

ADVANTAGES AND DISADVANTAGES OF USING NATURAL FIBERS AS REINFORCEMENT MATERIALS

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Abstract

In the manufacture of goods and applications the renewability and longevity of materials are becoming extremely important concerns because of which lot of research is going on in the field of natural fibres. As these fibers, which have become important substitutes to glass and carbon fibres in some applications because these are in less costly, more reliable and more environmentally sustainable materials. Moreover their light weight and long fiber lengths are suitable for various applications. In this various benefits of using natural fibers as reinforcement materials are discussed.

Keywords: Natural fibers, Green composites, Particulate Reinforcement, Fibrous Reinforcement

1. Introduction

Over the last few years, the consumption of oil reserves, the increasing knowledge of the planet and the incredible concern for the nursery effect have enabled companies (e.g. vehicle, construction, nautical) to replace ordinary engineered materials using appropriate ones. In comparison to manufactured fibre fortified composites, green composites, made of sustainable rural and ranger service feedstock, speak to an acceptable choice in these issues.[1] A composite material can be defined as a macroscopic mixture, with a recognisable interface between two or more separate continuous and discontinuous intermediate materials. A composite material can have magnificent and special mechanical and physical properties, as it incorporates the most attractive features of its constituents while at the same time taking out the least attractive[3]. The stiffer and heavier intermittent medium than the ceaseless stage is called strengthening, and the purported steady stage is called matrix[2]. The characteristics of a composite depend on the properties of the constituent materials and their spread and association. Due to their advantages over traditional glass and carbon fibres, natural fibres have attracted considerable exposure in recent decades as an effective reinforcement in polymer composites[4]. Materials can not only be used in material packaging, automotive, oil, sports and leisure industries, but also have sustainability for biomedical applications such as implants and medical applications Natural consciousness has also prompted a shift in attitude towards preparation materials that are good for nature. The use and end-of-life expulsion of common composite structures, usually made of carbon, glass or aramid fibres, is increasingly becoming important due to the expansion of natural knowledge and enacted prerequisites. In view of the fact that system gums are non-biodegradable, bio composites obtained from common fibres and common thermoplastics or thermosets are not naturally adequately well disposed of. Therefore, many benefits and drawbacks of using natural fibres are discussed in this article.

2. Particulate Reinforcement

Particulate common fillers, for example, saw residue and coconut shell powder, are utilized to improve high temperature execution, increment wear obstruction, and lessen erosion as well as shrinkage. A great part of the time, particulate fillers are used to lessen cost; under these conditions, the additional substance is known as a down to earth filler (fundamentally filler), however when a critical change in the properties

of the composite occurs, the additional substance is known as a help filler (basically fortress). The particles in addition share the pile with the lattice, anyway to a lesser degree than strands. Thusly, much of the time, particulate help improves solidness, not quality. Hard particles in a delicate cross section cause confined weight centers in the system, which diminish the all-around impact quality and make the composite down to earth[6].

3. Fibrous Reinforcement

The part materials of fiber-fortified composites are strands and grid and the composite show anisotropy in properties. The deliberate quality of most engineered materials is substantially less than anticipated hypothetically because of the defects as splits opposite to the applied burden that are available in mass materials. Common filaments have a lot higher longitudinal qualities, on the grounds that the bigger defects are not by and large present in such little cross-sectional regions[8]. In the composite, all things considered fibers are the noteworthy weight passing on people while the including matrix keeps them in the perfect territory and heading. In addition, the structure goes about as a store move medium and shields the strands from environmental damages on account of raised temperature besides, tenacity. The possibility of the interface between them is noteworthy to the degree the properties of the composites are concerned. The fibres dissipated in the composite cross section can be steady or broken. Table 1 shows comparison between natural and synthetic fibers the In constant fiber support, the move of the stack from cross section to the strands will be straightforward and fruitful, while in unpredictable (or short fibre) fibre support, the strands must have sufficient length (essential fibre length) to move the store effectively. The high calibre and moduli of these composites can be tweaked to the high weight headings[9].

Table 1. Comparison between natural and synthetic fibers [10]

Fibre	Density (g/cm ³)	Length (mm)	Failure strain (%)	Tensile strength (MPa)	Stiffness/Young's modulus (GPa)	Specific tensile strength (MPa/gCm ³)	Specific Young's modulus (GPa/gcm ³)
Ramie	1.4	900–1200	2.0–3.8	400–938	44–128	270–620	29–85
Flax	1.4	5–900	1.2–3.2	345–1830	27–80	230–1220	18–53
Hemp	1.4	5–55	1.6	550–1110	58–70	370–740	39–47
Jute	1.4–1.5	1.5–120	1.5–1.8	393–800	10–55	300–610	7.1–39
Harakeke	1.3	4–5	4.2–5.8	440–990	14–33	338–761	11–25
Sisal	1.3–1.5	900	2.0–2.5	507–855	9.4–28	362–610	6.7–20
Alfa	1.4	350	1.5–2.5	188–308	18–25	134–220	13–18
Cotton	1.5–1.6	10–60	3.0–10	287–800	5.5–13	190–530	3.7–8.4
Coir	1.2	20–150	15–30	131–220	4–6	110–180	3.3–5
Silk	1.3	Continuous	15–60	100–1500	5–25	100–1500	4–20
Feather	0.9	10–30	6.9	100–203	3–10	112–226	3.3–11
Wool	1.3	38–152	13.2–35	50–315	2.3–5	38–242	1.8–3.8
E-glass	2.5	Continuous	2.5	2000–3000	70	800–1400	29

4. Advantages of using natural fibers as reinforcement

The key benefit of using these fibres is that their individual weight is minimal, resulting in higher physical strength and stability than glass. The use of natural filaments that are inexhaustible prompts practical development. Traditional fiber-fortified polymer composites, such as biodegradability, substance reactivity, weight, non-harmfulness, decreased contamination, ease, and recyclability, are currently prior to engineered fiber-fortified composites in properties. Such points of interest rank the composites of traditional strands among the significant composites of presentation with favourable ecological and monetary conditions. The weak reinforcing impact of these cellulosic elastomer strands was overwhelmed by unequivocal shifts. Over the last 5 years, the use of trademark strands in the vehicle industry has rapidly expanded [11].

5. Properties of Green composites

As a help, plant strands have lately taken specialists into account as a result of their favourable circumstances over other existing materials. They are appealing to the planet, fully biodegradable, freely available, affordable and modest. The biodegradability of plant filaments will add to a sound biological system while the financial excitement of industry is fulfilled by their limited effort and elite. The discharged CO₂ calculation of the filaments is unbiased with regard to the acclimatised amount during their production at the point when characteristic fiber-strengthened plastics are oppressed, towards an impressive finish cycle, to the ignition procedure or landfill[12]. In terms of the advanced and reused handling of the composite materials, the rough idea of standard fiber-fortified plastics is much lower driving to points of interest when it is said to be finished. By using biodegradable polymers as structures, normal fiber-strengthened plastics are the most environmentally friendly materials that break down into a mind-blowing finishing period.

6. Disadvantages of natural fibres

Such fibres are hydrophilic in nature and absorb humidity. Physical and synthetic structures generally influence the expanding activity of characteristic strands. Therefore, due to the presence of moisture content, these fibres modify their dimensions, as the cell mass of these polymers includes hydroxyl and other molecules containing oxygen. That absorbs moisture through the keeping of hydrogen in dampness. The waxy materials present on the surface play an important role in water retention. The porous aid in water intake while the hydroxyl pack (-OH) in cellulose, hemicellulose, and lignin helps to create a great deal of hydrogen bonds in the plant fibre cell divider between the macromolecules.[13].

Conclusion

Natural fibres have played a major role in the development of human science and culture, as these fibres play a major role in the creation of advanced bio-based goods. The uses of these materials are therefore expanding because of their environmental and financial benefits. From many years of study, normal fibre composite materials of superior have been made. Therefore, a lot of work on common strands and their composites is currently being completed globally. In terms of applications with different uses for different properties, the strands and composites are structured. Inexhaustible strands of creatures offer an energetic opportunity to produce economical bio-composite materials. Light weight, minimal effort and eco-accommodating design have now been extended around these plant fibre reinforced composites in view of their easy accessibility. The material will provide lasting reaction to the problems of moisture maintenance (poor gum proximity), external affectability and weakness for resisting long stretch introduction, influencing, and unforgiving road trail conditions; a portion of the major impediments to their current sales

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