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A study on recent developments in natural fiber composites and their mechanical performance

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Recently, there has been a rapid growth in research and innovation in the natural fiber composites (NFCs) area. The mechanical performance of NFCs is affected mainly based on the fiber selection where fiber type is commonly categorized based on its origin, whether it is a plant, animal or mineral. The use of natural fiber from both resources, renewable and nonrenewable such as oil palm, sisal, flax, and jute to produce composite materials, gained considerable attention in the last decades. The plants, which produce cellulose fibers can be classified into bast fibers (jute, flax, ramie, hemp, and kenaf), seed fibers (cotton, coir, and kapok), leaf fibers (sisal, pineapple, and abaca), grass and reed fibers (rice, corn, and wheat), and core fibers (hemp, kenaf, and jute) as well as all other kinds (wood and roots). The matrix selection is an important part of a fiber-reinforced composite. It provides a barrier against adverse environments, protects the surface of the fibers from mechanical abrasion and it transfers load to fibers. The most common matrices currently used in NFCs are polymeric as they are light weight and can be processed at low temperature. Matrix selection is limited by the temperature at which natural fibers degrade. Interfacial bonding between fiber and matrix plays a vital role in determining the mechanical properties of composites and good interfacial bonding is required to achieve optimum reinforcement. The best mechanical properties can generally be obtained for composites when the fiber is aligned parallel to the direction of the applied load. Regarding the degree of influence of orientation on mechanical performance of NFCs, similar large reductions of strength and Young's modulus to those seen with synthetic fibers have been obtained with increasing fiber orientation angle relative to the test direction. Natural fiber reinforced polymer composites have beneficial properties such as low density, less expensive, and reduced solidity when compared to synthetic composite products, thus providing advantages for utilization in commercial applications (automotive industry, buildings, and constructions). Using natural fibers as reinforcement for polymeric composites introduces positive effect on the mechanical behavior of polymers, but it has high moisture absorption which results in swelling which can be further enhanced through the chemical treatment, while moisture absorption of the NFPCs can be reduced through surface modification of fibers such as alkalization and addition of coupling agents.

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Biodegradable natural fiber polymer composites- A review

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As per environmental prospect natural fiber has many advantages such as lower pollutant emissions, lower green house gas emissions and end of life biodegradability of components. Recently studies had proven that performance of natural fiber as per environment prospect is far better than glass fiber over its specific applications, Where the polymer matrices are derived from renewable resources such as poly lactide (PLA), thermoplastic starch (TPS), cellulose and polyhydroxyalkanoates (PHAs). TPS composites modulus displays a regular behavior where reinforcement effect increases with the fiber length from short length fiber (SF) to medium length fiber (MF) and fiber content. While elongation at break decreased with the increase in fiber contents and length. These composite materials with its various interesting properties may soon be competitive with the existing fossil plastic materials. This can be applied to various fields such as household items, automobiles and food packaging systems. By using this type of polymers an ecofriendly atmosphere can be created and thus hazardous effects can be reduced. However, the present low level of production and high cost restrict them for to be applied in industrial application. In addition, its hydrophilic properties make the real challenge to design the product which can be good candidate for outdoor applications.

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