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Application of paper processing on carbon, jute and paper fiber reinforced plastic

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Abstract

In this study, the chopped carbon fibers and jute fibers were used to fabricate hybrid paperboard. The paper making process was used. Combined with unsaturated polyester resin, paperboard fiber reinforced plastic (FRP), carbon hybrid FRP and jute hybrid FRP were fabricated and the mechanical property included tensile test, bending test and Izod impact test were carried out to compared the mechanical property of these three kinds of materials. The drilled holes tensile test was also carried out to examine the drilled holes property. Scanning electron microscope was employed to observe the fracture characteristic on failure specimens. It was found due to the manufacture process of paperboard, the materials expressed obvious anisotropic property. The paperboard composite has an excellent static property but lower impact property compared with carbon hybrid FRP.

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Keywords: Recycled paperboard; Carbo fiber; FRP; Jute fiber; Hybrid fabric

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1. Introduction

Paperboards are thick papers made of wood, chemical pulp waster paper, etc. The manufacturing method of paperboards is similar to papers'. In this method, the plant fibers are dispersed in the water and carried by big web rolls to dehydrate and to dry.

Several tanks and big web rolls are used to manufacture paperboard, so the paperboards are laminated materials. By this method different fibers can be used in different layers and each layer of paperboard can use mixed fibers so as to hybrid paperboard mat can be manufactured. It is considered that the original paperboards has anisotropic property mat due to paper fibers has different distribution on different orientation which is formed during fabrication process.

Many researchers had paid attention to paperboard materials. In the study of Qingxi Xia, etc. [1], it was found that a factor in a range from 2 to 3 could be obtained in the modulus and initial yield strength between MD (the direction along production line, machine direction) and TD (transverse direction). The mechanical and physical properties of single layer particleboards made with various ratios of waste paperboard fibers to wood particles was investigated by Amir Eshraghi and Habibollah Khademislam [2]. Urea formaldehyde resin was also used as adhesive in different amounts of 9% and 10%. Static bending strength, internal bonding and thickness swelling were measure during the study. The results revealed with increasing waste paperboard fiber content up to 50%, the modulus of rupture and modulus of elasticity of the panels increased. However, further additions decreased both of the values. The internal bonding property was found decreased with the addition of waste paperboard fiber in all panel types. All the physical and mechanical property improved by increasing the amount urea formaldehyde resin.

In order to meet the needs of the various, carbon fiber hybrid and jute fiber hybrid paperboard were fabricated. At current study, carbon fibers or jute fibers was used to manufacture paperboard materials. Carbon fiber or jute fibers were mixed with resin fibers (Poly Ethylene) for each layer of paperboards.

After fabrication of paperboards, paperboard fiber reinforced plastic (FRP) was fabricated with unsaturated polyester resin. Mechanical properties included tension, bending and Izod impact properties were tested and analyzed.

2. Experimental

2.1. Materials

Carbons were cut before using by a cutter with 6mm-diameter of strainer and jute fibers were also cut by a cutter with 2mm-diameter of strainer. In this study, the basic paper pulp was recycled milk package which was used in 40 wt%. Carbon fibers or jute fibers were used in 30 wt%. Resin fibers were in 30 wt%. The materials composition is shown in table 1. Three kinds of paperboard were used here, included recycled milk package paperboard, carbon hybrid paperboards and jute hybrid paperboard. The photos of these paperboards are shown in Fig. 1.

Table 1. Materials composition.

	Materilas (wt%)			
	Milk pulp	PE fiber	Carbon fiber	Jute fiber
Paper	100	0	0	0
Carbon fiber	40	30	30	0
Jute fiber	40	30	0	30

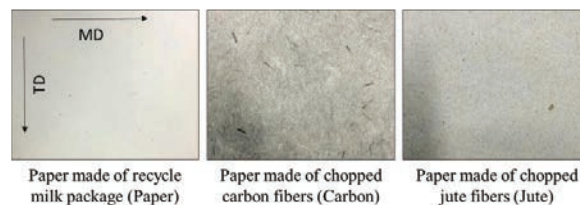


Fig. 1. Characteristics of paperboard, carbon fiber mat and jute fiber mat.

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