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EVALUATIONOFWATERABSORPTIONPROPERTIESONVARIOUS NATURAL FIBERS WITH POLYMERREINFORCEMENT COMPOSITE

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Abstract:- ***This project involves in certain investigations to fabricate and test the mechanical properties of a polymer composite with reinforcing a novel fiber material into the matrix. A polymer matrix is generally a plastic based petroleum by product which is widely used in all manufacturing industries for various applications in day to day life. Into a polymer matrix different synthetic and natural fibers are commonly reinforced to improve the mechanical properties of the composite material. This study involves in certain investigations to fabricate and test the water absorption properties of a polymer composite by reinforcing a natural fiber in flour based or powdered form, into the matrix. Since plastic based polymers are banned nowadays due to its less environment friendliness, this attempt has undertaken a natural and biodegradable polymer material, which is Poly lactic acid (PLA). The areca fibers, Natural fiber is reinforced with PLA in weight ratios of 5, 10, 15, 20, 25 and 30% respectively to obtain six individual samples which are processed using injection molding technique.***

KEYWORD: - Polymer Composite, Areca Fiber and Mechanical Properties

I. INTRODUCTION

It is a platitude that technological advances depends on fosters in the sector of materials. If sufficient materials to bear the service loads and conditions are not available, then one does not have to be a skilful to realize the most advanced turbine or air-craft pattern. Whatsoever the field may be, the ultimate restriction on progression is to be governed by materials. Composite materials in this regard signify a big step in the constant accumulation of optimization in materials. Composites are mixture of two or more materials such as reinforced plastics, metals, or ceramics. The reinforcements may be in the form of fibers, particles, whiskers or lamellae and are embedded in a suitable matrix, thereby providing a material that contains the most useful properties of the constituents. High structural strength, glass fiber reinforced plastics were developed in the early 1940"s and the application of reinforced plastics composites, the glass fibre provides strength and stiffness while the plastic matrix provides the temperature capabilities of the composite. Initially the glass fibres were incorporated in a polyester matrix which could withstand temperature up to 200^0C. They were applied in car bodies, appliance, boats etc. because of their light weight and mitigate of production. Intricate composites parts can be made by injection moulding. Polymer matrices are usually thermosets such as epoxies. Later, resins which can withstand high temperatures, of the order of 300^0C were developed such as polyamides. Other thermo setting resins include benzocylobutene – bismaleimides. Advanced composites are manufactured by using the above polymers with reinforcements of stronger fibres such as aramid and carbon. As a result, advanced composites.

Composites: - Over the last three decades years composite materials, plastics and ceramics have
been the ascendant developing materials. Numerous uses of composite materials have grown evenly,
pervasive and dominant new markets interminably. Modern composite materials comprise a significant amount of the engineering materials market varies from commonplace products to worldly niche applications. Although composites have already manifested their value as weight reduction materials, the existing job is to make them cost productive. The endeavours to yield economically smart composite components have evolved in some unorthodox manufacturing techniques currently being used in the composite industries. It is vibrant, specifically for composites, that the development in manufacturing technology only is not sufficient to overcome the cost hurdle. It is important that there must be an unsegregated implementation in material processing, designing, manufacturing, tooling, quality assurance and even programmers organisation for composites to make
them competitive with metals. Further, need of composites for lighter building materials

1.1 TYPES OF COMPOSITE MATERIALS

The composite materials are classified into the following categories. Fibre-reinforced composites

Because of intrinsic high specific strength and stiffness these composites are universally used in numerous industrial applications. These composites are acquiring high potential in tribological applications also as they possess brilliant structural presentation. Fiber reinforced composites materials comprises of fiber of high strength in or bonded to a matrix with discrete interfaces between them. In this form physical and chemical identities are retained by both fibres and matrix. Yet they produce an amalgamation of properties which is difficult to achieve with either of the composite constituents individually. In general, the role of fibers is to carry load, whereas the role of matrix is to keeps them in the crave position and alignment. Fibrous composite can be further classified into two groups: continuous (long) fiber composite and discontinuous (short) fiber composite

1.2 CONTINUOUS OR LONG FIBER COMPOSITE

Geometrically, a continuous fibre is distinguished as it possesses a high length to diameter ratio. It also comprises of reinforcement matrix by a disseminate phase in the type of continuous fibre. These are basically tougher and stiffer when compared to matrix i.e. bulk phase material. Based on the manner in which fibers are stuffed within the matrix, it is again subdivided in to two categories:

(a) unidirectional reinforcement and (b) bidirectional reinforcement. In unidirectional reinforcement, the fibers are aligned in one direction only where as in bidirectional reinforcement the fibers are aligned in two directions either at some desired angle (angle-ply) or at right angle to one another (cross-ply). When fibers are continuous and large, they transmit certain degree of anisotropy to the properties of the composites especially when they are oriented. Multi-axially oriented continuous fibre composites are also exhibit near isotropic properties.

1.3 DISCONTINUOUS OR SHORT FIBER COMPOSITE

Short-fiber reinforced composites comprises of a reinforced matrix by a distributed phase in the type of discontinuous fibers which are having, length < 100×diameter. The low cost, proficiency of fabricating intricate parts, and isotropic nature are sufficient to make the short fiber composites the material of selection for large-scale production. Accordingly, the short-fiber reinforced composites have profitably established its place in lightly loaded component production. Furthermore, the discontinuous fiber reinforced composite divided into

1.4 ARECAFIBER

Fig:1 Areca Fiber

Areca nut in powdered form was obtained from star agencies Erode. The powder was used as such into the matrix while blending. The powder was dark brown in color and had the following properties. alternate reinforcing design. In most of the applications of laminate composites, man-made fibers are used because of their good amalgamation of physico-mechanical and thermal behaviour.

1.5 POLY LACTIC ACID

Fig:2 Poly Lactic Acid

The PLA was sourced from Central Institute of Plastics Engineering and Technology, Chennai, Tamilnadu, in the form of granules and was further blended into powder form to ease the melting process and ensure good mixing of the matrix with the metal during injection moulding. The PLA had a melting temperature(Tm) of 1700 C, and a crystalline temperature(Tg) of 600 C approximately.

2. LITERATURE REVIEW

Natural Fibers: Source and Classification Growing environmental awareness has activated the researchers worldwide to enhance and utilize materials that are companionable with the environment. In the procedure natural fibers have become suitable options to traditional synthetic or manmade fibers and have the prospective to be used in cheaper, more sustainable and more environment friendly composite materials. Natural organic fibers can be obtained from either animal or plant sources. Most of the useful natural textile fibers are obtained from plant, with the anomaly of wool and silk. All plant fibers comprises of cellulose, whereas protein act as a chief content of fibers of animal origin. Hence, the natural fibers are categorized on the basis of their origin, whereas the plant fibers.

3. FABRICATION METHOD:

3.1 INJECTION MOULDING TECHNIQUE

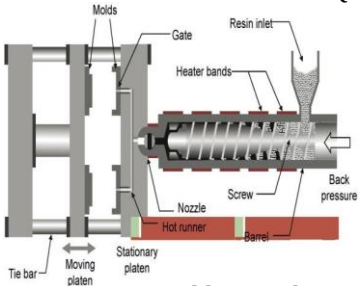

Fig :3 Injection Moulding Technique

Injection molding is the most widely used converting process for thermoplastic articles, especially for those that are complex in shape and require high dimensional precision. All injection molding machines have an extruder for plasticizing the polymer melt. Unlike a standard extruder, the extruder unit for injection molding machine is designed such the screw can reciprocate within the barrel to provide enough injection pressure to deliver the polymer melt into the mold cavities Most injection molding machines for PLA are based on the reciprocating screw extruder, although two-stage systems, which integrate a shooting pot and extruder in a single machine, have also been deployed for injection molding of performs for PLA bottles.

4. RESULTS AND DISCUSSION MOISTURE ABSORPTION BEHAVIOUR

The results of both untreated and treated fibre composite samples exposed to different environments the percentage of moisture absorption characteristics of composite samples with untreated and treated fiber exposed to Saline water and Distil environment with time. It is quite obvious from the figure that as the fibre content increases, the initial rate of moisture absorption and the maximum moisture absorption for both the environment increases. Moisture absorption is maximum for three layered composites. It is known that, the factors like adhesion between fibre and matrix, porosity content and the lumen are responsible for the moisture absorption behaviour of the natural fibre composites. But in this case the hydrophilicity of Luffa Cylindrical fiber, in addition to poor adhesion between fiber–matrix and voids content might have affect the moisture uptake characteristics of the composite.

4.1 VARIOUS TYPES OF NATURAL FIBERS

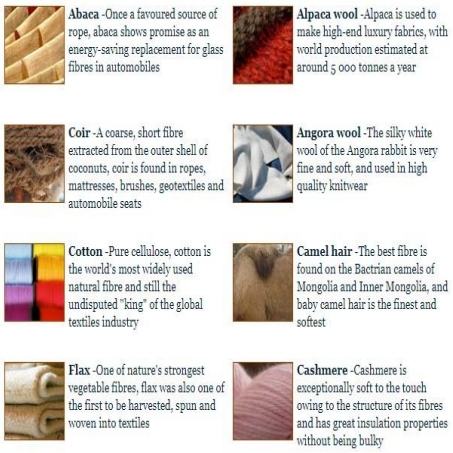

Fig: 4 Various type of Natural Fibers

5. CONCLUSIONS

The Areca Fiber PLA can successfully be used as reinforcing agent to fabricate composite by suitably bonding with epoxy resin. On increasing the fibre content the strength, modulus and work of fracture increases and the best combination is found with Double Layered composite. The fibre surface modification by chemical treatments significantly improves the fibre matrix adhesion, which in turn improves the mechanical properties of composite. The moisture uptake and thickness swelling values increases with increase in fiber loading. Both values are found to be higher in saline environment than in distil water environments. However, these values are considerably reduced with chemical treatments of the fibre. Under all environment conditions, the moisture diffusion process of both treated and untreated areca Fiber and Pla.

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