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Flexural Properties of Natural Fiber Calcium (Boiled Egg Shell) Impregnated Coir-Vinyl Ester Composites

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***ABSTRACT*:** *Flexural properties of natural fiber calcium (boiled egg shell) impregnated coir-vinyl ester composites were evaluated. The short untreated coir fiber with different proportions offiber length, fibercontentand filler content was used as reinforcements in polymer-based matrices. The fabricated composites with different levels of fiber parameters were tested as per ASTM standards.*
The particles filled coir-vinyl ester composites exhibit better value of Flexural strength of 28 MPa was obtained in 30 mm Fiber length,20 % fiber Content and 20 % Particulate Content.

Keywords: Natural fiber composite, vinyl ester

I. INTRODUCTION

The utilization of polymer composites in many engineering fields has undergone a marvelous increase.In the recent years, increasing environmental awareness,international government policy new global agreements and regulations have been directing attractiveness to a plant-based fiber as an alternative reinforcement material in polymer composites.Reduced weight and increased performance properties have paved a path to development of advanced engineering materials. Composite products have good mechanical properties-to-weight ratioand the technologies permit the manufacture of complex and large shapesHarish et al (2008).Fillers are added to a polymer matrix to reduce cost(since most fillers are much less expensive than the matrix resin), increase modulus, reduce mould shrinkage, control viscosity, and produce smoother surface. The major constituents of particulate (filler added) composites are particles of mica, silica, glass spheres, calcium carbonate, or others. In general,these particles do not contribute to the load-carrying capacity of the material and act more like a filler than a reinforcement for the matrix. The most commonfiller for polyester and vinyl ester resins is calcium carbonate (CaCO3), which is used to reduce cost as well as mould shrinkage Sathiyamurthy et al (2011). Jayabal et al (2010) investigated the influence of calcium carbonate on the mechanical properties of coir–vinylster composites. As per the design (three fiber parameters and three levels in each parameter) a total of 9 experimental runs were carried out in this investigation. The composites were fabricated as per the design of fiber parameters, namely fiber length, and filler content and the mechanical properties were evaluated as per ASTM standards.

II. EXPERIMENT PROCEDURE

2.1 Composite Fabrication

A stainless steel mould having size of (300mm× 300mm × 3mm) was used for composite fabrication using compression molding process. The fabrication parameters and their levels are given in Table 1.

Table1.Parameters and their level

Model	Fiber length(mm)	Fiber Content (%)	Particulate Content (%)
S1	10	30	10
S2	10	20	20
S3	10	10	30
S4	30	30	10
S5	30	20	20
S6	30	10	30
S7	50	30	10
S8	50	20	20
S9	50	10	30

2.2. Mechanical testing

Specimens for mechanical tests were cut from the manufactured composite and finished to the accurate size using emery paper. Three points' flexural tests were conducted using UNITEK machine as per ASTM D790. Five specimens with identical dimensions for each composite material were tested and average result is derived. Testing conditions of 23±2 ^{0} C temperature and relative humidity of 50 ±5 % were followed.

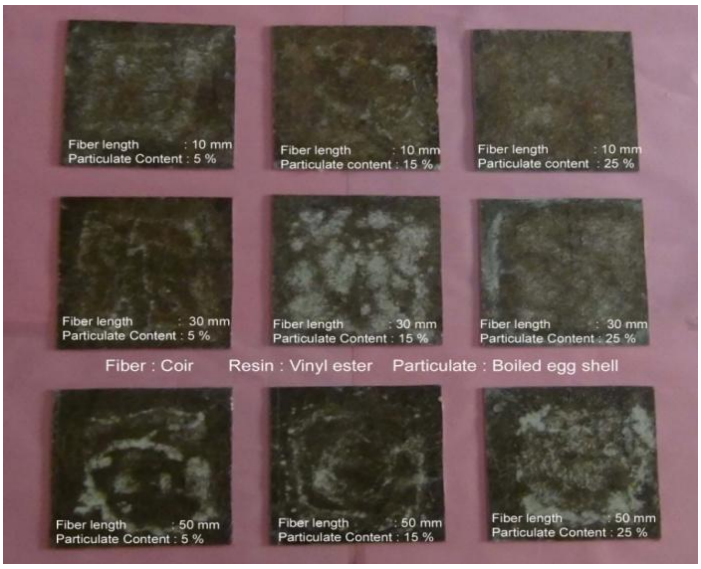

Figure.1Photographic image fabricated composites

Figure.2Photographic image of flexural

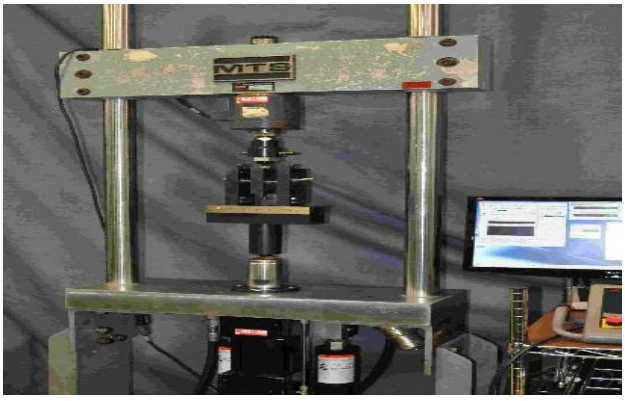

Figure.3Photographic image of test specimen after fracture flexural testing machine

III. RESULTS AND DISCUSSION

Table1.The flexural strength values of the calcium impregnated coir-vinyl ester composites

Model	Fiber Length (mm)	Fiber content (%)	Particulate	Flexural
S1	10	30	10	21
S2	10	20	20	22
S3	10	10	30	20
S4	30	30	10	24
S5	30	20	20	28
S6	30	10	30	26
S7	50	30	10	21
S8	50	20	20	24
S9	50	10	30	23

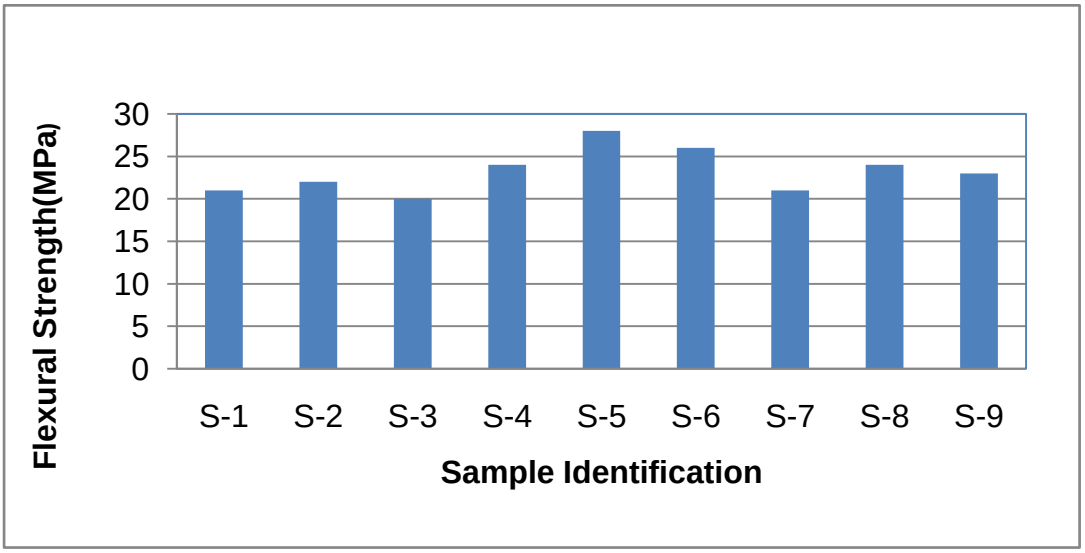

Figure 4.Effect of the Fiber parameters on the Flexural strength (Coir-Vinyl ester)

The maximum value of flexural strength of 28 MPa were obtained at 20% fiber content, 20% filler content and 30 mm fiber length (Figure. 4). It was observed that there is gradual increase in the flexural properties of the composites with the increase in filler content but when the filler content is increased beyond 20 % of the total composite composition an adverse effect is inferred.

IV. CONCLUSION

Boiled egg shell is used to fabricate coir-vinyl ester Composites successfully in this current investigation.From the experimental results obtained it can be concluded that the fiber length and particulate content play a significant role in improving the mechanical properties of coir fiber reinforced vinyl ester composite.The randomly oriented coir fiber reinforced vinyl ester composites exhibited better values of the flexural strength of 28MPa was obtained in 30 mm Fiber length, 20 % fiber Content and 20 % Particulate Content. This specific investigation on boiled egg shell particulate coir-vinyl ester composites provides an initiative for the development of new variety of coir-vinyl ester composites in engineering applications.

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