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Review of Sugarcane Bagasse Fiber Reinforced Composites Material with Recent Application

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Abstract - A composites material is made by combining two or more material to give a unique combination of properties one of properties one of which is made up of stiff, long fibers and the other, a binder or 'matrix' which hold the fibers in place. Bumper is the one of the parts Having more weight present cause. This review paper discusses about recent development of bagasse fiber reinforced polymer composites, types of matrix, processing method. This is bumper absorbs the impact energy and transfer to the opposite direction of the impact. In this work a bumper used for our analysis purpose more recently natural fibers have been employed in combination with plastic. Natural fibers have low cast, low density and low durability as compare to synthesis fibers, but with the help of fiber treatment mechanical properties of improved many references to the latest work on properties, processing and application have been reference in this review.

Keywords - Composites material, Bagasse fiber Composite, Natural Fibers.

1. INTRODUCTION

Over the last thirsty years composite materials, plastics and ceramics have been the DOMINANT emerging MATERIAL [1] IN automobiles, a bumper is the Front-most or rear-most part, OSTENSIBLY designed to allow the car to sustain an impact without damage to the VEHICLES. Safety Systems. [2] composite materials are also called composition material made from two or more constituents' materials with significantly different physical or Chemical properties. when we combine THIS MATERIAL Produce a material with different Characteristics from the individual Components. Composites. material that COMPRISES Strong load carrying material, is known as reinforcement and imbedded IN weaker MATERIALS known as Matrix. [3] the use of such materials in composites has increased due to their relative cheapness, their ability to recycle and for the fact that they can complete when in terms of strength to weight of material. Natural fibers can be considered as naturally occurring composites consisting mainly of cellulose fibrils embedded in complex matrix.[4] automotive bumper system is one of the key systems in passenger car. Bumper system is designed to prevent or reduce physical damage to the front or rear ends of passenger motor vehicle in collision condition.[5] the bumper beam is the main structure for absorbing the energy during collision therefore suitable impact strength is the main expectation for such a structure.[10] the modification will be made considering size, shape and material. The study will focus on existing design performance, advantage and limitations. Based on observation design improvement will be made terms of shape, size and or material based on design modification objectives. Modified from bumper design will be tested using FEM software for Impact loads as per intrnational standars.[11] An automobile's bumper is the front-most or rear – most part, quality designed to allow the car to sustain a structural without damage to the vehicle safty systems.[16] in some instance, best resuilts may be achieved throught the use of composites in conjuction with traditional materials.[1] bagasse fibre are short they resuits in paper with enhansed printing quality and also imporved papar porosity.[03]

2. LITERATURE SURVEY

Researchers have begun to focus attention on a natural fiber composite (i.e. bagasse fiber) which are composed of natural or synthetic resin reinforced with natural fibers fiber exhibit many advantages properties they are a low-density material, yielding relatively lightweight composites with high specific properties.

D.Verma and P.C Gope [2012] Studied [01] the Fiber are strong and stiff relative to the matrix and are generally orthotropic. The abundant Availability of natural fiber in India such as Jute, Core, Sisal, Pineapple, Ramie, Bamboo, Banana etc. Thousands of tons of different crops are produced but most of their wastes do not have any useful utilization. possible uses of bagasse water as reinforcement in polyester matrix composites and review regarding discusses the use of bagasse fiber its current status of research many referenced to the latest work on properties processing and application have been cited in this review.

G.A. Umadevi and N. Ramesh [2015] Studied [02] the fuel efficiency and emission gas regulation of passenger cars two important issues in these days. Bumper is the one of the parts having more weight present cause.in this paper the exiting steels bumper is replaced with light weight with suspension bumper will attach in my project. In this work the design and analysis with fabrication of standard composite material bumper made up of glass fiber reinforced polymer is carried out by which weight of the bumper can be reduced in different cross sectional of this process.

Sachin Yadav and Gourav Gupta. [2015] studied [03] A review on composition and properties of bagasse fiber this

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review discusses about the use of bagasse fiber and its current status of research. Natural fibers have low cost, low density and low durability as compare to synthetic Fieber treatments mechanical properties improved. Bagasse fiber is a residue of a sugarcane milling a process the present use of bagasse fiber is a fuel in the sugar can Mill furnace.

A. Balaji and B. Karthikeyan [2015] studies [04] Bagasse fiber – the future bio composite material A Review this paper discusses about recent development of bagasse fiber reinforced polymer matrix composites in this study a series of epoxy-based composites reinforced with sugarcane bagasse waste fiber are fabricated up to landscape. This effort to develop bio composites material with improved performance for global application is an ongoing process. This review Paper Discuss About Recent Development of bagasse Fibers reinforced polymer composites, types of matrices, processing Methods, and any applications.

Nikita kankariya and Dr.F.B. Sayyad [2015] Studied [05] The major concern in design of bumper is their potentially to bear impact loads. Therefore, bumper impact test is required to fulfil the safety requirement. In development of bumper systems for the automotive industry, iterative finite element (FE) simulation is normally used to find a bumper design that meet the requirements of crash performance.

Pankaj Tripathi and Dheeraj Kumar [2016] Studied [06] Study on Mechanical Behavior of Sugarcane Bagasse Fiber Reinforced Polymer Matrix Composites.in this study a Series of Epoxy Based Composites Reinforced with sugarcane bagasse waste fiber fabricated. Bagasse is Considered to be a by- product of the milling processes after production of sugar. The low caloric power of bagasse makes a low Efficiency process also sugar cane mill management encounters problem regarding regulation of clean air from the environmental protection. Usually, this excess is deposited on empty fields altering the landscape.

Isiaka Oluwole and Samuel Olumide Falana [2023] studied [17] Mechanical and wear properties of developed cellulosic fiber particles hybrid reinforced epoxy-based composites for automotive application. The sisal fiber was extracted employing soil retting method, subjected to surface treatment, and combined with paper partials. thus, epoxy-based composites reinforced with hybrid sisal fiber- paper particles are suitable for automobiles application in the fabrication of bumper and other epoxy-based body parts.

Sai Kiran Sidde and Wai Ming Cheung [2024] studies [18] Production of plastics is growing, and plastics are used in a variety of products. The use of a specific type of natural fiber composites (NFC) material for front-bumper in cars is considered in this investigation. The use of jute fiber is adopted for the design of a car front bumper and compared with the plastic bumper thought finite elements analysis. Comparing non-biodegradable plastic with environmentally Friendly natural Fiber composites on car front bumpers design.

3. TYPES OF REINFORCEMENT FIBERS

Fibers are used in composite materials to improve strength, stiffness, and durability.

Natural Fibers: - Natural fibers are sustainable, biodegrable materials sourced directly from plants, animals or minerals, featuring high absorbency and breathability.

Example: -Bagasse Fiber, Jute Fiber, Hemp Fiber, Sisal Fiber, coir Fiber

1) Synthetic Fiber are man :- Made materials derived primarily From petrochemically, dominating the textile industry with high durabilty, elasticity and water resistance.key types include polyster,nylon,acrrylic,and polyoelefin they are widely used in clothing, furniture and industrial applications but are less biodegrable than natural fibers.

Examples :- Glass Fiber,Carbon Fibre,Aramid Fiber

2) Mineral Fibres :- Mineral Fibres refers to Inorganic, Fibrours materials produced form rock,slag, Glass or Clay, primarily used for thermal insulation,fire protection, and a Acoustic celling ties.

These Materials, including rock wool and fiberglass, durable, non-combustible, and often made from recycled materials. They are widely used in construction to enhanced energy efficiency and sound absorptions

Examples: - Basalt Fiber asbestos fiber.

4. COMPOSITION OF BAGASSE FIBER

The physical properties of bagasse Fiber. Fibers with the highest aspect ratio will exit highest tensile Properties Provide high surface area which are advantageous for reinforcement purposes.

Dia(μm)	10-34
Length (mm)	0.8-2.8
Aspect Ratio (l/d)	76
Moisture content (%)	49

Physical Properties of the bagasse fiber
Table no.4.1 [03]

Chemical Composition of bagasse fibers natural fiber obtained from sugarcane after juice extraction. It mainly Contains Cellulose, Hemicellulose and lignin along with small quantities of wax and ash.

Cellulose (10%)	45-55
Hemi Cellulose (%)	20-25
Lignin (%)	18-24
Pectin (%)	0.6-0.8
Ash (%)	1-4
Extractives (%)	1.5-9

Chemical Composition of bagasse fibers.
Table no.4.2 [03]

Mechanical Properties of bagasse fiber by which we use fiber as reinforcement of a good mechanical properties of composites materials.

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Tensile Strength (Mpa)	180-290
Young's Modulus (Gpa)	15-19
Failure Strain (%)	1-5
Density (Kg/m^3)	880-720

Mechanical Properties of bagasse fiber
Table no.4.3 [03]

5. RECENT APPLICATION OF SUGARCANE.

Bagasse Fiber of Focus on maximizing Particularity Through Sustainable high value uses of bagasse. Sugarcane Bagasse Fiber is Increasingly used in the Automobiles industry to produce lightweight and Eco-Friendly Composite Materials. These Natural Fiber Composites help reduce Vehicle Weight improve Efficiency and Lower Environment impact.

5.1 Important Application in Vehicles

1. Vehicle Bumper:

Bagasse Fiber reinforced Composites can be used to manufacture lightweight bumper with good impact strength.

2. Interior Panels:

Sugarcane Fiber Composites are use indoor panels, Dashboards, and interior trims Because they are light and bio-degradable.

3. Seat Backs and headlines:

Natural Fibers composites made from Sugarcane bagasse are used in seat structure and roof headlines.

4. Engine Coves:

Some automotives Components such as engine coves and protective casting can be produced using natural fibers composites.

5. Battery and electric Vehicles Parts in electric Vehicles (EVS):

Sugarcane based Composites are uses to create light weight parts that help increase vehicle efficiency.

6. FUTURE WORKS

The Future of sugarcane in Vehicle Bumper and exterior Components lies in the development of advanced bio-Composites that replace petroleum -bases plastic with bagasse.

1) Improving mechanical strength and impact resistance of bagasse fiber composites so they can perform better in vehicle Bumpers.
2) Surface Treatment of fibers chemicals treatments such as alkali treatment can improve bonding between the fiber and the matrix materials like cy-230 Epoxy resin and Hy-951 Hardner.
3) Hybrid composite Development bagasse fiber can be combined with other fibers (such as glass or carbon fiber) to produce hybrid composites with higher strength and durability.
4) Weight reduction of vehicles further research can focus on developing lighter bumper materials to improve vehicles fuel efficiency and performance.
5) Improved manufacturing techniques new manufacturing proceed like compression molding and vacuum infusion can be to produce better quality composite bumper.
6) Environment sustainability future work can focus on making fully bridgeable and recycling vehicles components using natural fibers.

7. CONCLUSION

This project studied the use of sugarcane bagasse fiber as a reinforcement material in vehicle bumper composites. The composites materials were prepared using CY-230 Epoxy Resin as the matrix and HY-951 Hardner as the curing agent.
Form the study, it is observed that bagasse fiber reinforced composites are lightweight, Eco-friendly and cost-effectively compared to conventional materials. The naturals fiber provides good strength and stiffness while reducing the overall weight of the vehicle components this helps in improving fuel efficiency and reducing environmental impact.
Therefore, sugarcane bagasse fiber composites can be considered a sustainable alternative material for vehicles bumper application. Especially in the development of lightweight and environment friendly automobiles.

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