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Coconut Fiber Reinforced Composites: A Review

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Abstract*: Composites are materials made out of a polymer resin reinforced by fibers, merging the high mechanical and physical enactment of the fibers and the appearance, bonding and physical properties of polymers. For these uses the exchange of industrial fibers with natural fibers could be considered. Many natural fibers traditionally employed in weaving, sacking and ropes; present various abilities to be used as reinforcement elements in composites. Reinforced polymer composites have started to play a pivotal role in a wide range of applications due to their high strength and modulus. The fibers used may be synthetic or natural in reinforced composites. Due to high production cost, the usage of synthetic fibers is confined whereas natural fibers apart from being cheap in cost, it is also strong, less weight and amply available.
***Keywords*: Composites, Natural Fiber, Coconut Fiber, Review**

I. INTRODUCTION

Alok Singh et al. [1] describes that the coconut shells are available in abundance in tropical countries as a waste product after consumption of coconut water and meat. Such abundance can fulfil the demand of filler based composites while reducing waste. Procurement and processing of coconut shell powder is cost effective than other artificial fillers. T. Balarami Reddy [2] describes that Coconut fiber belongs to the category fibers/fibrous materials, Coconut fiber is obtained from the fibrous husk (Mesocarp) of the coconut (Cocas Nucifera) from the coconut palm, which belongs to the palm family (Palme). Coconut fibers have high lignin content and thus high cellulose content, as a result of which it is resilient, strong and highly durable. The remarkable lightness of the fibers is due to the cavities arising from the dried out sieve cells. Coconut fiber is the only fruit fiber usable in the textile industry.

II. PHYSICAL COMBINATION

T. Balarami Reddy [2] lists out the physical composition of the coconut fiber in Table I.

Table I Physical Composition of the Coconut Fiber

Green Properties	Percentage (%)	Dry Properties	Percentage (%)
Cellulose	33.61	Total water soluble	26.00
Lignin	36.51	Hemi-celluloses	8.50
Pentosans	29.27	Lignin	29.23
Ash	0.61	Cellulose	23.81

III. PROPERTIES OF COCONUT FIBER

Onuegbu T. U et al. [3] lists out a few of the significant mechanical properties of untreated coconut fiber are given in the Table II

Table II Tensile Results for Untreated Fiber Composites

Property	Values
Tensile Strength (MPa)	28.388
Modulus (MPa)	856.849
Load at Break (N)	1082.634
Tensile Strain at Break(mm/mm)	0.0423
Extension at Break (mm)	4.117

IV. APPLICATIONS OF COCONUT FIBER

Alok Singh et al. [1] found that the mechanical properties viz. density, tensile strength and flexural strength of CSP epoxy composite material is greatly influenced by the CSP filled volume fraction. T. Balarami Reddy [2] finds out that the mechanical properties viz., Tensile strength of the green coconut fiber reinforced HDPE composite material is greatly influenced by fiber length as well as fiber volume fraction and Tensile strength of the composite material decreases with increase in the fiber length. Onuegbu T. U et al [3] reveals that NaOH pre-treatment of coconut fiber has better reinforcing property than the untreated fiber. The treatment was observed to improve the tensile properties (tensile strength, modulus, load at break, tensile strain at break, extension at break) and micro hardness of the composite samples. N. Anupama Sai Priya et al. [4] has found that the static and water absorption behaviour of randomly oriented coir fibers mixed with reinforced polyester composites. The influence volume fraction of coir fibers on mechanical properties of composites was studied. The static and water absorption properties are highly dependent on volume percentage of fibers. Siva.I et al. [5] describes that an increasing trend in strength was observed with respect to increase in fiber volume fraction. Muneerabibi S. Jahagirdar and Shreenidhi R. Kulkarni [6] analysed the changing properties of Vinyl Ester Reinforced with Coconut Fibers and Vinyl Ester Reinforced with Coconut Fibers and Rubber Particles composites are seen from the results of tensile and bending tests. Vinyl ester - coconut fibers composite seems to be more promising for practical applications. Coconut fibers and rubber particles based composites seems more suitable for bending applications. Neeraj Dubey and Geeta Agnihotri [7] have reported the potential of the midribs of coconut palm leaves as an alternate fiber for reinforcement of plastics and propose development of a new natural fiber composite. MCL fiber is found lighter than the many commercial fibers and have potential to develop a lighter composite for moderate strength purposes such as furniture, packaging, boards, sheets etc. Tensile strength of the MCL is found competitive with the other natural fibers. Single fiber pull out strength and the critical length strongly recommend for suitable surface treatment of the fiber to enhance the interfacial bonding with hydrophobic polymers. H. Salmah et al. [8] described that the alkali treatment with sodium hydroxide has enhanced the mechanical and thermal properties of Coconut Shell (CS) reinforced Unsaturated Polyester (USP) composites. The treated USP/CS composites indicate higher tensile strength, modulus of elasticity, flexural strength, flexural modulus and thermal stability compared to untreated composites. SEM study exhibit that wettability and interfacial interaction enhanced between CS and USP matrix with presence alkali treatment was proven by Fourier infrared spectroscopy analysis spectra studied. Emanuel M. Fernandes et al. [9] investigated the mechanical reinforcement strategy of cork powder composites using random discontinuous distributed coconut fibres through melt based technologies. With this strategy it was possible to both improve the mechanical performances of cork-based composites and to increase the natural component on the novel hybrid cork-based composite materials. Salleh Z et al. [10] found that, carbon Komeng coconut shell (CKCS) carbon composites show the good achievement for tensile behaviour because they have the better results for tensile stress, tensile strain and tensile modulus when compared with carbon ripe coconut shell (CRCS) and carbon young coconut shell (CYCS) carbon composites. From the results it was obtained that, the toughness of the samples especially CKCS carbon composite increased when rich with the carbon, silicon and oxygen contents.

V. CONCLUSION

This paper reviewed a few works related to coconut fiber reinforced composites and their properties. It also revealed the reliability of such composites for various industrial applications.

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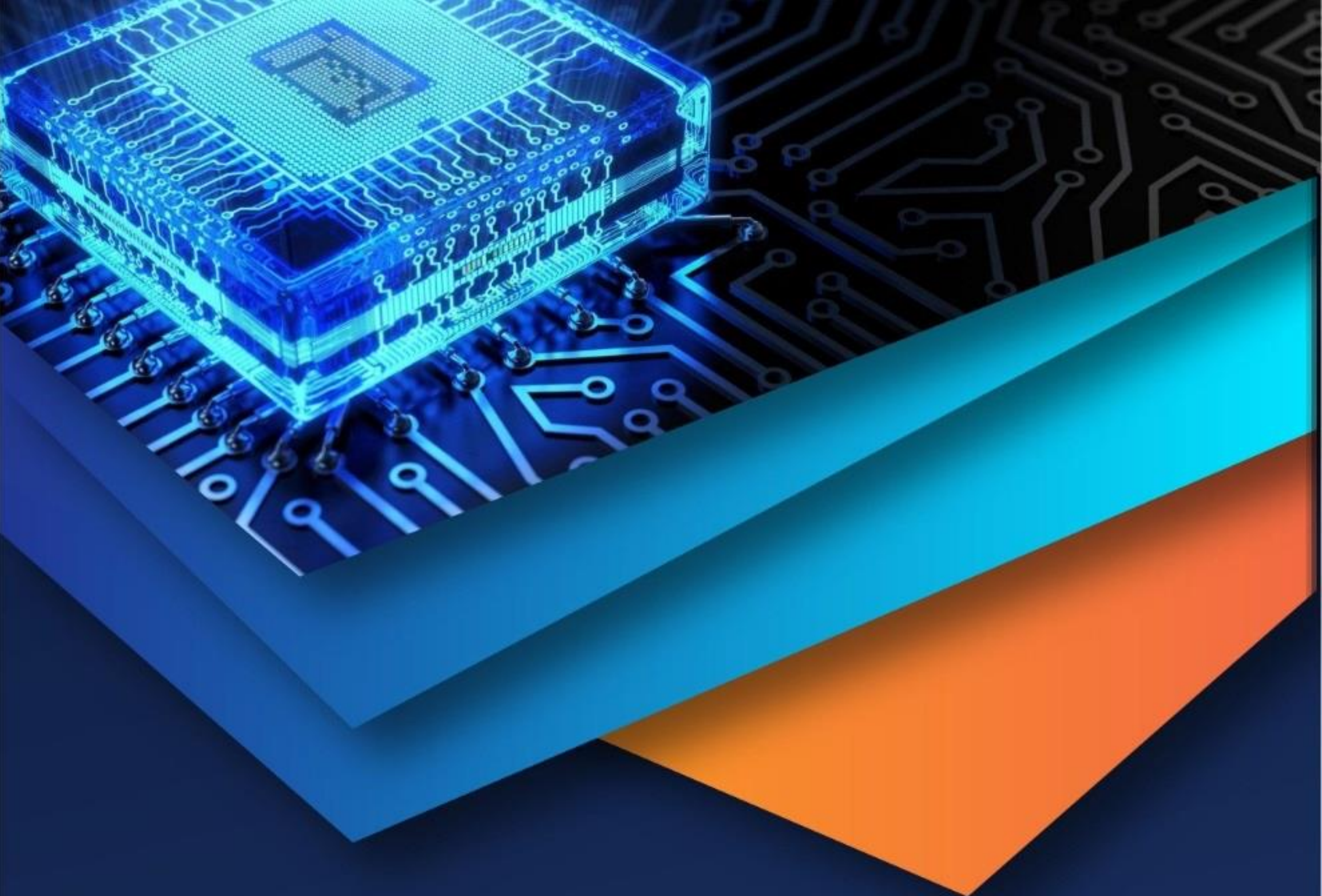

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