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Natural Hybrid Composite

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Abstract
The high cost of synthetic Fibre such as glass, carbon, kevars…etc., etc. results in high production and products derived from this material, which has necessitated alternative means of materials development. This has also informed the utilization of locally available bamboo, banana, and sisal Fibre for composite materials development. We could use natural Fibre as a renewable and cheaper substitute for synthetic materials such as glass, carbon, and aramid, used as reinforcements. In this work, the objective was to develop, investigate, and analyze a composite material's mechanical properties using banana, sisal, bamboo Fibres polymer. The long banana, bamboo, and sisal Fibre was extracted using chemical digestion and maceration methods. The composite fabrication was carried out using polyester resin as the matrix and the banana, sisal the bamboo Fibres reinforcement. Tests were carried out to determine the mechanical properties such as tensile, hardness, and bending and impact strengths. Then results were studied and compared with each other.

I. INTRODUCTION

Composites comprise reinforcement carrying material (load carrying material) embedded with matrix weaker materials (weaker materials). Strength and rigidity are given by reinforcement, thus supporting the structural load. The matrix or binder (organic or inorganic) maintains the reinforcement and transfers the external load to the reinforcement. Natural Fibre has emerged as a renewable and cheaper substitute for synthetic materials such as glass, carbon, and aramid, used as reinforcements.

A. Material And method

a). Material used:

E glass, Polymer resin, Wax, Sisal fiber, Banana fibre, Bamboo fibre.

b). Methods:

The oldest and simplest open molding method for the composite fabrication processes is Hand lay-up. Hand lay-up is a low volume, the labor-intensive method used, especially for larger components, such as boat hulls. Other reinforcing materials are positioned manually in the open mold and resin, sprayed, brushed, or poured over and into the glass plies. Air trapped is removed manually or naturally with rollers or squeegees, which complete and laminates structure. Polyesters and epoxies are the most commonly used matrix resins in which curing takes place at room temperature. Curing is done by a catalyst in the resin system, whose primary purpose is to harden the Fiber-reinforced resin composite at room temperature. For a high-quality part surface, a pigmented gel coat is first applied to the mold surface. The minimum infrastructure requirement is only needed for this method. The processing steps are quite simple. The first step is spraying a release gel on the mold surface to avoid polymer sticking to the surface. Thin E-glass are used at the top and bottom of the mold plate to get a good surface finish. Reinforcement in woven mats or chopped strand mats is cut as per the mould size and placed at the mold's surface after the Perspex sheet. The liquid type thermosetting polymer is mixed thoroughly with suitable proportion HR15N as hardener (curing agent), poured onto the surface of the mat that is already placed in the mold. After this, a brush is used to spread uniformly. The second layer of the mat is then placed on the polymer surface, and a roller is moved with mild pressure on the mat-polymer layer to remove any air trapped and the excess polymer present. This process's repetitions are done for each layer of polymer and mat, up to which the required layers are stacked and formed. Release gel is sprayed on the top mold plate's inner surface after placing the plastic sheet in which pressure is applied after keeping on the stacked layers. Curing occurs at room temperature or any temperature, after this mould is taken, and the composite part which is developed is taken out and further processed. Curing time depends on the type of polymer used for composite preparation. For example, for a polyester-based system, the normal curing time at room temperature is 24-48 hours. This method is mainly suitable for thermosetting polymer-based composites. Money and other requirements are less for the hand lay method as compared to other methods. But the production rate is less and difficult for achieving a high volume fraction of reinforcement in the processed composites. The hand lay-up method is used for fabricating aircraft components, automotive parts, boat hulls, dice board, deck, etc.

c). Result and discussion

The material is made, and the test is carried out. The tests carried out are hardness test, tensile test, bending test.

The result is: hardness value is 75, the yield stress is 10.23 n/mm2, tensile strength is 23mpa, bend test is 35mpa.

Fig 1: composite material

II. CONCLUSIONS

The natural hybrid composite (sisal, banana, bamboo) that we created has more strength than banana fiber composite from the above value. Still, when compared with the plywood, its value is slightly low. The plywood has a large value for the bending test. But the hardness test value is higher than that of plywood.

So we can replace the banana fibre composite with our newly prepared composite natural hybrid composite (sisal, banana, bamboo). Still, we won't be able to replace plywood by using another type of hardener, by changing the alignment of the Fibre, treating the Fibre with chemicals. Thus the strength can be increased.

We also concluded that there are different constraints on which projects depend, such as knowledge about the project, money for material, money for preparation, time,.....etc....

After doing the project, we can say that it requires more money than we expected, but the money decreases drastically when it is produced in masses.

We also found out that by changing alignment, position, ...etc.... we could increase the strength.

It is a biodegradable, natural, environmental-friendly product, so we don't need to worry about anything.

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