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Sustainability of Natural Fibers used in Textile Clothing in the Present Scenario

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ABSTRACT: The increasing environmental concerns and depletion of petroleum resources have increased the importance of natural fibers and have stimulated researchers and industries to use sustainable fibers instead of conventional synthetic fibers. Besides exceptionally brilliant mechanical and physical properties are also attractive aspects of natural fibers enabling the utilization of natural fibers in myriad of textile and non-textile applications such as clothing, and reinforced composite products in various industries such as automotive, building, and furniture. Natural fiber composites are composite materials comprising of reinforcing fibers derived from renewable and carbon dioxide neutral resources such as wood or plants. NFCs find application in molded articles that demand moderate strength for acceptable performance for various indoor and outdoor applications. A rapid drift from oil-derived polymers and mineral-reinforced materials to sustainable alternatives has fostered automotive and packaging industries to start utilizing natural fiber composites in their designs. Accordingly, natural fiber composites are serving as energy efficient and sustainable alternatives replacing traditional materials such as metals, polymeric resins, and reinforcement fibers. A worldwide clamor for green products and thus upsurge in sustainable alternatives have been witnessed as a result of diminishing petroleum reserves worldwide, exorbitant prices of petroleum, and high disposal costs of petroleum-based composites along with inability of decomposition of some petroleum-based composites. Contrastingly, natural materials outshine the petroleum-based products in being renewable, inexpensive, biodegradable, and eco-friendly.

KEYWORDS: sustainable, eco-friendly, clothing, textile, fibers, present, biodegradable

I. INTRODUCTION

Understanding the basic properties of natural fibers is important to determine the optimal intended uses for instance as high-quality bio-composite raw material. This review describes the characteristics, and potential uses of some natural fibers in order to improve their sustainability and economic values. The natural fibers have low density and high strength to weight ratio and reduction make them potential as light weight composite and reinforcement materials. The microstructure and chemical compositions of fibers affect the mechanical properties with the fiber cross-sectional area is the most variable influencing the fiber strength[1,2,3]. Natural fibers are easy to absorb water due to the presence of hemicellulose that give hydrophilic properties make them less compatible in the interaction with matrix with hydrophobicity properties. Higher cellulose content and crystallinity tend to result better strength properties of fiber while lignin is since versa. Besides that, fiber anatomical characteristics vary between different and same species that affect on the density and mechanical properties. The other factors namely environmental conditions, method of transportation, storage time and conditions, and fiber extraction affect the size and quality of the natural fibers.

Today, scientists around the world are concerned to the protection of the atmosphere and the biodiversity, by enhancing the sustainability and quality of eco-friendly products. Due to the bio-renewable properties and eco-friendly behaviors, people return to natural fibers to replace synthetic and hazardous materials. Some disadvantages of natural fiber, such as biocompatibility and hydrophilic properties, can be overcome by several surface modifications and methods of treatment of chemicals to achieve sufficient uses. They have been used successfully for many purposes, such as composite materials-despite their lower density compared to glass fiber construction and engineering fields, textile, biomedical, biopolymer, biosensors, and smart packaging. The utilization of natural fibers would help to mitigate pollution issues, such as waste, landfill, toxic, and greenhouse gases emissions [[1], [2], [3]].

Fiber is a type of material that is intact, long, thin, and simple to bend to form an elongated tissue [4]. According to the sources of the materials, fibers are categorized into three groups, namely natural, semisynthetic, and synthetic sources. Natural fiber is abundant and more affordable in comparison with synthetic fiber specifically lower density and energy requirements, renewability, no skin irritation, higher strength-to-weight ratio, higher aspect ratio length to diameter (L/D) of around 100, and higher strength and elasticity modulus, showing great potential as glass, carbon, or other synthetic fiber replacements. In addition, these benefits have led to the use of natural fiber for human needs as well as

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for industrial raw materials such as textiles, pulp and paper, accessories, bio-composites, and crafts [5]. Natural fibers remain in demand and compete for consistency, longevity, colour, and shine with wool, silk, and synthetic fibers.[4,5,6] Natural fiber consists of plant, mineral fibers, and animal. Protein and cellulose, respectively, are the principal components of animal and plant fibers. Furthermore, the fiber plant is divided into stems, leaf, seed, xylem, bark, and fruit. These fibers come from primary or secondary meristematic tissue depending on the species. Rice, bamboo, corn stem, wheat, and bagasse are also included in the stem fiber. The examples of fruit fibers include oil palm andcoconut, while leaf fibers include abaca, pineapple, sisal, and agave. Furthermore, examples of seed fibers include wider, kapok, and cotton. Bark fibers are rosella, jute, hibiscus, abaca, soybean fiber, ramie, while animal fibers include wool, silk, bird fiber, hair, and collagen fibers. Asbestos, carbon, and glass are examples of mineral fibers [[6], [7], [8], [9], [10]].

Indonesia and Malaysia have a high potential for bioresources that have not been optimally studied and fiber is one of them. From 2013 to 2015, Indonesia's cotton, ramie, abaca and pineapple production reached 1,200, 1023, 6,8 million, and 1,8 million tons per year [11]. Malaysia, like Indonesia, has a high natural fiber potency. Every month, the 'Panasonic Electric Works Kenaf' in Malaysia uses roughly 600 tonnes of kenaf fibre to make fibre board [12]. The world's pineapple plantation area reached roughly 1,022,319 ha in 2014, according to data from the Malaysian Pineapple Industry Board (MPIB), producing 25, 439, 366 MT of pineapple. Furthermore, Malaysia has a plenty of pineapple raw material waste to meet the needs of composite manufacturers and research and development departments [13]. Malaysia's most cost-effective oil crop is oil palm. With 352,385 ha of plantation, Malaysia became the world's biggest producer and exporter of palm oil in 1971. The overall cultivated area increased by 3.87 million hectares in 2004. Oil palm development will generate a substantial amount of waste, estimated to be over 30 million tons of oil palm biomass per year, comprising trunks, fronds, and empty fruit bunches that can be utilized as useful fibers [14].

Malaysian natural fibers have enormous potential in a variety of fields. Many studies on the usage of fiber, such as the usage of Malaysian Yankee Pineapple AC6 leaf fiber treated with silane in composites for diverse industrial uses, have been undertaken [13]. Automotive manufacturers have employed kenaf, flax, abaca, and hemp for door panels, seat backs, various interior trim, and spare-wheel pans in particular. Jute-based composites, such as jute thermoplastic board, are created from jute and plastic waste and can be used to make sheet/boards, doors, furniture, window frames, fences, and other items, may be considered as new application for future development [12].

On the basis of this availability, technical viability makes natural fiber an attractive replacement for unsustainable glass and carbon fiber reinforced composites as an attractive bio-resource for raw materials [15]. Scientists are concerned with eco-friendliness and sustainability in designing new bio-products [[15], [16], [17]]. However, environmental impact assessment (EIA) and life cycle assessment (LCA) should also be accessible for the future in the production of new products due to the conservation of resource demand [18]. The LCA is a method for evaluating the effects of goods or services, while the EIA is an interrelated process that helps to determine the influence of products and services on the environment [19]. This paper reviews studies from 1995 to 2020 and describes the characteristics (physical, mechanical, chemical and anatomical), and potential use of some natural fibers mainly for eco-friendly bio-composites in order to[7,8,9] improve their sustainability and economic values.

2. Types of natural fibers and their utilization

Botanical types are the most common classification for natural fibers. According to [20], five specific types of natural fibers are categorized by this approach, namely (i) bast fibers such as jute, flax, cannabis, ramie and kenaf, (ii) leaf fibers such as banana, sisal, agave, and pineapple, (iii) seed fibers such as coir, cotton, and kapok, (iv) grass and reeds such as wheat, maize, and rice, (v) all other types such as roots and wood. There are some crops that produce more than one type of fiber. For instance, both bast and core fibers have jute, flax, hemp and kenaf, while agave, coconut and oil palm have both fruit and stem fibers. Cereal grains, in addition, have both stem and hull fibers [21].

Recently, Suparno [5] reported potential and future efforts of Indonesia's natural fiber as raw material for various industries, and summarized in Table 1. Table 1 shows the types and use of natural fibers that have been documented of various studies in latest references. Usage of composites based on natural fiber in automotive interior linings (roof, side panel lining, rear wall, furniture, building, packaging, and pallets for shipping have also reported by Kumar and Hiremath [33], Sood and Dwivedi [34], and Lau et al. [35],

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Table 1. Types of natural fiber and their utilization.

Types of natural fibers	Utilizations	Latest references
Abaca	Textiles, clothes, and useful papers such as money, journal, and check paper, as well as composites	[22]
Bamboo	Lactic acid, construction, vinegar, charcoal, methane, composite reinforcement, shoes, food, textiles, pulp and paper production, shocks, and bioenergy sources.	[23]
Banana/Musa	Rope, place mats, paper cardboard, string yarn, tea bags, high-quality textile/fabric fabrics, currency note paper, mushroom, art/handicraft, cordage, cushion cover, table cloth, curtain, natural absorbent in colored wastewater, oil absorber, light weight composites, and bio-fertilizer.	[24,25]
Biduri	Heat insulation material	[26]
Coir	Filler, reinforcement in composite materials, light weight composites	[5,24]
Collagen fiber	Tissue manipulation, operating sewing thread	[5]
Cotton	Fabric, clothes, yarn, furniture industry as coating materials	[22]
Derris scanden	Reinforcing agent alternatives for synthetic fibers in polymer matrix composite	[27]
Hemp	Bags, tarpaulins, carpets, rope, furniture materials, fabric, textile, garden mulch, fleeces and needle felts, light weight composites, composites, geotextiles/geotextile insulation industry	[3]
Jute	Bags, sack, carpets, carpet upholstery, transportation or geotextile, electrical insulation and ropes, tarpaulins, packaging, furniture materials, fabric, light weight composites	[5]
Pineapple	Bags, table linens, mats, ropes, pulping material, handbags, composites, lightweight duck cloth, conveyor belt cord, coasters and many other interior design products, and livestock and agriculture	[28]
Kenaf	Pulp and paper product	[5]

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Types of natural fibers	Utilizations	Latest references
Ramie	Textile, paper, pulp, yarn, biofuel, fabric, oil, resin, wax, seed food, composites, livestock, and agriculture,	[5]
Silk	Silk cloth, silk yarn	[5]
Wool	Cotillion, wool yarn	[5]
Sorghum bagasse	Particle board, sugar production sources, pulp, and paper	[[29], [30], [31], [32]]

The presence of hydroxyl and other polar groups, dead cells, wax and oil, and low fire resistance makes natural fibers in raw conditions not compatible with polymers and causes the formation of aggregates. Furthermore, the high water absorption of natural fiber causes low interface strength than glass or carbon fibre composites. For developing eco-friendly composite applications, basic properties and components of natural fibers need to be properly understood. Furthermore, in order to utilize natural fiber as textiles, some properties such as length, flexibility, and strength need to be fulfilled. The most important properties considered in substitution of synthetic fibers are fiber ratio of length and width. Natural fiber yarns or synthetic fibers consist of short (staple) or very long fibers (filament) and are intended to provide a flexible and easily concatenated yarn [36]. Generally, the natural fibers are present in the form of staples with few inches in length excluding silk fibers [36], and could be mixed with semi-synthetic (semi-cellulose, protein or mineral) or synthetic fibers. Viscose and acetate rayons, and kupri ammonium are semi-synthetic fiber. While synthetic fibers are produced by condensation (nylon, polyester and spandex) and addition of polymers such as acrylate [10,11,12].

Dhaliwal [22] stated that stretching, calendaring and production of hybrid yarns are modifications that could be used the change physical characteristics of natural fibers. Furthermore, Sudjindro [37] stated that abaca fibers have high potency to be used as raw materials in textile industries because they are strong, resistant to humidity, and have salty water. Biduri fibers have a hollow shape that functions as a medium/air trap in order to control the flow of heat flow [38]. They could be used as a natural, renewable and environmentally friendly heat insulation materials. Biduri fiber does not cause allergies, and are mild and hydrophobic [26].

Munawar et al. [39] stated that ramie bast fiber, pineapple and sansevieria leaves are prospective high-performance plant fiber composites based on their high mechanical properties. Kandachar and Bruwer [40] also reported that because of its high strength and stiffness, this hemp fiber is also used as reinforcement biocomposites. Composite materials of natural fibers have great potentials, especially in the automotive industry. They are generally used in interior parts such as door panels, dashboard parts, parcel shelves, seat cushions, backrests and cable linings [[41], [42], [43]]. Pineapple fibers, copolymer and composites in automobiles and railway coaches [28,44] are used in textile industries because they have a very high initial modulus [44].

Water retting method is used to extract fiber from natural sources such as the Sansevieria trifasciata plant. The results showed that the fiber had good strength and fineness with low elongation. Due to its greater strength, cost-effective and renewable source, it could be used to make products like sacks, ropes, handicrafts, mattresses for bedding and other wider applications of textiles [45]. Furthermore, sisal fibers are used as polypropylene reinforcement for good application [46]. The extraction of fibers from Derris scanden stem were carried out by Ilaiya Perumal and Sarala [27]. Based on their properties, these fibers may become promising candidates for reinforcing agent and alternatives for synthetic fibers in polymer matrix composite, thereby creating an economic value for the plant and providing benefits to the society and environment.

Fig. 1 shows the potential application of banana pseudo-stem component which is divided into three parts, namely central core, banana fiber and waste materials after fiber extraction. While prospective utilization of pineapple leaf is presented in Fig. 2. Some utilizations of banana fibers have been reported including in papermaking [48,49], fiber-cement composites [[50], [51], [52]], animal feed due to high cellulose and starch content [53], fiber-polymer composites [25,47,54], binder less fiberboard [55], rope, place mats, paper cardboard, string thread, tea bags, high-quality textile/fabric materials, currency note paper, mushroom, art/handicraft, cordage [47,56], cushion cover, table

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cloth, curtain [57]. These fibers are also used as natural absorbent in colored wastewater from dyes of textile industries and an absorbent for oil spillage in refineries [58,59]. Furthermore, banana pseudo-stem has antimicrobial properties [58], and could be used as bio-fertilizers [13,14,15].

II. DISCUSSION

Among all the natural fiber-reinforcing materials, areca appears to be a promising material because it is inexpensive, availability is abundant and a very high potential perennial crop. It belongs to the species Areca catechu L., under the family palmecea and originated in the Malaya peninsular, East India. Major industrial cultivation is in East India and other countries in Asia. In India, areca nut cultivation is coming up on a large scale basis with a view to attaining self sufficiency in medicine, paint, chocolate, Gutka, etc. It is estimated that about 6 Lakh tonnes of areca husk is available in south West-India. The husk of the Areca is a hard fibrous portion covering the endosperm. It constitutes 30% - 45% of the total volume of the fruit. Areca husk fibers are predominantly composed of hemicelluloses and not of cellulose. In Table 1 the chemical composition of Areca fibers is shown along with few known fibers. Areca fibers contain 13% to 24.6% of lignin, 35% to 64.8% of hemicelluloses, 4.4% of ash content and remaining 8% to 25% of water content [6] . It is a well known fact that banana is one of the oldest cultivated plants in the world. The word “banana” comes from the Arabic language and means ‘finger’. It belongs to the Musaceae family and there are approximately 300 species, but only 20 varieties are used for consumption. Approximately 70 million metric tons of bananas are produced every year by the tropical and subtropical regions of the world. The nutritional facts of banana (100 g pulp) are as follows: carbohydrates— 18.8 g; protein—1.15 g; fat—0.18 g; water—73.9 g; vitamins C1 B1 B2 B6 E, other minerals—0.83 g and 81 kcal. Banana plants generally produce 30 large leaves (almost 2m long and 30 - 60 cm wide) [7] . Bamboo belongs to the grass family Bambusoideae, which consists of cellulose fiber embedded in a lignin matrix. Bamboo has several advantages over other plant fibers such as its low density, low cost, high mechanical strength, stiffness, high growth rate and its ability to fix atmospheric carbon dioxide. Bamboo also has some disadvantages for various applications, including high moisture content, the difficulty of extracting fine and straight fibers, and thermal degradation during manufacturing. More than 1000 species of bamboo and approximately 70 genera grow naturally in diverse climates, with particular abundance in Asia and South America. [16,17,18]Bamboo has traditionally been used in construction and as a material for the manufacture of tools for daily living due to its high strength to weight ratio [8] . Hemp is naturally one of the most ecologically friendly fibers and also the oldest. Cannabis Sativa L. is the scientific name for the hemp plant. The Columbia History of the World states that the oldest relics of human industry are bits of hemp fabric discovered in tombs dating back to approximately 8000 BC. Hemp is an annual plant native to central Asia and known to have been grown for more than 12,000 years. It probably reached central Europe in the Iron Age and there is evidence of its growth in the UK by the Anglo Saxons (800 - 1000 AD). It is now grown mostly in the EU, Central Asia, Philippines, and China. According to Food and Agriculture Organisation (FAO), almost half of the world’s industrial hemp supply is grown in China, with most of the remainder being cultivated in Chile, France, the Democratic People’s Republic of Korea, and Spain [9] .

Aspects	Property	Natural fibers	Synthetic fibers
	Mechanical properties	Moderate	High
Technical	Moisture sensitivity	High	Low
	Thermal sensitivity	High	Low
	Resource	Infinite	Limited
Environmental	Production	Low	High
	Recyclability	Good	Moderate

Table 2. Comparison between natural fibers and synthetic fibers [5] .

Jute is a bast fiber whose scientific name is Corchorus capsularis of Tiliaceae family. Plant of jute takes nearly 3 months to grow to a height of 12 - 15 feet. Jute plant is cut and kept immersed in the water for Retting process during season. The inner stem and outer gets separated and the outer plant gets individualized to form fibers. Jute fiber is known as golden fiber of Bangladesh, jute is an important fiber of Eastern Indian and Bangladesh [10] . Kenaf is one of the natural (plant) fibers used as reinforcement in Polymer Matrix Composites (PMCs). Kenaf (Hibiscus cannabinus L. family Malvacea) has been found to be an important source of fiber for composites, and other industrial applications. Kenaf is well known as a cellulosic source with both economic and ecological advantages; in 3 month (after sowing the

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seeds), it is able to grow under a wide range of weather conditions, to a height of more than 3 m and a base diameter of 3 - 5 cm. This statement is supported by previous studies, which mentions that growing speed may reach 10 cm/day under optimum ambient conditions. The kenaf plant is composed of many useful components (e.g., stalks, leaves, and seeds) and within each of these there are various usable portions (e.g., fibers and fiber strands, proteins, oils, and allelopathic chemicals). The yield and composition of these plant components can be affected by many factors, including cultivar, planting date, photosensitivity, length of growing season, plant populations, and plant maturity. Kenaf filaments consist of discrete individual fibers, of generally 2 - 6 mm [11] . Oil palm (Elaeis guineensis Jacq.) is the highest yielding edible oil crop in the world. It is cultivated in 42 countries in 11 million ha worldwide. West Africa, South East Asian countries like Malaysia and Indonesia, Latin American countries and India are the major oil palm cultivating countries [12] . Pineapple leaf fiber (PALF) is obtained from the leaves of the plant, Anannus comosus, belonging to the Bromeliaceae family.[19,20,21] PALF is largely cultivated in tropical countries, mainly for its fruits. Its cultivation in India is substantial (about 22, 50,000 acres of land is cultivated and is increasing; in the future a considerable increase in the production of the fiber is envisaged). The pineapple plant has a very short stem which first produces a rosette of leaves but which latter elongated and bears numerous spirally arranged fibrous leaves. The leaves are 3 ft. long, 2 to 3 inch wide sword shaped, dark green in color and bear spines of claws on their margins. The leaves of the pineapple plant yield strong, white fine silky fibers. Since the pineapple plant is a special crop, only limited quantity of fiber is available. Therefore, no attempt has been made to grade these fibers [13] . Sisal fiber is a hard fiber extracted from the leaves of the sisal plant (Agave sisalana). Though native to tropical and sub-tropical North and South America, sisal plant is now widely grown in tropical countries of Africa, the West Indies and the Far East. Sisal fibers are extracted from the leaves. A sisal plant produces about 200 ± 250 leaves and each leaf contains 1000 ± 1200 fiber bundles which are composed of 4% fiber, 0.75% cuticle, 8% dry matter and 87.25% water. So normally a leaf weighing about 600 g will yield about 3% by weight of fiber with each leaf containing about 1000 fibers [14] . Figure 1 shows different kinds of mainly available natural fiber plants.

Industrial uses of natural fibers increasingly gain attention from various manufacturing sectors. The use of natural fibers for polymer composites is growing rapidly to meet diverse end uses in transportation, low cost building, and other construction industries [15] . Qualities of natural fibers are strongly influenced by growing environment, age of plant, species, temperature, humidity, and quality of soil. Various fields where natural fibers can be employed are: structural composites, automobile, non-structural composites, geotextiles, packaging, molded products, sorbents, filters, and in combinations with other materials. Structural beams and panels were designed, manufactured, and tested for bio-based composite materials, particularly on plant oil-based resins and natural fibers [5] . Kenaf and hemp fiber bundles as well as their mixtures significantly increase tensile strength and Young's modulus of composites; they markedly lower the impact strength of pure Poly lactic acid. Thus, these composites should be used for parts that need high tensile strength and stiffness but are subjected to low impact stress. Examples are furniture, boardings or holders for grinding discs. In contrast, cotton fibers cause high impact strength but lower tensile strength and stiffness. These composites could be used for impact stressed components like interior parts in cars or safety helmets. A mixture of bast and cotton could combine the positive tensile characteristics of bast with the good impact properties of cotton, making the composites suitable for various car parts as well as for suitcases [16] . The automobile industry is successfully applying composites reinforced with a variety of natural fiber to replace components such as interior panels and seat cushions originally made of glass mat PMC or polymeric foams [17] .

Apart from the plant-based fibers, animal-based fibers become other alternatives for producing biodegradable, biomedical and bio-resorbable composite materials for bioengineering and orthopaedic applications. Silk fiber has been used in biomedical applications particularly as sutures [22,23,24] .

III. RESULTS

Natural fibers reinforced composites are emerging very rapidly as the potential substitute to the metal or ceramic based materials in applications that also include automotive, aerospace, marine, sporting goods and electronic industries [19] . Natural fiber composites exhibit good specific properties, but there is high variability in their properties. Their weakness can and will be overcome with the development of more advanced processing of natural fiber and their composites. Their individual properties should be a solid base to generate new applications and opportunities for biocomposites or natural fiber composites in the 21st century "green" materials environment. The exploitation of natural fiber composites in various applications has opened up new avenues for both academicians as well as industries to manufacture a sustainable module for future application of natural fiber composites [20] .

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In the United States, composite building materials are being made from straw. Straw bales are being used in the construction of buildings. Many automotive components are already produced with natural composites, mainly based on polyester or Polypropylene and fibers like flax, hemp, or sisal. The adoption of natural fiber composites in this industry is led by motives of price, weight reduction, and marketing rather than technical demands [5] . Germany is a leader in the use of natural fiber composites. The German auto-manufacturers, Mercedes, BMW, Audi and Volkswagen have taken the initiative to introduce natural fiber composites for interior and exterior applications. The first commercial example is the inner door panel of the 1999 S-Class Mercedes- Benz, made in Germany, of 35% Baypreg F semi-rigid (PUR) elastomer from Bayer and 65% of a blend of flax, hemp and sisal. It should be emphasized that luxury automotive manufacturers are on board which could be seen as evidence that natural fiber composites are being used for environmental needs and not to lower costs [21] . Mercedes-Benz used an epoxy matrix with the addition of jute in the door panels in its E-class vehicles back in 1996. Another paradigm of natural fiber composites' application appeared commercially in 2000, when Audi launched the A2 midrange car: the door trim panels were made of polyurethane reinforced with a mixed flax/sisal material. Toyota developed an eco-plastic made from sugar cane and will use it to line the interiors of the cars [25,26,27] .

Biodegradable bark cloth reinforced green epoxy composites are developed with view of application to automotive instrument panels [23] .The coir/polyester composites have been used to produce mirror casing, paper weights, projector cover, voltage stabilizer cover, mail-box, helmet and roof. In structural applications and infrastructure applications, natural fiber composites have been used to develop load-bearing elements such as beam, roof, multipurpose panel, water tanks and pedestrian bridge [24] . Jute-based green composites would be suitable for even primary structural applications, such as indoor elements in housing, temporary outdoor applications like low-cost housing for defence and rehabilitation and transportation. Due to its insulating characteristics, jute may find areas of applications in automotive door/ceiling panels and panels separating the engine and passenger compartments [25] .

The use of natural fiber as reinforcement in polymer matrix focused the attention towards environmental awareness among all over the world. A hybrid composite is a combination of two or more different types of fiber in which one type of fiber balance the deficiency of another fiber [26] .

IV. CONCLUSION

Natural fiber reinforced polymer composites have been proven alternative to Synthetic fiber reinforced polymer composites in many applications [27] [28] . Many Natural fiber composite products being developed and marketed, very few natural fiber composites have been developed, with most of their technologies still in the research and development stages. Natural fiber composites in automobile include for parcel shelves, door panels, instrument panels, armrests, headrests and seat shells [29] . Plastic/wood fiber composites are being used in a large number of applications in decks, docks, window frames and molded panel components [30] . The passenger car bumper beam is manufactured by kenaf/glass epoxy composite material [31,32,33] . Recently, banana fiber reinforced composites are coming into in interest due to the innovative application of banana fiber in under-floor protection for passenger cars [32] . Automobile parts such as rear view mirror, visor in two wheeler, billion seat cover, indicator cover, cover L-side, name plate were fabricated using sisal and roselle fibers hybrid composites [33] .The variety applications of natural fiber and its composites are discussed in this paper. This review concludes that the natural fiber composites form one of the emergent areas in material science that makes awareness for use in various applications.[28,29,30]

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