



KENAF FIBRE REINFORCED COMPOSITES: A REVIEW

V. R. Raman Bharath¹, B. Vijaya Ramnath² and N. Manoharan¹

¹AMET University, Kanathur, Chennai, Tamil Nadu, India

²Department of Mechanical Engineering, Sri Sairam Engineering College, Chennai, Tamil Nadu, India

ABSTRACT

Natural fiber composites are nowadays playing a vital role in automotive and construction industries. Various natural fibers namely, jute, sisal, kenaf, abaca, hemp and banana are widely used in industries for making composite which are fabricated by either hand layup method or by other mechanized methods. Among the various fibers, kenaf fibers have vast applications in automotive industries. They have indisputable advantages over synthetic reinforcement materials. They are economical, non-toxic with low density. They have very good strength and are associated with less waste disposal problems. This paper aimed to review the properties and applications of kenaf fibre reinforced polymer composites to provide a platform for further research in this area.

Keywords: kenaf, fibre, automotive industries.

1. KENAF FIBER REINFORCED COMPOSITES

Kenaf fiber is getting attention of industries and researchers to utilize it in different polymer composites due to environmental awareness of consumers, industries and government regulations in various countries. Kenaf fibres are reinforced with epoxy resin to form fibre reinforced polymeric composites which improves the strength of the composites. Nishino *et al.* [1] investigated the development of biodegradable composite materials using natural fibers and examined molding conditions, mechanical properties and interfacial bonding. They concluded that the shape, size and strength of natural fibers mainly depend on cultivation environment, region of origin and other characteristics which influence the mechanical properties of fiber composites. Mohanty *et al* [2] found that the Kenaf plant absorbs carbon dioxide approximately 1.5 times of its weight. It represents the highest level of absorption of all of the plants studied by them. Zaveri *et al.* [3] identified that kenaf plants can grow to a height of approximately 3.5m to 4.5m within 4 to 5 months with an annual fiber yield of 6 to 10 tons of dry fiber/acre. This is approximately four times greater than that of southern pine trees. A technical report TR-2101-ENV [4] of the Naval Facilities Engineering service center has evaluated Kenaf core as an absorbent material for cleaning oil spills. The research showed that the core particles outperformed other natural absorbent materials by a significant margin. Some studies have been conducted to characterize the basic tensile properties of kenaf bast fibers. The results indicate that the average tensile strength of kenaf fibers range from 157Mpa to 600Mpa [5-8]. According to ACI Committee 544 [9], the tensile properties of kenaf fibers are comparable to those of other natural fibers such as jute, flax and bamboo, which have been previously used to produce natural fiber reinforced concrete. Kenaf fiber is obtained from stems of plants genus Hibiscus, family of Malvaceae and the species of H.Cannibinus. It requires less water to grow because kenaf fiber has a growing cycle of 150 to 180 days with an average yield of 1700kg/ha [10]. Kim *et al.* [11] found that natural fiber composites are able to absorb

moisture since they are hydrophilic in nature. The moisture penetrates into the micro gaps between polymer chains of composite material. Akil *et al.* [12] immersed kenaf fiber reinforced composite in sea water and observed the highest reduction rate in tensile modulus, followed by acidic rain water and distilled water. Srinivasan *et al.* [28, 29] investigated tensile and double shear properties of flax-kenaf hybrid composites and concluded that hybrid composites have better mechanical properties than mono fiber composites.

2. PROPERTIES OF KENAF FIBRE

Properties of kenaf fibre are shown in Table-1.

Table-1. Properties of kenaf fibre.

Fibre	Diameter (mm)	Ultimate stress (Mpa)	Density (kg/m ³)	Specific stress	Water absorption (in %) for 24hours
Kenaf	0.15-0.30	350-600	1500	0.22-0.44	0.95

3. APPLICATIONS OF KENAF FIBRE

Manufacturer and scientists are attracted towards composites fabricated with natural fiber like hemp, flax, kenaf and jute which have high specific strength biodegradability and low density. They are light in weight and nontoxic. They possess low tool wearing rates, good thermal insulation properties and acoustic properties They are relatively stronger and being considered {being} for making various products which can be use in construction industry, automotive industry and for furniture production [13, 14, 15]. Anuar *et al.* [16] found that use of kenaf fibers are increasing as significant natural material sources contributing towards the development of eco-friendly assets for the automotive, sports industries, food packaging and furniture industries. Kenaf is in an advanced position when compared with other lignocelluloses fiber crops since it has a short plantation cycle, flexibility to environmental conditions and requires



relatively lowered quantity of pesticides and herbicides [17]. Nishino et al. [18] claimed that mechanical strength and thermal properties of kenaf composite are superior to other natural fiber composites, thus suitable for high-performance applications. It was found that kenaf composites can eventually, supplement and substitute petroleum based composite materials in many of the known industrial applications and proposing innovative environmental, agricultural, manufacturing and consumer profits formulation methods [19, 20, 21]. According to researchers, the kenaf bast fibers possess striking mechanical properties that make them as a replacement to glass fibers in polymer composites as reinforcing elements as they are taken from bast, core, and pith and make it suitable for various applications [22, 23, and 24]. Liu *et al.* [25] investigated that fiber length, fiber content and fiber orientation of kenaf fiber which affect physical and mechanical properties of kenaf fiber reinforced soy based bio composites. Juliana *et al.* [26] found that kenaf fibers are widely considered as suitable biological resources and potential substitute for fossil fuels and wood-pulps. According to Mossello *et al.* [27] with the possibility of planting twice a year, kenaf has a great potential to be used as an alternative source of fiber for MDF and particle board manufacturing.

4. CONCLUSIONS

Since, composite materials are playing a vital role in automotive and construction industries, the study and review on their processing techniques, properties and application are important. Hence, this paper aimed to review the works done using kenaf fibers as reinforcements for making composites with various resins. Also, this paper gave an overview of the applications of kenaf reinforce polymer composites.

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