**EXPERIMENTAL INVESTIGATION OF DISCARDED**

**OPTIC FIBRE AND BANNER WASTE HYBRID COMPOSITES**

**FOR STRUCTURAL APPLICATIONS**

**INTRODUCTION:**

Hybrid composite material is a combination of reinforcement of two or more fibres within a single matrix material. The primary phase is known as matrix, which holds the reinforcement phase and shares the load with it. The second phase is known as the reinforcement, and it acts as load-carrying elements. The strength of the composite is increased by both the matrix and the reinforcing phase. These composites are used in many engineering applications for their versatile properties like lightweight, strength-to-weight ratio, low cost, ease of structure development, and high strength.

Electronic waste has become a global problem in the last 10 years. E-waste disposal is becoming a critical challenge. Telecommunication equipment accounted for 12% of e-waste generated in India. Optical fibre has received a lot of attention in telecommunication services, including the internet, television, and telephones.

On the other hand, banners which are used for short duration of advertisement are made from polyvinyl chloride (PVC), which is the third most abundant plastic in the world. As part of one-day events such as VIP invitation, parties, marketing promotions, school and college co-curricular activities, etc., banners are commonly used. There’s a lot of waste created every year when banners are thrown away after events.

These optical fibres are composed of glass with a silica substrate, whereas banners are made of PVC, both emits dangerous pollutants such as sulphates and nitrates. It has the potential to cause cancer and infertility. The improper disposal of optic fibre and banner wastes can spread the diseases and negatively affect the environment.

To overcome these issues, a novel hybrid composite material can be developed by replacing waste materials with existing ones. These composites are developed by employing a simple hand layup technique that combines banner and optic fibre wastes as reinforced with a polyester matrix. The mechanical behaviour of composites, such as tensile, flexural, and impact, is investigated in accordance with ASTM standards by comparing different layers of composites to determine the most suitable composites with superior mechanical properties, light weight, high durability, and low cost, improving useful for making structural applications with the aim of safeguarding our environment by reducing optic fibre and banner waste.

**OBJECTIVES:**

* Gain knowledge about fibre-reinforced composite material.
* Collect optic fibre from discarded optic cables and waste banner sheets.
* Design the best layout/layer and fabrication of partition sheet using waste material.
* Evaluation of mechanical properties such a tensile, flexural, impact, and surface morphology of composites in accordance with ATSM (American Society for Testing and Materials) standards.
* To analyse the mechanical properties and compare the results to existing materials to identify the best composite for structural applications.

**METHODOLOGY:**

The steps involved are:

1. **Preparation of composite:**

The discarded optic cable and waste banners are collected from numerous places for use in the manufacturing process. The die is manufactured to prepare the hybrid composite. Five different composites are formed by hand layup technique utilizing various layers of banner sheet and optic fibre as reinforcement and a matrix as the polyester resin is applied in between each layer.

Layers in FRP composite:

* Composite A- polyester matrix, 3 layers of banner sheet & 2 layers of optic fibre.
* Composite B- polyester matrix, 2 layers of banner sheet& 1 layer of optic fibre.
* Composite C- polyester matrix, 2 layers of banner sheet.
* Composite D-polyester matrix, 1 layer of banner sheet.

1. **Testing:**

A wire hacksaw blade was used to cut laminate into specimen as per ASTM standards.

1. Tensile test utilizing a universal testing machine in accordance with ATSM D3039.
2. The flexural test with a Universal testing machine in accordance with ATSM D790.
3. The impact test with load impact testing equipment in accordance with ATSM D256.

**Workplan:**

**BUDGET:**

|  |  |  |  |
| --- | --- | --- | --- |
| **SI.No.** | **Budget items** | **Amount Requested**  **(Rs)** | **Justification for each head** |
| **1.** | Purchase of chemicals & consumables | 5,000 | Polyester resin, woven glass fibre, methyl ethyl ketone peroxide (catalyst), acetone cobalt naphthalene (accelerator), pigment and wax, etc. |
| **2.** | Purchase of hand tools and accessories etc. | 1,500 | Hand gloves, tray, cutting plier, brush, roller, scissors, mug, and die, etc. |
| **3.** | Testing charges &  contingencies | 3,500 | Mechanical properties such as tensile test, impact test, and flexural test are taken to identify the best composite, etc. |
| **TOTAL** | | **10,000 (Rupees Ten Thousand Only)** | |

Collection of banner waste and discarded optic cables from various places.

Material requirement:

Reinforcement by discarded optic fibre, ban waste and matrix as polyester resin.

Literature survey