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Crab carapace particles filled coir reinforced polyester composites; Impact strength and Fractography study

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Abstract: Natural fibre reinforced composited are finding their way in commercial and engineering application because of its value added benefits such as biodegrability, availability and recyclability etc. The application of this natural fibre reinforced composites was restricted to some extent due its poor mechanical properties and poor compatibility with matrix materials. This work is focused on determine the possibility of improving the mechanical properties of coir fibre reinforced polyester composites by impregnation of bio based particulate; crab carapace. The composite was fabricated using compression moulding process by varying the fabrication parameters namely; fibre length (10, 30, 50 mm) and filler loading (2, 4, 6 wt. %) .The composite specimens fabricated were subjected to impact test as per ASTM standard to identify the maximum energy absorbed by the specimens. The fractography study on the fractured specimens was carried out using Scanning electron microscope (SEM) and the outcome of particle addition on the impact strength of coir fibre reinforced composites was analyzed. From this investigation it was confirmed that the inclusion of crab carapace play a major role in improving the impact strength of coir fibre reinforced polyester composites.
Keywords: Crab carapace; coir fiber; fractography study; impact strength; polymer composites.

1. Introduction

Natural fiber reinforced composites materials are consist of coir fibre and resin. Fiber reinforced polymer were important role in the engineering materials. The natural fiber reinforced polymer has been successfully used in applications in automobiles, aircrafts, constructions and other Industries, because low cost and high strength and stiffness simultaneously low weight and ease degradable. The main use of coir fiber and evaluates the mechanical properties of natural fiber – epoxy composites. They are qualitative evaluation for using SEM images find out the fracture surfaces and interfacial properties from coir epoxy and compared with glass fiber epoxy composites (1). Investigated the effect of the stacking sequence of untreated woven jute and jute glass fabric polyester composites .Evaluate the various sequences are used and find out the tensile, flexural and interlinear behaviour of the jute and glass fibre composites (2). Investigate the thermal conductivity and diffusivity and specific heat of natural (banana and sisal) fibre polyester composites as a utility of the filler concentration and for several fibre surfaces treatments in composites (3). Fillers are added to a polymer matrix to reduce cost (since most filler are much less expensive than the matrix resin), increase modulus, reduce mold shrinkage, control viscosity and produce smoother surface. The most common filler for polyester and vinyl ester resins is calcium carbonate ($CaCO_3$), which is used to reduce cost as well as mold shrinkage. Although

fillers increase the modulus of an unreinforced matrix, they tend to affect its strength and impact resistance [4]. The mechanical properties such as Tensile, flexural and water absorption properties of sisal reinforced polyester composites was studied by fabricating the composites using compression moulding and resin transfer moulding techniques for different fibre loading and fibre length and results were compared [5]. Some of the manufacturing studies on Glass Fiber Reinforced Composites were carried out using Response surface methodology and Neural Network techniques (6,7).In this present work to evaluate the impact behaviour and fractography study and failure analysis of impact using from the SEM images on the crab carapace impregnated the coir polyester composites.

2. Experimental procedure

2.1 Composite Fabrication

The resin system consists of unsaturated orthophthalic polyester resin Methyl Ethyl Ketone Peroxide (MEKP) catalyst and Cobalt Octoate accelerator was used (Ratio: 1:0.015:0.015). The natural green husk coir fiber was selected as reinforcement material in this investigation. The crab carapace filler was mixed with resin system for different percentage of weight content and blended by using simple mechanical stirring at 20 rpm for 10 min. in the room temperature [25^0C].A stainless steel mould having size of 300 × 300 × 3 mm^3 was used for composite fabrication using compression moulding process. Specimens for impact test were cut from the manufactured composite and prepared to the accurate size using emery paper. The izod impact test was carried out using Tinius Olsen (Model: 104) Impact Tester as per ASTM D256 standard.

3. Results and discussion

3.1 Effect of fabrication parameter on impact behaviour of composites

The influence of fibre length, fibre content and filler content on the impact strength of the materials is shown in the Fig.1, The Maximum value of impact strength of 43.3kJ/m^2 was obtained the parameters Fibre length 30mm, fibre content 25 and filler content 4%.andthe minimum value of impact strength on composite material of 33kJ/m^2 was obtained the parameters Fiber length 10mm,fiber content 40 and filler content 2%.When the filler content increased the strength was increased in the natural fibre reinforced polymer composites.

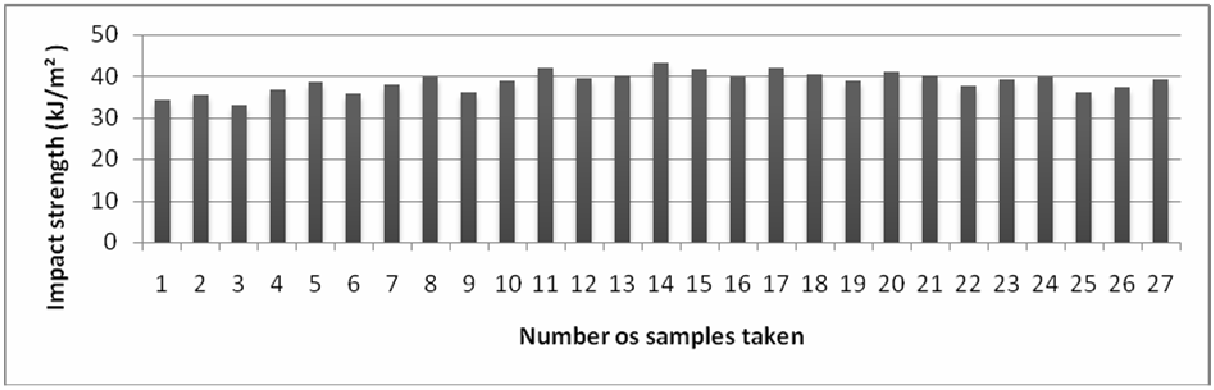

Fig.1. Impact Strength of the composites.

3.2 Fractography study of Crab carapace filled coir polyester composites

The fractographs studies of the SEM images after impact testing are discussed in Fig. (2). The fiber has cracked different level this indicates that the certain amount of energy has been absorbed during pull out the fibers. It develops the some voids formed on the resin surface due to fiber pull out. It exhibits the crack growth on the resin surface and it formed striations. The fibers not bonded in the resin, the result that fiber –matrix relation in weak. They have obtained the lower impact strength for the poor interface between fiber and resin.

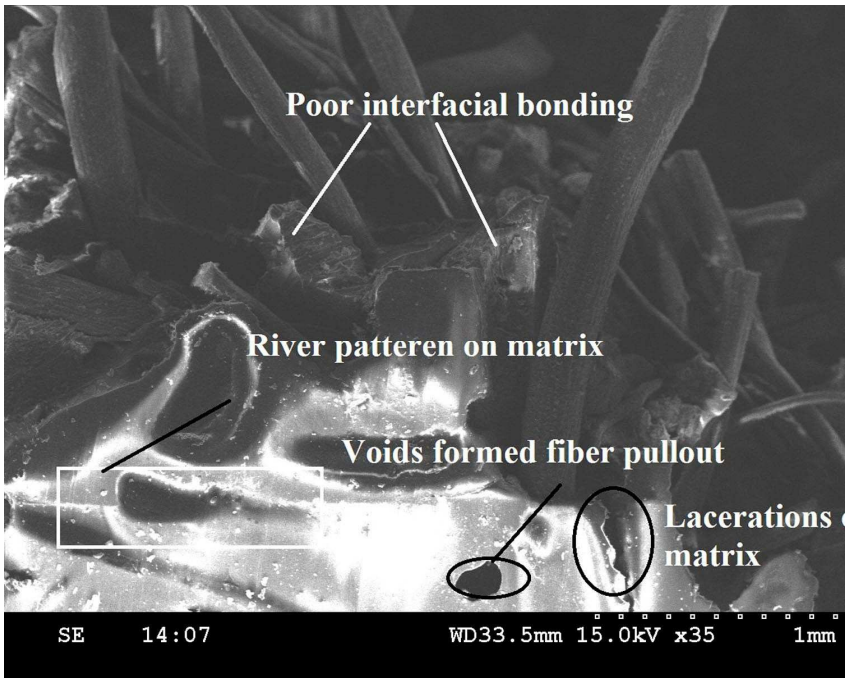

Fig.2 (a) & (b) SEM images of crab carapace filled coir – Polyester composites after impact testing.

4. Conclusion

Crab carapace is used to fabricate the natural fiber reinforced composites. Further work was to develop the increasing strength of composites and used the sea source wastage material for added the crab carapace filled randomly oriented reinforced natural fiber polyester composites. It is observed that energy in impact strength in high value of 43.3 kJ/m^2 and also fractography study on the composites failure analysis and study on the interface bonding among the fiber, matrix and filler contents. Due to high impact strength of the crab carapace filled polyester composites are used the high loading the automotive parts.

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