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Testing on Energy Absorption of Banana Fiber Polyester Composite

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Abstract. Natural fibers are now becoming a subject of interest to replace synthetic fiber as reinforcement materials where the development of natural fiber composites has been conducted in the last few decades. The objective of this research is to investigate the energy absorption capacity of banana fiber polyester composite and its specific energy absorption capacity as well. Banana fibers are extracted and cut into 10mm, 20mm and 30mm fiber length. Fabrication of rectangular bar as composite samples with different banana fiber length and fiber volume fraction (1%, 2%, and 3%) were conducted and the results are studied and analyzed. The information on energy absorption and specific energy absorption capacity are useful for applications such as automotive structures where the ability to absorb impact may save life. The increase of banana fiber content and length shows an increase of maximum load and energy absorption values for all specimens.

Introduction

Natural fibers has interesting characteristic, where a combination of desirable properties such as low cost, low density, non-toxicity and recyclability has gain interest from the manufacturing industry of low cost and light composites [1]. Furthermore, natural fibers are recyclable, biodegradable and carbon dioxide neutral and can be energy recovered.

Natural fibres also have potential application in the automobile industry as they have good mechanical properties such as mechanical strength, low weight and low cost.. In Europe, car makers are using materials made from abaca, flax and hemp in press-molded thermoplastics panels for door liners, parcel shelves, seat backs, engine shields and headrests. For consumers, natural fiber composites in automobiles provide better thermal and acoustic insulation than fibre glass, and reduce irritation of the skin and respiratory system. The low density of plant fibres also reduces vehicle weight, which cuts fuel consumption [2].

Banana fiber is one of the natural fibers that present important advantages such as low density, appropriate stiffness and mechanical properties, high disposability, and renewability. Furthermore, they are also recyclable and biodegradable. Banana fiber is a "ligno-cellulosic" fiber, which is obtained from the pseudo-stem of banana [3].

Experimental method

Fiber Extraction. The banana fiber is extracted from banana tree bark. The fibers are drawn using needle and pulled out by hand. After the extraction process, the fibers are placed in the bucket and they are immersed in water for 24 hours in order to remove any chemical composition or impurity that contained in the fibers. All broken fibers and unwanted particle are removed. The fibers are further cleaned until yellowish-white portion of fibers are obtained. Then, the fibers are left to dry for two to three days under the sunlight. After the drying process, the fiber is cut to size of 10 mm, 20 mm, and 30 mm length.

Composite Preparation. Composite is prepared by using hand lay-up method. Polyester is poured into bottle and the weight is measured by weight machine to obtain the right fiber-matrix weight ratio. Small amount of hardener is then poured into the polyester and the mixture are mixed slowly to achieve uniform distribution of polyester and hardener and to remove trapped air in the mixture.

To manufacture and fabricate the composite, discontinuous and randomly oriented fibers will be used for all of the fabricated specimens.