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A Review on Hybrid Composites Reinforced With Sisal Fibers, Glass Fibers, Steel Fibers and Prosopis Juliflora

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Abstract - Natural fibers have the advantage that they are renewable resources and have marketing appeal. These agricultural wastes can be used to prepare fiber reinforced polymer composites for the commercial use. Among the various natural fibers, sisal is of particular interest that its composites have high impact strength besides having moderate flexural and tensile properties compared to other lignocellulosic fibers. Applications of composite materials to structures have presented the need for engineering analysis. The present experimental study aims at learning the mechanical behavior of hybrid natural fiber composites. The mechanical properties of vinyl ester reinforced with sisal fiber, glass fiber, steel fiber and prosopis juliflora is evaluating. The samples are manufactured using hand lay-up technique where the stacking of piles was alternate. The present work focuses on the fabrication of polymer matrix composite by using natural fiber like sisal fiber, metallic fiber like steel fiber, non - metallic fiber like glass fiber and calculating the material characteristics by conducting tests like tensile strength test, impact strength test and flexural strength test

Keywords - Sisal Fiber, Glass Fiber, Steel Fiber, Vinyl Ester, Prosopis Juliflora, Mechanical Properties, Hand Layup Technique.

I. INTRODUCTION

The importance of natural fibers has been recognized since their use by the Egyptians 3,000 years ago, but since the 1970s a number of high-tech synthetic fibers such as glass, aramid, and carbon have entered and dominated the composite market because of their superior mechanical and thermal properties. With increasing environmental concerns, natural fibers are once again being considered as reinforcements for polymer composites. Natural fibers (NFs) have provided raw materials to meet the human requirements of fibers in their life. With the high-tech developments of man-made fibers, NF lost much of its interest and many of the ancient natural fibers are no longer in use. However, as a result of a growing awareness of the interconnectivity of global environmental factors, the principles of sustainability, industrial ecology, eco-efficiency, and green chemistry and engineering are being integrated into the development of the next generation of materials, products, and processes. Many companies have shifted their focus to using materials that weigh less, are durable and efficient, and have high mechanical properties. In such scenario, NFs are creating great demand as they come at a very low cost, are neutral to CO_2, recyclable, biodegradable, can be separated easily and have low density and contain desirable physical properties. NFs are in general suitable for reinforcing inorganic polymers, synthetic polymers and natural polymers due to their relative high strength, stiffness and low density. This study focus on the mechanical properties of composite consisting of a natural fiber, metallic fiber and non-metallic fiber bonded with vinyl ester.

II. REVIEW ON LITERATURES

Composite materials are intended to combine desired characteristics of two or more distinct materials. The reinforcement can be synthetic (e.g. glass, carbon, boron and aramid) or of natural sources (coir, sisal, prosopis juliflora). Natural fibers like coconut coir (short fibers) and sisal fibers (long fibers) were used in hybrid combination and the fiber weight fraction of 20%, 30% and 40% were used for the fabrication of the composite [6]. Treatment of jute fibers with alkali treatment and MPP emulsion has been found to be very efficient in improving the fiber-matrix adhesion in jute fiber mat reinforced PP composites. NaOH treatment removed wax and fatty substances and changed surface topography of the jute fibers [5]. The different natural fibers impregnation and consolidation with two different thermosetting resins, orthophthalic polyester resin and epoxy resin with SD 2505 hardener. Eight layers of each reinforcement fiber type were impregnated by hand lay-up with the polyester and epoxy resins [6]. Sisal /GFRP

composites sample possess good tensile strength and withstand the strength up to 158.167 N/mm^2. The Jute/GFRP composites specimen showed the maximum flexural load [1]. Vinyl ester resins having density 1.05 g/cm3 are becoming increasingly important for fiber reinforced composites. They combine the excellent mechanical, chemical and solvent resistance properties of epoxy resins with the properties found in the unsaturated polyester resins [3]. Natural fibres as the reinforcement material (with fiber weight fraction, randomly continuous long fibre orientation) by using hand layup fabrication technique. Natural fibres as the reinforcement material (with fiber weight fraction, randomly continuous long fibre orientation) by using hand layup fabrication technique [18]. Tensile test was carried out on the samples using Instron Universal Tensile Testing Machine. Impact test was carried out on the sample using Charpy impact testing machine. The samples were cut into the impact test dimension of 80 mm x 10 mm x 3 mm maintained at a distance of 60 mm between lines of support. . Hardness test was carried out on the samples using Shore D hardness tester [14].

III. MOTIVATION OF THE STUDY

The idea of using fiber composites is got from the literature studies. Studies showed a path of comprising natural fiber, metallic fiber and non-metallic fiber bonded with any thermosetting polymers. For the purpose of experiment sisal fiber is selected as the natural fiber, steel fiber as the metallic fiber, glass fiber as the non-metallic fiber and the vinyl ester as the polymer. Literature studies showed that the Sisal /GFRP composites sample possess good tensile strength and glass fibers possess good flexural strength. Vinyl esters are cheaply available, easily applicable than any other resins. Hence the idea of finding out the mechanical properties of fibre reinforced composites reinforced with sisal, glass, steel fibers has taken in account. Hybrid composite of fiber is made by using sisal fiber, prosopis juliflora, glass fiber and steel fiber. Vinyl ester is used as thermosetting polymer matrix to ensure the bonding between the fibers.

IV. CONCLUSION

The Sisal/Glass composites possess good impact strength. The performance of natural fibers with glass fiber and steel fiber is greater than when it is used alone. Sisal fiber exhibit large impact strength, glass fibers exhibit greater flexural strength while steel fiber and prosopis juliflora gives maximum tensile strength to the the hybrid composites.

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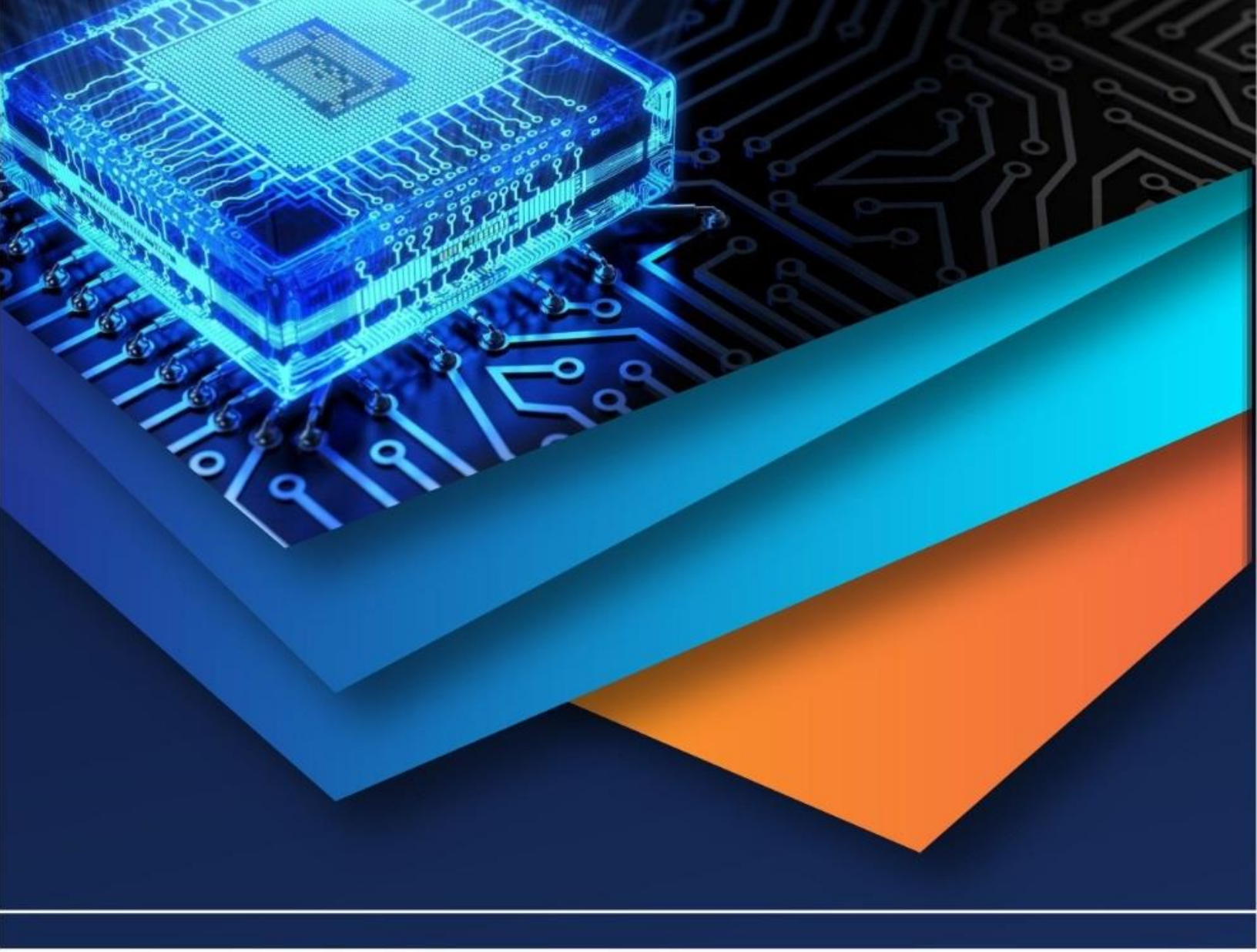

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