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Study On Coir Fiber Reinforcement Composite Technique

L.Nagarajan[1] , K.Venkateshwarlu[2] , S.Karthik[3] , P.Abarna[4]

[1] Associate Professor, Department of Textile Technology, Jaya Engineering College, Chennai.
[2] Stduent of M.Tech Department of Textile Technology, Jaya Engineering College, Chennai
[3] Assistant Professor, Department of Textile Technology, Jaya Engineering College, Chennai.
[4] Assistant Professor, Department of Civil Engineering, Jaya Engineering College, Chennai.
texhod@jec.ac.in

ABSTRACT
This paper reviews various manufacturing techniques of nonwoven fabrics from coir fiber. It has been seen that needlepunching process is mostly used for manufacturing nonwoven structure from coir fiber. Various physical, mechanical and functional properties of needle-punched coir-nonwovens have been discussed here. The influence of various factors on various properties of coir-nonwoven such as Thermal Insulation, Air Permeability, Compressibility, Water Absorbency and Acoustic Insulation has been reported. A huge growth of potential applications of coir non-woven in various field of Geo-textiles, Dry filtration, Household goods, Agriculture and Horticulture, Acoustic and Thermal insulation have been observed.

Keywords: Fiber extraction, Nonwoven, Natural Fibers-coir Needle Punching, composite preparation with resin finish.

I. Introduction

The natural fibers like Banana, Coir, Cotton, Sisal and Jute have attracted the attention of scientists and technologist for application in consumer goods, low cost housing and other civil structures. Nonwoven products are taking the place of many woven and knit materials because of their lower cost and lighter weight. Nonwoven fabrics are also predominating in the geo textiles industry because of their higher permeability, better friction and construction survivability compared to that of woven product. The fibers apart from low cost and renewable in nature, it is more attractive as reinforcing material. The use of natural material gives the user or a designer more inspiration and indicates the flow and performance of a product.

Nonwoven is usually made by producing a web of fibers, which is then strengthened by various bounding techniques. More recently needling has been used in the production of higher performance fabrics. There have been developments in the speed of the needle punching machines. Taking punching speeds to 920 strokes per minutes and increasing needle densities. Special advantages have been claimed for the new process developed by manufacturing companies in which

the web is needled from both sides by inclined needle. This process and others have been successful in the production of good quality nonwoven mats. The natural fibers have started to be used again because of being naturally derived from plants and due to their characteristics of being light weight compared to glass. The plant fibre reinforcements are resoluble, good insulator of heat and sound, degradable and have a low cost. Natural fibre can be substituted for glass and carbon. Natural fibre apart from low cost eco-friendly and renewable in nature, it is more attractive as nonwoven and as a reinforcing material in composites, a great deal of emphasis has been focused on the development and application of natural fibre nonwoven reinforced composite materials in many industries. The demands of these industries are weight retention and fuel economy and several automobiles have been constructed using natural fibre nonwoven with epoxy resins. Since then the investigator or researcher selected the natural fibres such as, Coir and to prepare nonwoven.

II.Literature Review

Nonwovens are fibers in the form of webs, which have to be bonded. Fiber bonding methods are generally chemical, thermal and mechanical. The development are taken place in the process of manufacturing a nonwoven such as spun bonding, spun lacing, air laying, cross lapped nonwovens, formation of random nonwoven webs with the static method, needle punching nonwoven. Due to continuous research a newer nonwoven products started developing such as development of eco-friendly Nonwoven product by solubalisation of viscose, production of nonwoven fiber board panel and latex foam sheet using coir and polypropylene blend, needle punched nonwoven blankets, the vertical and horizontal type of nonwoven products also starts utilizing for automobile interiors.

Coir composites exhibit average values for the tensile strength, flexural strength and impact strength of 15.86 MPa, 32.08 MPa and 11.69 kJ/m2, respectively. These values are significantly lower than those measured for GFRP laminate specimens. Further research work needs to be carried out in the development of natural fiber composites. This is important if new improved materials are to be developed for safe usage against crack growth and environmental pollution. Hybrid fiber composites with coir and other fibers rather than glass may open up new applications. However, as inferred from the results presented here, significant improvements in strength and fracture characteristics must be realized for this class of materials.

Research on material and helmet shell production has been studied. Hand layup process was employed to produce industrial helmet from renewable sources. Coir fiber of 10, 20, 30, 40 and 50 wt% were introduced separately into epoxy resin matrix and their mechanical properties investigated. The composite material made with 30 wt% coir fiber gave the highest impact strength 26.43 N/mm2 and was therefore selected for helmet fabrication. The produced helmet shell has acceptable compressive strength and reduced weight. The 50 wt% coir fiber composite have the least impact strength of 20.12 N/ mm2 followed by that with 10

wt% coir. It has shown that 30 wt% coir with epoxy reinforced composite material has sustainable strength for the application of industrial safety helmet and their mechanical properties compare well with those of ABS and PC plastic which is commonly used in the production of helmet. For further research, other matrix materials such as polyester resin can be suggested and mechanical tests such as impact test and penetration test should be carried out on the helmet prototype. Helmet shell needs a specially designed mould. In this research, mould is fabricated using already made helmet shell. This posed the difficulty of not having positive and negative mould. From literature, helmet shell mould can be fabricated from concrete mould or aluminum mould, but the problem is that it needs higher capital and longer time to fabricate. Mould made from concrete and aluminum can be used more than once and is suitable for large- scale production. Apart from helmet, the coir/epoxy resin composite fabricated could also find application in building construction such as partitioning.

The coir fiber-reinforced vulcanized rubber composite can be used in insulations, mattresses, and toys. It can also be used in automobile tires. Different weight percent- ages can also result in significant changes in the properties of the material. Research can be done on the interfacial bonding between fiber and rubber.

Natural fiber:

1. Wool
2. Silk
3. Jute
4. Hemp
5. Rayon
6. Cotton
7. Coir

Coir

The thickest and most resistant of all commercial natural fibres, coir is a coarse, short fibre extracted from the outer shell of coconuts. Its low decomposition rate means is a key advantage for making durable geo-textiles.

Coconut fiber is extracted from the outer shell of a coconut. It is the natural fiber of the coconut husk where it is a thick and coarse but durable fiber. The common name, scientific name and plant family of coconut fiber is Coir, respectively. There are two types of coconut fibers, brown fiber extracted from matured coconuts and white fibers extracted from immature coconuts. Brown fibers are thick, strong and have high abrasion resistance. White

fibers are smoother and finer, but also weaker. Both brown and white coir consist of fibers ranging in length from 4-12 inch (10-30 cm). Those that are at least 8 inch (20 cm) long are called bristle fiber. Shorter fibers, which are also finer in texture, are called mattress fiber. A 10-oz (300-gm) coconut husk yields about 3 oz (80 gm) of fiber, one-third of which is bristle fiber. Industries based on coir have developed in many coconut producing countries especially India, Tanzania, Kenya, Bangladesh, Burma, Thailand, Sri Lanka, Nigeria, Ghana etc.

Chemical Composition of Coconut / Coir Fiber:

- Lignin……45.84%
- Cellulose……43.44%
- Hemi-Cellulose……..00.25%
- Pectin's and related Compound……..03.00%
- Water soluble……..05.25%
- Ash……..02.22%

Physical Properties of Coconut / Coir Fiber:

- Length in inches……..6-8
- Density (g/cc)……1.40
- Tenacity (g/Tex)……10.0
- Breaking elongation%.....30%
- Diameter in mm……..0.1 to 1.5
- Rigidity of Modulus…1.8924 dyne/cm2
- Swelling in water (diameter)…….5%
- Moisture at 65% RH……..10.50%

Benefits

Coir is a material which is widely used to overcome the problem of erosion. When woven into geo-textiles and placed on areas in need of erosion control it promotes new vegetation by absorbing water and preventing top soil from drying out. Coir geo-textiles have a natural ability to retain moisture and protect from the suns radiation just like natural soil, and unlike geo-synthetic materials, it provides good soil support for up to three years, allowing natural vegetation to become established.

III.Conclusion

The definition of textile gives the understanding of the types and forms of textile materials. This is very important to understand and acknowledge the contribution of textile material as composite reinforcement. Even for fibre, basically limit to low and medium load bearing applications. Thus, research emphasized to improve the fibre reinforced composite to suit the purpose of application should be and will be continued. Utilization of textile fabric in composite as reinforcement is well recognized for high performance fabric so it is with natural fabric. Nonetheless, there is a limit of work considering fabric properties or parameters when characterize its composite to understand the fabric contribution in composite material.

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