANAGEMENT INSTITUTE (NCRMI), THIRUVANANTHAPURAM

# INFRASTRUCTURE

## DIVISION OF POLYMER CHEMISTRY

**NCRMI** Chemical laboratory facility offers advanced resources for specialised chemical examination of coir pith, fibre, and associated products. Chemical testing on coir involves analysing the composition and properties of coir fiber, pith, or coir-based products using various chemical techniques. These tests provide information about coir quality, purity, and suitability for different applications. Testing of coir and coir-related products are done following IS standards. NCRMI is the certifying agency of coir pith compost according to the BIS standards. This state-of-the-art facility is utilised to advance research requirements and is accessible to academics, students, government agencies and commercial organisations.

### RESEARCH FACILITIES



**KJELDAHL ACID DIGESTION**  
used for the decomposition and digestion of organic compounds



**AUTOMATED FIBRE ESTIMATION SYSTEM**  
to determine cellulose, hemicellulose and lignin in plant/ feed/ food samples



**AUTOMATED DISTILLATION & TITRATION SYSTEM**  
to determine the total nitrogen content



**COLD EXTRACTION SYSTEM**  
for Defatting of Fibre



**UV - SPECTRO PHOTOMETER**  
to determine chemical composition of pith/ fibre



**FLAME PHOTOMETER**  
to determine Na, K and Ca in pith/ fibre

### KEY CHEMICAL TESTING PARAMETERS CONDUCTED ON COIR PITH/FIBRE

- 🌿 pH
- 🌿 Electrical conductivity
- 🌿 Salinity
- 🌿 Total Dissolved solids
- 🌿 Ash content
- 🌿 Moisture content
- 🌿 Nitrogen
- 🌿 Phosphorous
- 🌿 Potassium
- 🌿 Sodium
- 🌿 Calcium
- 🌿 Lithium
- 🌿 Crude fibre
- 🌿 Organic carbon
- 🌿 Organic matter
- 🌿 Chloride
- 🌿 Lignin
- 🌿 Cellulose
- 🌿 Hemicellulose





# DISCOVERING THERMAL CONDUCTIVITY:

## AN INDIGENOUS SETUP FOR COIR MATS INSULATING POTENTIAL

**Mr. Siji Kumar T S**

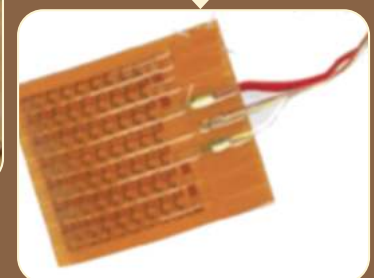
Assistant Professor  
Department of Mechanical Engineering  
SCT College of Engineering, Thiruvananthapuram

As sustainable materials gain prominence in modern construction, the need to accurately measure their thermal properties becomes crucial. In a pioneering experiment, a novel indigenous setup was employed to determine the thermal conductivity of coir mats with air-filled void spaces, shedding light on their insulating capabilities.

The heart of the setup is a custom-built 150 W IR lamp, resembling a miniature solar heater. The significance lies in IR radiation's role as a key component of solar radiation, aligning experiment findings with actual environmental scenarios. An aluminium plate of (100 mm x 100 mm x 2mm) grade 1100 having a thermal conductivity of 237 W/mK is heated up at a distance of 20 cm. Thermocouples are installed on both sides of the plate and connected to a data acquisition system (Agilent-2099A). On the opposite side, a heat flux sensor (HFS-03) gauged the transmitted heat energy (q).

The methodology hinges on establishing an equivalent thermal conductivity (ke) for the coir mat. The experimental setup's ingenuity lies in its ability to measure the material's thermal properties in tandem with air-filled void spaces. Air voids play a significant role in the thermal properties of insulating materials. Void spaces act as barriers to heat transfer by reducing solid-to-solid contact. Theoretical calculations rested on the equation:

$$k_e = k_a \phi + (1 - \phi)k_c$$



where ke, ka, and kc are equivalent to thermal conductivity, the thermal conductivity of air and the thermal conductivity of coir material, respectively.  $\phi$  is the void fraction of air in the coir mat.

The method's practical implementation unfolded in two steps. Initially, the thermal conductivity of the aluminium plate was derived, serving as a benchmark. Subsequently, coir mat-adorned aluminium plates underwent testing. By comparing the second case's thermal conductivity with that of the first, the ke of the coir mat was determined. Astonishingly, this setup yielded an equivalent thermal conductivity of 0.039 W/mK for the coir mat, closely mirroring the theoretically calculated value of 0.043 W/mK.

The implications of this breakthrough are extensive. The rapid and accurate method can be widely applied to assess diverse grades of coir, establishing their viability as insulation materials for various applications such as wall insulation. Additionally, the setup holds promise for determining time lag/ decrement factor etc., that are essential factors in thermal insulation.

By merging indigenous ingenuity with cutting-edge methodology, this experiment introduces a swift and effective means of quantifying thermal conductivity. As sustainable solutions surge in demand, the ability to gauge the efficiency of materials like coir becomes indispensable. With this breakthrough, the path to energy-efficient, eco-friendly construction becomes more evident.

# DEVELOPMENT OF CHEMICAL AND BIOLOGICAL SYSTEMS TO TREAT RET LIQUOR

Extracting coir involves retting, which separates the fibres from the husk. Conventional retting involves soaking husk in water, leading to the breakdown of non-fibrous components. This process generates a by-product called “retted water,” a pollutant. The mechanical extraction of coir fibre is an alternative to conventional retting. Mechanical extraction of husk is instantaneous but yields coir fibre that may photo oxidise to brown colour with a harsh texture. Soaking the fibre for 24 hrs immediately after de-fibring helps to reduce the light fastness and to retain good texture. This washed water (ret liquor) is distinctly brown due to Polyphenols, tannins, pectins etc. The discharge of ret liquor to water bodies is harmful to the environment. Hence NCRMI aimed to develop a proper treatment system to recycle the water.



Chemical treatment of ret liquor

## CHEMICAL TREATMENT RET LIQUOR

The physical and chemical properties of ret liquor were studied. Various chemicals were tried to settle down the polluting components. Among the substances tested, treating the effluent with 0.02% alum was an effective method to clarify and remove impurities from ret liquor. Aluminium Sulphate, or Alum, is commonly used as a coagulant in water and wastewater treatment processes. It destabilises the suspended particles and colloidal matter in the effluent, allowing them to come together and form larger flocs that can be easily settled or filtered out. These flocs capture and bind fine suspended particles, including contaminants like solids, organic matter, and some heavy metals. Gentle stirring or mixing encourages the formed flocs to grow larger by collision and attachment. Alum reacts with the

water to form aluminum hydroxide flocs. After flocculation, the mixture is allowed to settle in a sedimentation tank. The clarified water is carefully decanted or pumped out from the top.

Experimental studies showed that treating effluent with 0.02% alum produces clear water that can be reused for one more washing cycle. The alum treatment also reduces the electrical conductivity of the effluent.

## ANAEROBIC FERMENTER FOR THE BIOLOGICAL TREATMENT OF RET LIQUOR

Prototypes of different fermenters were designed to study the behaviour of biological treatment on ret liquor. A double-chambered fermenter design showed good reduction of ret liquor’s Biological Oxidation Demand (BOD). The treatment system is designed so that the first chamber has a mixture of cow dung slurry, cheese whey, and effluent from the paper industry. This combination act as a source of bio inoculum for the anaerobic digestion of coir ret effluent. Half portion of the second chamber is filled with coconut shell pieces through which anaerobically digested effluent passes, providing a filtration effect to the treated effluents. The integration of chemical and biological processes in the treatment system has proven to be synergistic. Chemical treatments help in breaking down complex organic compounds and facilitating the subsequent biological degradation, leading to enhanced overall treatment efficiency. NCRMI is undertaking researches to find novel ways to utilize the ret liquor-treated sludge.



Anaerobic Fermenter for the biological treatment of Ret liquor



# EMBANKMENT PROTECTION OF PONDS USING COIR GEOTEXTILES



## **NCRMI Project – Pond stabilisation done using coir Geotextiles at Minnamcode, Trivandrum**

In the rural areas of Kerala, especially in the Alappuzha district, small ponds are used for domestic and farm purposes. However, during monsoon, the side banks of these ponds erode, and the ponds get silted up. This necessitates continuous maintenance, which is expensive. Conventional solutions, such as building stone bunds around ponds, are only viable in some cases. This leads to the neglect of ponds, resulting in water shortage during the summer season.

NCRMI found it socially relevant to explore an alternative that effectively reduces soil erosion, enhances soil moisture and vegetation growth, and is economically attractive. NCRMI created a model where coir geotextiles can be used for embankment protection of ponds and provide an alternative, cost-effective option for watershed management to reduce soil erosion and increase vegetation.

After desilting and clearing the pond, the embankment is levelled and cleaned. The top of the embankment is flattened, and the coir geotextile is laid on it. One end of the geotextile is fixed on top of the embankment using bamboo pegs and rolled down along the sloping face of the embankment. The other end is fixed at the bottom of the pond. The geotextiles overlap each other by at least 30 centimetres. Before fixing the geotextile sheet, grass seeds sprayed with cow dung are planted under the geotextile. The geotextile provides a structural lattice in which the vegetation can take root. Furthermore, the geotextile will biodegrade in a few years, leaving vegetation with well-established roots that will stabilise the pond's banks. Using coir geotextiles for embankment protection resonates with NCRMI's guiding principle of coir research to solve real-world problems.



### **Advantages**

- ✦ It is totally a green technology
- ✦ Material is fully eco-friendly
- ✦ No use of steel, Cement and sand
- ✦ Easy construction, maintenance and cost effective.

## **NCRMI Project – Pond stabilisation done using coir Geotextiles at Mararikulam, Alappuzha**

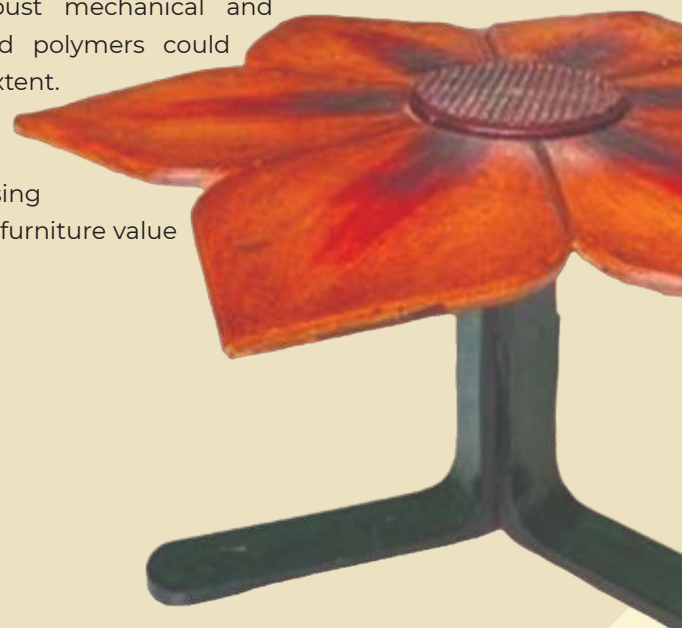
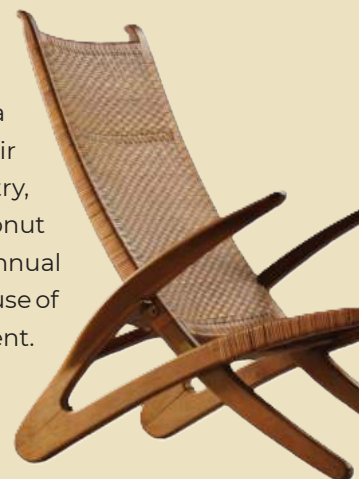
# COIR POLYMER COMPOSITES FOR FURNITURE APPLICATIONS

Wood has been a standard building and furniture material for centuries. However, with the rise of global warming and increasing public consciousness about deforestation, there is an increasing demand for wood alternatives. Furthermore, increasing cost of labour for fabrication is a major concern in the furniture industry. If readymade furniture with aesthetic design can be made with moulded parts using alternate materials, it will be a big boost to the furniture industry.

Green composites are one such alternative to wood. Green composites are eco-friendly materials composed of natural fibres which offer sustainability and green chemistry. Among the various natural fibers produced in India, coconut fiber, commonly known as coir, has the shortest renewable time and stands next to jute fiber in production. India accounts for more than two-thirds of the world's production of coir and coir products. Kerala is home to the Indian coir industry, (particularly white fiber), accounting for 61% of coconut production and over 85% of coir products. The annual production of coir is about 250,000 tons. The use of coir also fosters local economic development.

A collaborative project between NCRMI and CSIR-National Institute for Interdisciplinary Science and Technology (CSIR-NIIST) paved the way for designing and developing coir-polymer composites with high performance as a substitute for wood. Coir fibre reinforced polymer composite products are the best alternative to wooden furniture due to their advantages over synthetic fibre reinforcement in terms of relatively low cost, low weight, non-toxicity, less damage to processing equipment, improved surface finish of moulded parts, abundant availability, renewability, recyclability, biodegradability, and robust mechanical and thermal properties. Coir fibre-reinforced polymers could replace plastic polymers to a great extent.

NCRMI's research also proved that different intricate shapes can be fabricated using Coir fibre-reinforced polymer composite using different processing technologies. NCRMI's efforts are thus transforming the furniture value chain to make it more sustainable and economical.





# COIR MATTINGS, MOURZOUKS AND RUGS

## —COIR MATTINGS—

Coir matting is typically handloomed with sturdy construction. Artisans play a vital role in achieving the desired aesthetics and finish. Coir matting can also be produced using semi-automatic and power looms. Multi-shaft weaving techniques can create a wide range of designs, and the width of the mats can vary from 60 cm to 5 meters. Based on the weaving patterns, handloom/powerloom mattings are classified into – two treadle plain weave [Panama matting, Saloon matting, Ribbed matting], three treadle weave, four treadle weave (Spot or Dot Matting). Patterns/designs beyond the capacity of 4 shaft looms are woven on Dobby/Jacquard looms.

## COIR —MOURZOUKS—

Coir Mourzouks come in various sizes and patterns and are commonly used for furnishing. The unique feature of the mourzouk weave is that it hides the warp threads with weft threads to create an exceptional surface pattern. Design is visible on both sides, and the mourzouks are sturdy and heavy. Intricate designs can be made using coloured weft threads on a plain weave base structure.

## —COIR RUGS—

Coir rugs can be produced in various sizes and designs by cutting coir mattings to the specified length and finishing them accordingly. The mattings can be completed by knotting the warp strands (fringed ends), drawing in ends (tucked in ends), or binding ends (ends bound with jute/cotton webbing).

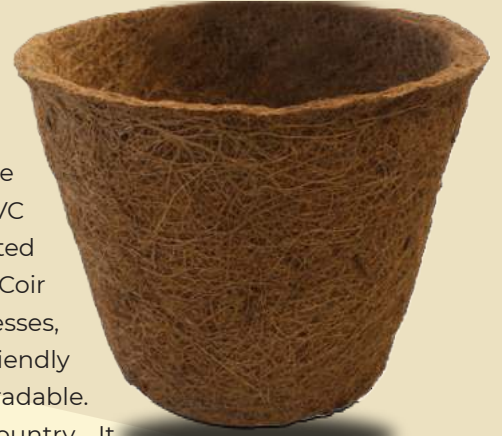


# COIRFED

THE APEX BODY OF COIR CO-OPERATIVE SOCIETIES



Established in the year 1979 as the Apex Federation of primary Coir Co-operatives functioning in the State, Coirfed, play a pivotal role in the coir sector of the country. Coirfed runs 11 factories for producing various coir related products. These include units for PVC Tufted mats, Latex Tufted mats, Rubberized Coir Products(RCP),mattresses,



cushions, among others. Coirfed also sells its innovative and eco-friendly rubberised coir pots called “Coco Green Pot”, which is durable and biodegradable.

Coirfed runs several successful signature shops throughout the country. It has 25 showrooms in various states. Through these outlets, Coirfed’s innovative and versatile products like Rubberized Coir Mattresses, Coir Mats, Matting’s, PVC Tufted Mats, Rubber Backed Door Mats, Coir Tiles, Cocofert Organic Fertilizer, Coco Pot, Inoculated Pith and many other products are made available for individual and commercial customers. As part of Coirfed’s foray into other marketing areas, a Neethi Medical Store has been set up at Valiyakulam Junction, Alappuzha. Effective leadership is propelling Coirfed to make historical changes and explore avenues for accelerated growth that ensure values of equity and sustainability

**ഈ ഓണത്തിനും കയർഫെഡ് നിങ്ങളോടൊപ്പം**  
കയർഫെഡ് മിന്നും പൊതോണം സ്വർണ്ണ സമ്മാന പദ്ധതി

2023 ഓണം വിപണന പദ്ധതി കാലയളവിൽ 2000 രൂപയിൽ കൂടുതലുള്ള ഓരോ പർച്ചേസിനും ഒരു ബില്ലിൽ ഒരു കൂപ്പൺ വീതം നൽകുന്നതാണ്.

**1+1 സൗജന്യം** 50% വരെ വിലക്കുറവ്

6900 രൂപ വിലയുള്ള വാബിൾ കോട്ട് കെട്ടുകൾക്ക് അതേ അളവിലുള്ള ഒരു കെട്ടെ സൗജന്യം

**വാബിൾ കോട്ട് കെട്ടുകൾ 3400 രൂപ മുതൽ**

\*അതേകാലയളവിൽ പീറ്റോ, ബെബിൾ, RC 3 മാറ്റ്, മാൽ അറ്റ് ചുറ്റും മാത്രം

- ഒന്നാം സമ്മാനം 3 പവർ
- രണ്ടാം സമ്മാനം 2 പവർ
- മൂന്നാം സമ്മാനം 1 പവർ
- സമാശ്വാസ സമ്മാനം 1 ഗ്രാം (വീതം 50 പേർക്ക്)

2023 ഓഗസ്റ്റ് 1 മുതൽ സെപ്റ്റംബർ 15 വരെ



## CLOSING CEREMONY OF FRAME MAT TRAINING AT PURATHOOR COIR CO-OP, MALAPPURAM





NCRMI as part of the consultancy activities, is also imparting training on product manufacturing, mainly mats and coir geotextiles. From statistical analysis, it is evident that Frame mats have good marketing scope in the present market scenario. By upskilling the women workers of coir cooperative societies the workers can be equipped for commercial production of frame mats using low cost infrastructure.

Based on requirement, NCRMI is conducting a 45 day training program on frame mats manufacturing including Corridor Mat, Sinnet Mat, Round Mat & Mesh Mat. All aspects regarding the manufacturing of frame mats is covered on a factory mode in the shop floor. A wide range of attractive designs and colours with good quality products are being trained for manufacture during the program. NCRMI associates with leading design institutes like NIFT, IFTK etc. for development of new attractive designs.



# FRAME MATS TRAINING



# MUHAMMA LABOURERS SOCIETY

Foreigners such as James Darragh and Henry Smail were among the first to identify the immense potential to create high quality rope and coir products from Kerala coir. Many foreigners were soon attracted to setup business in and around Alappuzha and Cherthala. In the mid-70s, one such company, William Goodacre and Sons, handed over some of its assets to its workers in lieu of gratuity thanks to the timely intervention of the labour union.



Thanneermukkam route. Since then, the Muhamma Co-operative Society has been bringing

2.46 acres of company land was obtained in the name of 38 workers. The workers, with the support of Muhamma Coir Factory Workers Union, started efforts to run the factory from 1979 to ensure employment for the workers. On 24 March 1980, the Labourers Coir Mat and Mattings Cooperative Society was registered, and manufacturing activities were initiated. The factory is located on the Alappuzha-

quality handloom mattings and rope products to the market. Today their products are exported globally. The present president of the society is Sri. C K Surendran and the Secretary is Sri. Bimal P. In 2022-23 the co-operative had a turnover of 2.54 crores. They are presently engaged in the manufacture and export of coir yarn, coir mats & mattings, coir geotextiles, coir pith and other quality coir products.

# COCOTUFT

Back in 1917, a visionary Mr. Velayudhan founded a coir exporting business in Alleppey, the land of coir. Values like trust, dedication and professional ethics formed the basis of this century-old business group. What started as a coir exporting company has grown to be a INR 500 crore annual turnover business group comprising of a Super Specialty Hospital, Technical Institutes, social welfare establishments and more. Cocotuft attributes its success to its dedicated workforce that share the vision for excellence and continuous improvement.

Cocotuft's diversified portfolio today consists of floor covering in coir, cotton, wool, rubber, jute, sisal and synthetic textiles and health care. In 2020 Cocotuft became the largest exporter of doormats from India exporting 2500 container loads to over 85 countries. Cocotuft's design pallet includes more than 15 catalogues containing 20,000 designs that help develop market-oriented and buyer-centric design themes. Onlymat, the Indian brand of Cocotuft, has grown to become the largest e-commerce company in India for mats and carpets.





# NOVEL FERTILIZERS FROM COIR PITH USING AZOLLA

**Dr. Sevichan P J**

Organic Rich, PV Exports,  
Muhamma, Alappuzha, Kerala – 688 525

Coir pith is a by-product of coconut husk produced during coir fibre extraction. Fresh coir pith is not suitable for farming because it contains high amounts of polyphenols and salts. Partly decomposed coir pith is called coco peats. Fresh coir pith conducts heat: hence, it is called high EC (Electric Conductivity) coir pith. When it is washed or subjected to the activity of natural microbes or fungi, coir pith becomes low EC coir pith or coco peat suitable for agriculture.

An organic Rich unit under PV Exports is one of the rarest units in India that cultivates Azolla on an industrial basis. Azolla is a water Fern rich in proteins, macronutrients, micronutrients, enzymes, hormones etc. The modern methods of agriculture depend heavily on chemical fertilizers, especially Nitrogen. Azolla is a very important biofertilizer that fixes atmospheric nitrogen due to the presence of cyanobacteria *Anabaena* (Blue Green Algae) in its leaf cavities. Because of its high protein content, Azolla is used as cattle feed, poultry feed, and fish feed and is edible for human consumption too, for making 'thoran', 'vada' and cutlet. In several countries, it is grown with rice as a dual crop for providing

fertility in the soil. The Azolla-fish-rice method of triple farming is practised in China, Vietnam, Korea etc.

Azolla fixes atmospheric carbon dioxide and nitrogen. Azolla can fix 120 kg of nitrogen per hectare per year in the paddy field. Azolla is the main ingredient in our organic fertilizers.

We, at Organic Rich, are making use of the potency of Azolla to create organic fertilizers like Azolla Plus, Farmate Fertilizer, CPOM Flower Mix etc.

Azolla Plus is bio-enriched coir pith-based organic manure. Azolla, marine fish, and neem cake are packed in between the coir pith layers. Water is applied to the composite for three months. It is mixed with wood ash, Azolla, and coconut water to make Azolla Plus. Farmate Fertilizer is a bio-enriched coir pith organic manure with Azolla, marine fish, neem cake, and slurry. CPOM Flower mix contains Azolla, coir pith, and mushroom, subjected to watering for 30 days. The coir pith compost is then mixed with bone meal to make it an important organic fertilizer.





Department of Coir Development  
Government of Kerala, India



National Coir Research  
& Management Institute



National Coir Research & Management Institute (NCRMI)

Kudappanakkunnu P.O., Thiruvananthapuram – 695 043

— KERALA, INDIA Tel. 0471 2730788 —

E.mail:ncrmikerala@gmail.com | Website: www.ncrmi.org