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Mechanical Behaviour of Chicken Feather Reinforced Polymer Composites

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ABSTRACT

The goal of this proect is to use and assess the mechanical properties of the chicken quill strengthened polyester composites. Preceding creation of the composites, the chicken plume strands (CFF) were cleaned, tried and dissected as far as physical properties; straight thickness and elastic conduct. The unidirectional CFF fortified composites were created with polyester resins with various extents. Trials were led to decide physical properties of the control (0%) and CFF fortified composites; tensile,flexural and Charpy impact testing. It was discovered that the impact properties of the CFF strengthened composites are altogether superior to the control composites. Anyway both the malleable and the flexural properties of the CFF fortified composites have less fortunate qualities contrasted with the control composites. The CFF fortified composite have potential applications because of its improved impact conduct. Therefore the poultry waste can be used for any designing application and they will be favored because of minimal effort and prevalent attributes and the above all they won't cause biological and medical issues

Keywords : Chicken Feather, Composites, Mechanical Properties, Polyester

I. INTRODUCTION

1.1.COMPOSITE MATERIALS

Since the beginning, mechanical advancements have helped mankind improve their ways of life, with the rate of advancement and research is so amazing. In any case, certain innovation likewise makes a negative natural effect. In this manner endeavors are put resources into utilizing characteristic based biodegradable and manageable material that exist in nature as opposed to make another material. Material structures fortified composites, explicitly with filaments, have picked up significance in designing and specialized applications because of their light weight, higher constancy, predominant flexibility and quality, great warm opposition, low thickness, and better unbending nature [1-3]. The CFF are normally depicted as a loss result and they are adding to ecological contamination because of the transfer issues. There are two fundamental chicken plume transfer strategies that exist, a consuming and covering. Them two have negative effect on nature. Ongoing investigations on the chicken feathers showed that the waste can be a potential composite support. The composite fortification use of the CFF offers considerably more compelling approach to comprehend ecological concerns contrasted with the conventional transfer techniques. A portion of the upsides of the CFF are economical, inexhaustible, and plentifully accessible. The CFF as a composite support having certain attractive properties including lightweight, high warm protection, superb acoustic properties, non-rough conduct and incredible hydrophobic properties. The CFF has the least thickness esteem contrasted with the all normal and engineered strands [4-7]. Castano et al found that the CFF keratin biofibres permits an even appropriation inside and adherence to polymers because of their hydrophobic nature and they revealed that CFF strengthened composites have great warm solidness and low vitality dispersal [8]. The primary motivation behind this examination is to produce and decide the mechanical properties of the CFF strengthened vinylester and polyester thermoset composites. The chicken plume strands were tried and dissected to recognize the accompanying properties; direct thickness, breaking lengthening and determination. The CFF strengthened composites were created by hand layup system in the research facility. Vinylester and polyester gum were utilized as lattices and the composites were fabricated by utilizing three distinctive fiber stacking extents. The mechanical properties of these composites were resolved and looked at including tractable, flexural and Charpy impact properties.

II. MATERIALS AND METHODS

2.1.MATERIALS

The raw materials used in this work are

1. chicken Feather
2. Polyester resin
3. Methyl Ethyl Ketone Peroxide
4. Cobalt

2.1.1. Chicken Feather

Chicken feather is collected from the poultry farms. It is the waste of chicken which are cleaned well. After the washing process the chicken features were rinsed and leftto dry for 24 hours under normal room temperatures. and dried in sun light. The dry feathers are cut into short fibers.

2.1.2. Polyester resin

Softener (Araldite LY 556) made by CIBA GEIGY limited having the following outstanding properties has been used as the matrix material.

a. Excellent adhesion to different materials.
b. High resistance to chemical and atmospheric attack.
c. High dimensional stability.
d. Free from internal stresses.
e. Excellent mechanical and electrical properties.
f. Odourless, tasteless and completely nontoxic.
g. Negligible shrinkage.

2.1.3. Hardener

In the present work hardener (HY951) is used. This has a viscosity of 10-20 MPa at 25ºc.

2.2. SPECIMEN PREPARATION

Preceding the composite assembling, the CFF tests were adapted for 48 hours at 65% RH and 20°C [9]. The fiber straight thickness esteems were resolved as per ASTM D1577 [10] and the elastic properties of the filaments were resolved as per ASTM D3822 [11]. The composites were created with various fiber loadings (0%, 2.5%, 6% and 10%). At first, polyester resin was blended in Gobalt utilizing a blender in a bowl after the polyester, resin was additionally arranged independently. The grid materials were set up in a segment of 73% of resin framework and 23% of hardener by volume. At that point, the strands were spread into shape and secured with the grid. The composites were made by utilizing a hand lay up method with size form of 300 mm length x 300 mm width x 20 mm thickness. The composites were kept for 24 hours at room temperature and along these lines put in a broiler for 8 hours at 80°C for restoring. The control and the CFF strengthened composites were assessed as per ASTM D3039/D3039M (Tensile Properties of Polymer Matrix Composite Materials), EN ISO 14125 (Fibrereinforced plastic composites-Determination of flexural properties), and EN ISO 179-1 (Determination of Charpy impact properties).

2.3.HAND LAY –UP METHOD

Hand expose up is a open molding method appropriate for making a wide assortment of composites items including: pontoons, tanks bathware, lodgings, truck/auto parts, engineering items and numerous different items extending from extremely little to exceptionally enormous. Generation volume per form is low; be that as it may, it is possible to deliver generous creation amounts utilizing various molds. Straightforward, single-pit molds of fiberglass composites development are commonly utilized. Molds can run from exceptionally little to huge and are ease in the range of delicate composites molds. Gel coat is first applied to the shape utilizing a splash weapon for a great surface. At the point when the gel coat has restored adequately, move stock fiberglass fortification is physically put on the form. The cover tar is applied by pouring, brushing, showering, or utilizing a paint roller. FRP rollers, paint rollers, or squeegees are utilized to merge the cover, completely wetting the support, and expelling ensnared air. Ensuing layers of fiberglass support are added to manufacture cover thickness (Fig 2.1). Easiest strategy offering minimal effort tooling, straightforward preparing and wide scope of part estimates are the significant focal points of this procedure. Configuration changes are promptly made. There is a base interest in gear. With gifted administrators, great generation rates predictable quality is realistic.

III. RESULTS & DISCUSSIONS

This paper presents the mechanical properties of the chicken reinforced polyester composites prepared for this present investigation. Details of processing of these composites and the tests conducted on them have been described in the previous chapter. The results of various characterization tests are reported here. This includes evaluation of tensile strength, flexural strength, impact strength and micro-hardness has been studied and discussed.

3.1. Mechanical Characteristics of Composites

The portrayal of the composites uncovers that the fiber content is having critical impact on the mechanical properties of composites. The properties of the composites with various fiber substance under this examination are introduced in Table 3.1.

Table 3.1 Mechanical properties of the composites

Specimen	Hardness (HB)	Tensile strength,(N)	Flexural strength (N)	Impact energy (KJ/m^2)
A	17	989	48	3.25
B	14.6	1115	67	4.26
C	18.9	1305	117	8.96
D	21	2589	148	12.5

3.2. DISCUSSIONS

3.2.1. Effect of Fiber content on Micro-hardness

The deliberate hardness estimations of all the four composites are introduced in Figure. It tends to be seen that the hardness is diminishing with the expansion in fiber content upto 60%. Anyway further increment in fiber content builds the smaller scale hardness esteem.

3.2.2. Effect of Fiber content on Tensile Properties

The test results for rigidities and moduli are appeared in Figures 4.2 and 4.3 individually. It is seen that the rigidity of the composite increments with increment in fiber substance. There can be two purposes behind this expansion in the quality properties of these composites thought about. One plausibility is that the concoction response at the interface between the filler particles and the network might be too solid to even think about transferring the elastic. From

Figure 4.3 plainly with the expansion in fiber content the malleable moduli of the chicken strengthened polyester composites increments bit by bit.

3.2.3. Effect of Fiber contents on Flexural Strength

Figure 4.4 shows the correlation of flexural qualities of the composites acquired tentatively from the curve tests. It is intriguing to take note of that flexural quality increments with increment in fiber content.

3.2.4. Effect of Fiber contents on Impact Strength

The effect vitality estimations of various composites recorded during the effect tests are given in Table. It demonstrates that the protection from sway stacking of coconut chicken fortified polyester composites improves with increment in fiber substance as appeared in Figure4.5. High strain rates or effect burdens might be normal in many building utilizations of composite materials. The reasonableness of a composite for such applications ought to in this manner be resolved by regular plan parameters, however by its effect or vitality retaining properties.

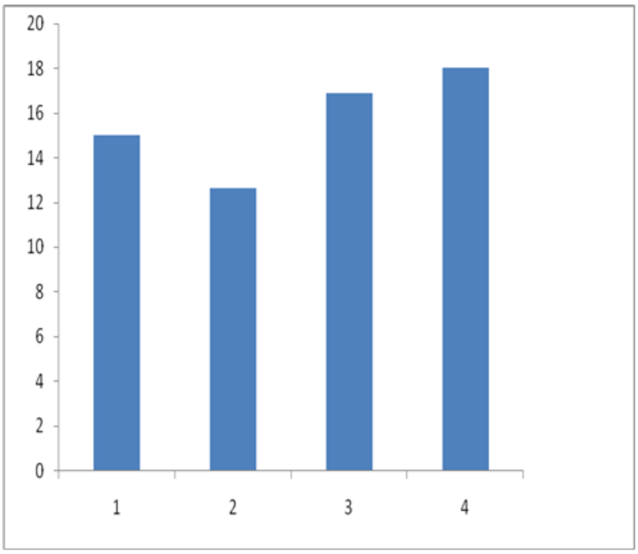

Figure 4.1 Effect of fiber content on micro-hardness of the composites

X-Axis-Fibercontent 90%,80%,70%,60% respectively

Y-Axis -Micro Hardness

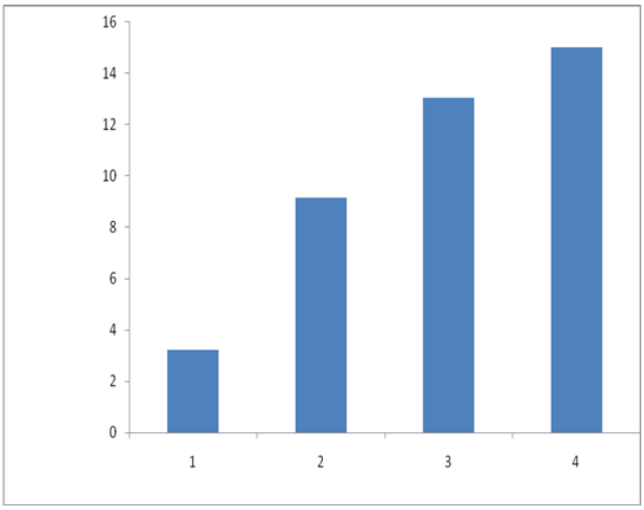

Figure 4.2 Effect of fiber content on tensile strength of composites

X Axis - specimens

Y Axis - Tensile strength in MPa.

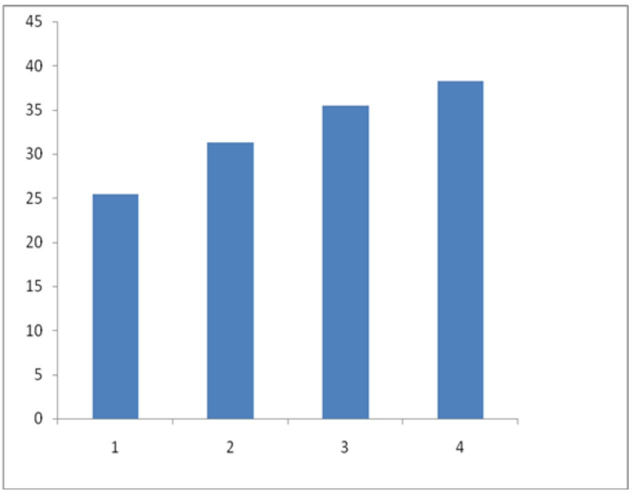

Figure 4.4 Effect of fiber content on flexural strength of composites

X Axis- Specimens

Y Axis- Flexural strength in Mpa

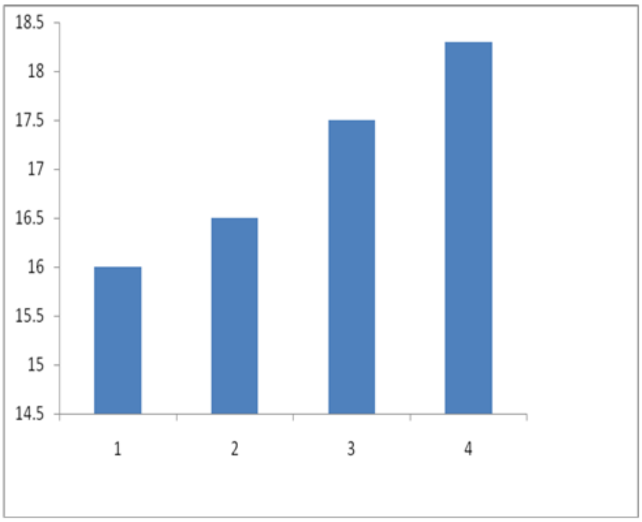

Figure 4.5 Effect of fiber content on impact strength of composites

X Axis- Specimens

Y Axis – Impact strength in KJ/m^2

IV. CONCLUSION

This trial examination of mechanical conduct of coconut chicken fortified polyester composites prompts the accompanying ends:

This work shows that fruitful manufacture of a chicken fortified polyester composites with various fiber substance is conceivable by straightforward hand lay-up strategy. It has been seen that the mechanical properties of the composites, for example, smaller scale hardness, elasticity, flexural quality, impact quality and so on of the composites are additionally enormously affected by the fibre substance.

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