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ARECA FIBER BASED COMPOSITES – A PERSPECTIVE REVIEW

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***Abstract*-** **Natural Fibers are the great gift of the nature. Due the vital advantages of natural fibers namely Cost effective and surplus in nature, blending with matrix makes its effective in case of thermal, Physical, Chemical and Mechanical Properties to be used for applications. So this paper deals with the review of the areca which is natural fiber and its effect on various properties after mixing with Synthetic Matrix forming composites.**

Keywords: **Natural Fibers, Areca Fiber, Synthetic Matrix, Composites, Mixing.**

I.INTRODUCTION

Plant resources play a vital role in mankind. The benefit of using natural fibers is that, they are versatile, their suppleness in characteristics, biodegradability and broad distribution all over the earth. Fossil-based resources are limited, and are more intentionally located than the main petroleum and natural gas reserves. About 97% of all chemicals are obtained from petroleum and natural gas [2]. Researchers have projected that the portion of plant resources for chemical and material needs will exceed 20% per year over next decade [3]. Global consumption of oil will increase by 60% over the next 10 years. Researches in biotechnology are projected to make bio-polymers cost-effective with their petroleum based counterparts by 2012 to 2017.The prominence of composites has experienced a steady growth and is expected to continue its reputation. The fiber-reinforced polymer promote was expected to be 1.04 million metric in 2002, and is expected to increase by 15% in volume [4].

The term „composite" in material science refers to a material made up of a matrix

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containing reinforcing agents. Reinforcement is the part of the composite that provides strength, stiffness, and the tendency to withstand load. Wood is a natural composite of cellulose fibers in a matrix of lignin. In manufacturing, fibers are the most frequently used reinforcement that produces Fiber Reinforced Composite (FRC). The reinforcement is embedded into the matrix. Widespread of matrixes includes mud (wattle and daub), cement (concrete), polymers (fiber reinforced plastics), metals and ceramics. The most common polymer-based composite materials include fiberglass, carbon fiber and Kevlar. Fiberglass is one of the known reinforcing composite materials that were introduced in 1940, incorporating glass fiber reinforcement of unsaturated polyester matrix [6]. Christo Ananth et al. [5] proposed a system, this fully automatic vehicle is equipped by micro controller, motor driving mechanism and battery. The power stored in the battery is used to drive the DC motor that causes the movement to AGV. The speed of rotation of DC motor i.e., velocity of AGV is controlled by the microprocessor controller. The Origin of composite materials may have been the bricks fashioned by the ancient Egyptians from mud and straw. The ancient brick-making process can still be seen on Egyptian tomb paintings in the Metropolitan Museum of Art. Commercialization of the composites could be traced to early century when the cellulose fibers were used to reinforce phenolics, urea and melamine resins [7]. Composites in the current scenario have wide range of applications, wherever high strength-to-weight ratio remains and important consideration for use. Its primary use is found in automotive, marine and construction industries. In greater part of cases, requiring high performance in the automotive and aerospace industries, the irregular phase or filler is in the form of a fiber. In the majority of the cases, composite matrices are the thermosets having carbon and ceramics for high temperature applications. Thermosets (epoxy, polysulfones) and thermoplastics (polyether ether ketone, polyimide) due to high strength and performance lead the way for research and industrial applications. Nano-composites in the latest advances have high aspect ratio and improved electrical, mechanical and thermal properties.

II. ARECA FIBERS

Areca fibre is a kind of about 50 species of plms in the family arecaceae found in humid tropical forests from China and India, across the Malay Archipelago, to the Solomon Islands [10]. The generic name *Areca* is derived from a name used locally on the Malabar Coast of India [11]. It is a straight, unbranched palm reaching altitude of 12-30 m, depending upon the ecological circumstances. The stem, marked with scars of fallen leaves in a regular annulated form, becomes visible only when the palm is about 3 years old. Girth depends on genetic variation and soil conditions. Root system

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adventitious, typical of monocots. The adult palm has 7-12 open leaves, each with a sheath, a rachis and leaflets. The leaf stalk extends as the midrib until the end of the leaf and ends as leaflets.

The husk of the Areca is a hard fibrous portion covering the endosperm. It constitutes 30–45% of the entire size of the fruit. Areca husk fibers are chiefly composed of hemicelluloses and not of cellulose. Areca fibers hold 13 to 24.6% of lignin, 35 to 64.8% of hemicelluloses, 4.4% of ash content and left over 8 to 25% of water content [12]. The fibers adjoining the inner layer are irregularly lignified group of cells called hard fibers and the portions of the middle layer contain soft fibers. Areca fiber is highly hemi cellulosic and is much greater than that of any other fibers. The Biometrical and Physical Properties of Areca Fiber are given in the table 1.Coir has higher lignin content than fibers. Areca fibers are hard and show similarity to coir fibers in cellular structure. The unmanaged green Areca husks left in the agricultural estate show the way to terrible odors and other decompose-linked ecological problems. Therefore widespread preparation for the clearance of this material is necessary. The present use of this highly hemi cellulosic material is as a boiler fuel when satisfactorily dried. However for the use of these fibers as a reinforcing material for composites, a study of the chemical and physical characteristics is necessary. Usually acids and alkalis have been used for modifying the properties of natural fibers like jute, coir etc. Strong alkali solutions show the way to a decrease in strength and increase to in elongation does not root significant lowering in strength which was studied by G.C. Mohan Kumar.

Table 1 Biometrical and Physical Properties of Areca Fiber

Table 1

Diameter		Length of fiber (mm)			Density
(mm)					(g/cm3)
	short	medium	long	average	
0.285	18-29	30-38	39-46	29-38	05
0.89					1.25

Based on the previous research of using Areca fibers as a possible reinforcement in Phenol Formaldehyde or Urea Formaldehyde resin [13] and the mechanical performance of phenol formaldehyde resin can be greatly improved by the incorporation of these fibers. G. Kalaprasad [14] studied the chemical surface modifications such as alkali, acetic anhydride, stearic acid, permanganate, maleic anhydride, silane and peroxides given to the sisal fibres [21, 22]. Fibers and matrix were found to be victorious in getting better the interfacial bond and compatibility between the fibre and matrix. The nature and

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extent of chemical modifications were analyzed by infrared spectroscopy while improvement in fibre- matrix adhesion was checked by studying the fractography of composite samples using a scanning electron microscope. Assessment of water retention values has been found to be a successful tool to characterize the surface of the stearic acid modified fibres [23, 24].

Fig 1 Areca Fibers

III. DEVELOPMENT OF COMPOSITES

Fiber Extraction and Alkali Treatment

The Areca Fibre composites are first obtained from barks of the areca tree; it is then treated with NaOH or KOH solution. Based on the previous studies on natural fibers [14-16] treating chemical will alter all the properties namely mechanical, thermal etc. The forthcoming says about the effect of chemical treatment with NaOH or KOH of Areca fiber on mechanical properties. Fibers to be soaked in the 5-25% of solution up to 5– 60 hours as per requirement. These fibers were further washed with water containing few drops of acidic acid. Finally, the fibers were washed again with water and dried. This conduct leads to the irreversible mercerization effect, which increases the amount of amorphous hemicelluloses at the expense of crystalline cellulose. Mercerization treatment improves the fiber surface adhesive characteristics by removing natural and artificial impurities. The treatment results in clean fiber surface. The study reveals that weight of the Areca fiber was decreased by 8-13% after alkaline treatment [12]. Chemical treatment of natural fiber with NaOH shows that the treatment favourably increases the strength of the fibers. This is because as the crystalline cellulose dissolves, lignin increases in the Areca fiber. Once the Areca fiber is soaked in the alkaline bath, the material considerably shrinks during drying. The disadvantage of Areca fiber soaked with NaOH is that it becomes highly flexible. However the proper soaking time with required percentage of NaOH solution makes the areca fiber usable in the preparation of composites [19, 20].

Preparation of Composites

Fiber configuration and volume fraction are two important factors that affect composite properties. In various research work the areca fibres which are treated with Solution are mixed with urea formaldehyde, melamine formaldehyde, modified Phenolic

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resin with varying proportions will be developed.

The mould was refined and then a mould-releasing agent (Polyvinyl alcohol) was applied on the surface. The fibres were mixed methodically with the matrix materials. This mixture was left for 10 min and then the mixture was filled into the mould. Care will be taken to ensure a uniform thickness of the mat which was pressed in a hydraulic press at the room temperature and a pressure of 0.5 MPa for 30min. After that, the composites will be post-cured at room temperature (27±3°C) for 24h.

Characterization

The prepared composite boards will be post cured for 8 days at standard laboratory atmosphere prior to preparing specimens and performing mechanical tests. The appropriate ASTM methods will be followed while preparing the specimens for test. At least five replicate specimens will be tested and the results will be presented as an average of tested specimens. The tests will be conducted at a standard laboratory atmosphere of 27°C and 46% relative humidity. Impact energy absorbed by the specimens will determined by performing both Charpy and Izod method of impact testing.

Mechanical Testing:

All the tests will be conducted based on the IS2372 Part I – XII series [18], based on the standards following test namely Impact Test, Hardness (Steel Ball Method Test), Water Absorption Test, Moisture Content , Tensile Strength, Compressive Strength, Shear Strength are performed.

IV. CONCLUSION

Thus by using this areca fibre based composites will be helpful in usage for automobile ballet lining to prevent the outside heat entering in to car inside because of the advantages namely Raw material abundance , Low production cost , Light weight , Design flexibility , Machinability, Biodegradable, Good thermal insulator, Less Moisture absorption. Thus not only for the above application it can be also used for packing materials, Furniture, False roofing and Interior decoration.

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