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SYNTHESIS AND CHARACTERIZATION OF NATURAL FIBERS DERIVED FROM PLANTS AND ANIMALS FOR POLYMER BIO-COMPOSITE MATERIALS

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ABSTRACT

Recently, the mankind has realized that unless environment is protected, he himself will be threatened bythe over consumption of natural resource as well as substantial reduction of fresh air produced in the world. Conservation of forests and optimal utilization of agricultural and other renewable resources like solar and wind energies, and recently, tidal energy have become important topics worldwide. In such concern, the use of renewable resources such as plant and animal based fibre-reinforce polymeric composites, has been becoming an important design criterion for designing and manufacturing components for all industrial products. Research on biodegradable polymeric composites, can contribute for green and safe environment to some extent. In the biomedical and bioengineered field, the use of natural fibre remixed with biodegradable and bioresorbable polymers can produce joints and bone fixtures to alleviate pain for patients.

Keywords: Natural fibre, plant fibre, animal fibre, biocomposites.

I Introduction

The increasing demand for environmental friendly materials and the desire to reduce the cost of traditional fibre lead to the development of natural fibre composites.The natural fibre-reinforced polymer composite is rapidly growing both in terms of their industrial applications and fundamental research. They are renewable, cheap, completely or partially recyclable and biodegradable. These composites are having low density and cost as well as satisfactory mechanical properties make them an attractive due to easy availability and renewability of raw materials. Natural fibres have been proven alternative to synthetic fibre in transportation such as automobiles, railway coaches and aerospace. Other applications include military, building, packaging, consumer products and construction industries for ceiling panelling, partition boards.

Natural fibre composites include coir, jute, bagasse, cotton, bamboo, hemp. Natural fibres come from plants. These fibres contain lingo cellulose in nature. Natural fibres are eco-friendly; lightweight, strong, renewable, cheap and biodegradable. The natural fibres can be used to reinforce both thermosetting and thermoplastic matrices. Thermosetting resins such as epoxy, polyester, polyurethane, phenolic are commonly used composites requiring higher performance applications. They provide sufficient mechanical properties in particular stiffness and strength at acceptably low price levels. Recent advances in natural fibre development are genetic engineering. The composites science offer significant opportunities for improved materials from renewable resources with enhanced support for global sustainability. Natural fibre composites are attractive to industry because of their low density and ecological advantages over conventional composites. These composites are gaining importance due to their non-carcinogenic and bio-degradable nature. Natural fibre composites are very cost effective material especially in building and construction, packaging, automobile and railway coach interiors and storage devices .These composites are potential candidates for replacement of high cost glass fibre for low load bearing applications .

Natural fibres have received much attention from materials scientists and engineers in the past decades because they are less expensive, lightweight, non-toxicity, ease of recyclability and biodegradable Lightweight materials that involve bio fibre composite materials are revolutionising the materials field .Recent reports indicate that plant-animal based natural fibres can very well be used as reinforcement in polymer composites, replacing to some extent more expensive and non-renewable synthetic fibres such as glass.

II OBJECTIVES

- It have to be easy to fabricate
- It ought to be transportable and cost-efficient.
- It ought to be environmentally friendly
- It doesn't have harmful elements.
- It have to be easy decomposable with no effect.

III SELECTION OF MATERIAL

The materials used in this work are

- Chicken feather fiber
- Coir fiber
- Polyester resin

IV METHOD

Hand lay-up technique is the simplest method of composite processing. The infrastructural requirement for this method is also minimal. The processing steps are quite simple. First of all, a release gel is sprayed on the mold surface to avoid the sticking of polymer to the surface. Thin plastic sheets are used at the top and bottom of the mold plate to get good surface finish of the product. The polymer is uniformly spread with the help of brush. Second layer of mat is then placed on the polymer surface and a roller is moved with a mild pressure on the mat-polymer layer to remove any air trapped as well as the excess polymer present. The process is repeated for each layer of polymer and mat, till the required layers are stacked. After placing the plastic sheet, release gel is sprayed on the inner surface of the top mold plate which is then kept on the stacked layers and the pressure is applied. After curing either at room temperature or at some specific temperature, mold is opened and the developed composite part is taken out and further processed.

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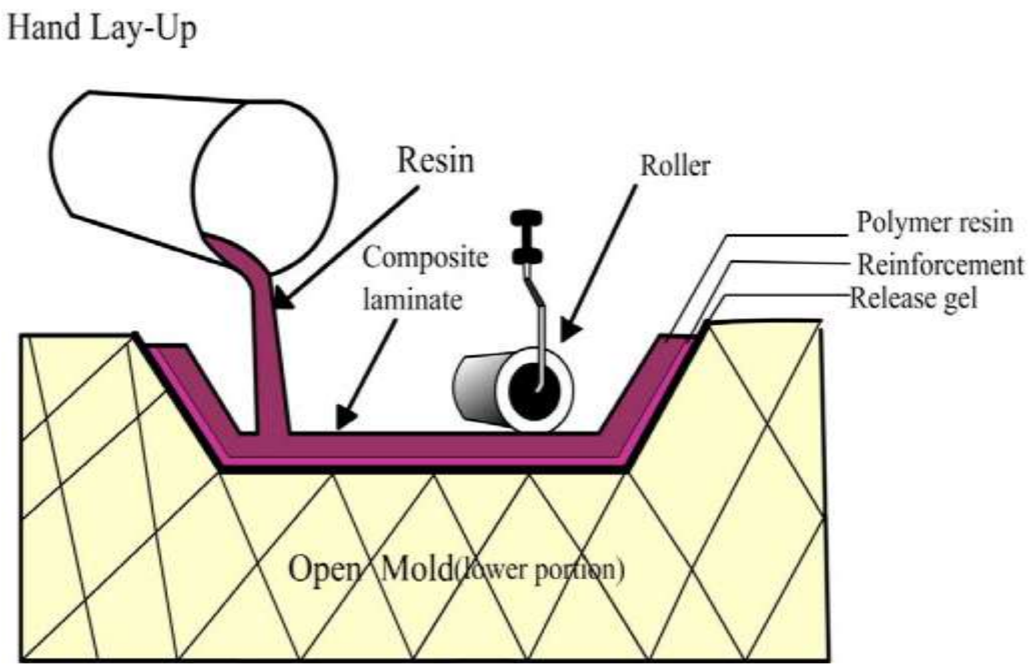

Fig 4.1 Handlayup method

V. METHODOLOGY

1. Selection of natural fibers: Different plant fibers (such as jute, sisal, bamboo, coir, etc.) and animal fibers (such as wool, silk, etc.) will be selected for the study based on their availability and potential for use in bio-composite materials.
2. Extraction and processing of fibers: The selected natural fibers will be extracted from the plants or animals using appropriate techniques such as retting, decorticating, or shearing. The fibers will then be processed to remove impurities and improve their compatibility with polymer matrices.
3. Preparation of bio-composite materials: The characterized natural fibers will be combined with polymer matrices such as polypropylene, polylactic acid, or polyethylene using different processing techniques such as compression molding, extrusion, or injection molding. The fiber content and processing conditions will be optimized to achieve desirable properties in the bio-composite materials.
4. Characterization of bio-composite materials: The prepared bio-composite materials will be characterized for their mechanical, thermal, and morphological properties.
5. Evaluation of bio-composite performance: The performance of the developed bio-composite materials will be evaluated for their suitability in different applications such as automotive, construction, packaging, etc. This will involve testing the materials for their durability, weather resistance, and recyclability.
6. Comparison with conventional materials: The properties of the developed bio-composite materials will be compared with conventional materials such as glass fiber-reinforced composites or synthetic polymers to assess their potential for replacing existing materials in various applications.

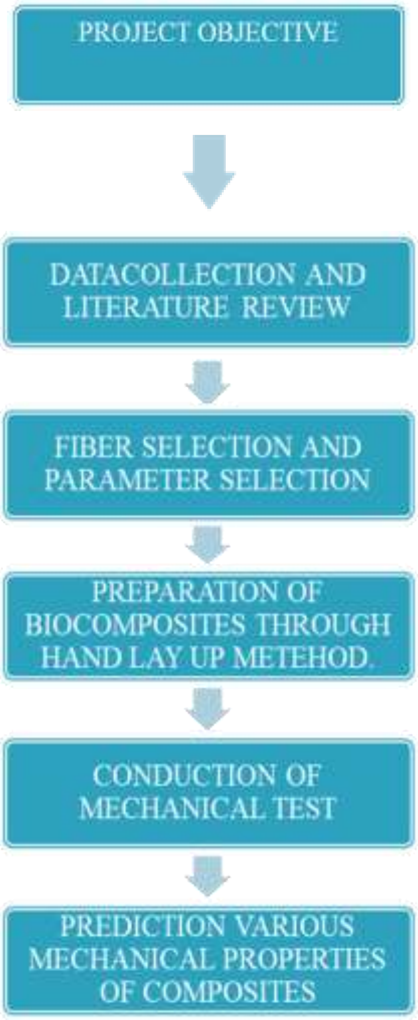

Fig 5.1 – Methodology schematic diagram

VI– Fabrication

- The Two laminates are fabricate by using chicken feather fiber, Coir fiber with Polyster resin.
- First laminate consists of three layers that is two layers of coir fiber and one layer chicken feather fiber is going to fabricate by using Hand by lay-up method.
- Second laminate consists of three layers that is two layers of Chicken feather fiber and one layer Coir fiber is going to fabricate by using Hand by lay-up method.

VII. MERITS

- Light weight
- High strength
- Corrosion and chemical resistances
- Non conductive
- Elastic

Fig 6.1 – Fabricated sample

VIII. APPLICATION

- Low density: This may lead to a weight reduction of 10 to 30%.
- Acceptable mechanical properties, good acoustic properties.
- Favourable processing properties, for instance low wear on tools, etc.
- Options for new production technologies and materials.
- Favourable accident performance, high stability, less splintering.
- Favourable eco balance for production of automobile components.
- Favourable eco balance during vehicle operation due to reduction in weight.
- Occupational health benefits compared to glass fibres during production.
- No off-gassing of toxic compounds (in contrast to phenol resin bonded wood and recycled Cotton fibre parts).
- Reduced fogging behaviour.
- Price advantages both for the fibres and the applied technologies.

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