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The International Conference on Sustainable Development (ICSD), March 6th 2012, Bali, Indonesia

UTILIZATION OF NEW NATURAL FIBER AS COMPOSITE MATERIALS BASED ON ARCHITECTURE PRODUCTS DESIGN

By I Komang Astana Widi, Soeparno Djiwo, Wayan Sujana
Department of Mechanical Engineering, ITN Malang, Indonesia
aswidi@yahoo.com

Abstract

Utilization of natural fibers as strengthened in composite materials as new products have a great chance to replace metal, wood and ceramic products. Interior panel products for example, nowdays is not only focused on their qualities but also on the art and aesthetics appearance should be considered as innovative products. It is based on the market demand in which artistic value is needed. Natural fiber spinosa thund is a new fiber that offers the value of art with its natural properties will provide comfort for anyone who uses this natural product.

The existence of market competition and the increasing needs of society both to load and use in terms of art / aesthetics that is necessary to improve the quality of these raw materials (increased lifespan) so as to enhance industrial productivity, may improve the welfare of Indonesian industrial society in addition to employment Indonesian farmers for fiber processing.

Natural fibers utilization research has been done since several years ago but only a few natural fibers that can be produced such as kenaf and hemp fibers that can be applied safely for automotive products. Natural fibers utilization research on spinosa thund has been conducted by researchers since the last two years and is currently developed applications on products and wall panels art tiles. Generally, the wall tiles is made by materials such as porcelain, clay or ceramic glaze. In this case the researchers made the product wall tiles with composite materials in the design process variable polyester fiber orientation spinosa thud. Polyester resin was used polyester BQTN 108-EX. In this case the Licuala spinosa thund fiber is a natural fiber derived from plants belonging to the Licuala spinosa thund Arccaccae or Palmae family. Preparation of speciment test forms depend on standard products which is available in the market. Performance of these products will be investigated based on their load (impact and flexure strength) versus fibers orientation design. From the analysis of tests on model design fiber orientation, straight and oblique showed that the highest impact strength against shock loads obtained in the two direction layer (0 and 90 degree) fiber orientation (0.0033 (Joule/mm2) this is the case for bending strength best designs obtained is not same orientation (6, 44 Mpa on 45 degree fibers orientation). This orientation is the most artistic and easieast to control their design. The quality of composite fibers depend on their fabrication process (fibers treatment and manual hand lay up methods).

Keywords: wall tiles (wall tiles), Polyester resin BQTN 108-EX, Licuala spinosa thund fiber.

INTRODUCTION

Composite materials design based on natural fibers are increasingly regarded as alternative to metal, wood and ceramic materials. Based on ecological consideration, composites natural fibers are more frindly. Agricultural or biodegradable material plays important role in human life. The advantage of using such resource is that they are widely distributed all over the world, its multifunctional, strength and biodegradable [3]. The other hand, parts with a reinforcement of natural fibers are safer than glass fibers parts, as no sharps edged fracture surfaces accur in case of crash. It is about 4000 to 5000 tons of natural fibers were used in European automotive industry in 1996 [Dieter H et al, 2004]. Currently, an average of 5 to 10 kg of natural fibers is incorporated in every European passenger car with interiors parts such as door trim panels or trunk liner as the main fields of application [2]. Nowdays, composites natural fibers research is issued on impact strength applications such as good shoot behavour as anti-balistic products (armour materials). Fiber reinforced composites with thermoplastic matrices have successfully proven their high qualities in various fields of technical application. Apart from conventional fiber materials like aramide, kevlar or glass fibers natural fibers such as hemp or flax are increasingly applied for reinforcement.

Further advantages of a reinforcement by natural fibers result from their high absorptivity, which creates excellent acoustics and an air cleaning effect. With respect to industrial safety, natural

fibers do not cause allergic reactions or skin irritations. And finally a positive image and product Marketing related to the utilization of a renewable material should be taken into consideration.[5]

There are several geometries/architechtures for natural fibers composite.[5] The various types of architectures can be formed depending on how the pattern in the interlaced regions is reapeted.[10] In this paper, new natural fibers (Liquala spinosa thund fiber) was utilized as reinforcement is studied.[10] This natural fibers shown the ability to be produced in a continues form.[3]

The mechanical properties of the fibers orientation have been studied especially for static and impact loading of the parts.[19] The paper describes the effects of orientations design parameters (continues-0 degree, continues-45 degree and combination 0 and 90 degree) on licuala spinosa thund fibers for architecture components as well as the impact and flexure strength characteristics.[18]

However, in order to utilize the mechanical capabilities of natural reinforced thermoplastics in a more Optimized way, a well-adapted process technology is required.

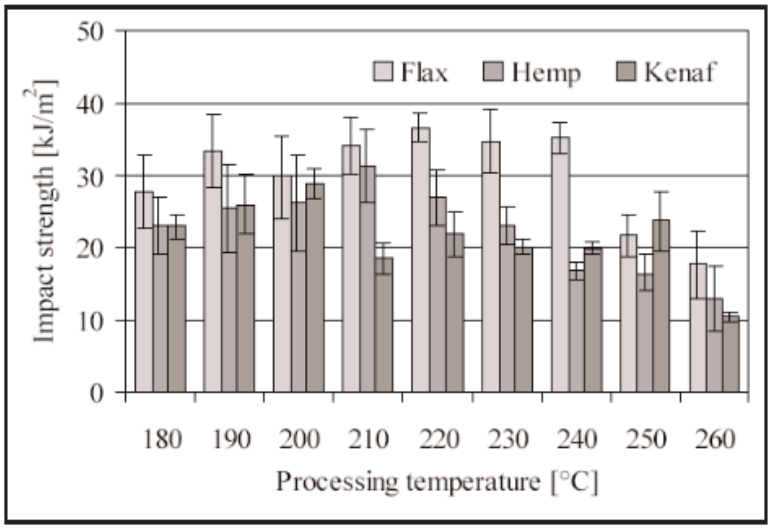


Figure 1. Impact strength vs processing temperature for composite reinforced by different natural fibers, all composite natural fiber /PP 50/50, 1600 g/m2.

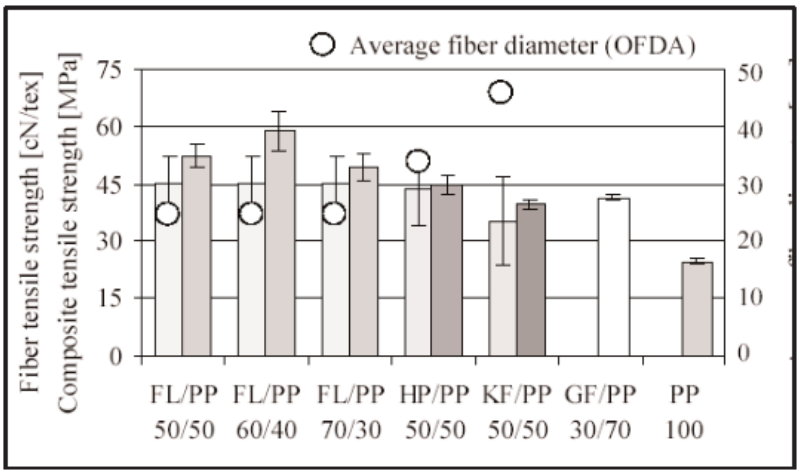


Figure 2. Tensile strength for composites basing on different fiber materials and pure pp in comparison to tensile strength for separate fibers (shaded bars) and average fiber diameter (ofda), optimized processing, all Composites 1600 g/m2

EXPERIMENTAL METHODS

Liquala spinosa thund fibers and polyester BQTN 108-EX Matrix resins were fabricated by hand lay up as wall tiles products with deferent orientasions layers 0 degree, 45 degree and combination 0 and 90 degree (single layer). A series of experiments were conducted by varying mechanical test standart [39] i.e. Flexure test (ASTM D790) and Impact test (ASTM D5942) as shown in Figure 3 and Figure 4.

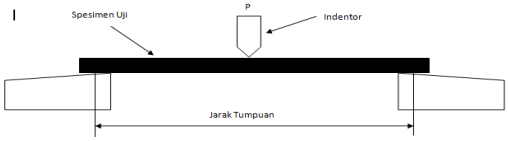
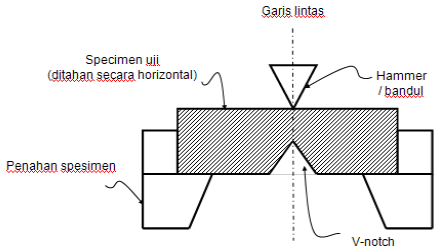


Figure 3. Bending specimen attachment [6]



[3] Figure 4. Impact specient attachment [7]

Figure 3 shows a bending spesiment in which at the end of adges are free or simply supported.[3] The specimen were loaded by central transverse impacts. The difference with Figure 4 is about the type of load in which this load is impacted.[3] The characteristics of liquala spinosa thund reinforment natural camposite are attainanble the data of bending strength and impact strength.

RESULT AND DISCUSSION

Influence of the orientations parameters on the flexure behavior

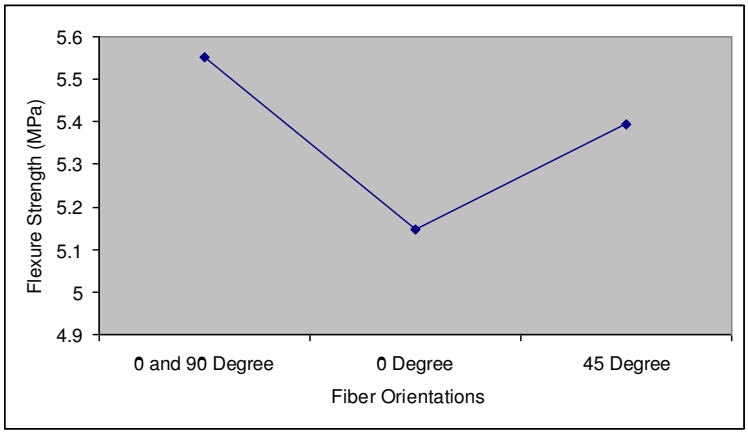


Figure 5. Bending strength vs fibers orientasions

Figure 5 shows the influence of the the bending strength of the different fibers orientations polyester composites materials reinforced by liquala spinosa thund natural fibers. The orientation of fibers are 0 degree, 45 degree and combination 0 and 90 degree in which this layer is placed in the middle of polyester matrix. The highest number is showed on combination 0 and 90 degree orientation layer followed by 45 degree of fibers orientation and the lowest is 0 degree orietations fibers. These results shows that fibers orientation is very important depend on the specific static loading. The fibers orientation (0 and 90 degree) as reinforcement is a major parameter to reduce the material stress fram two direction. The propagation of cracks between fibers and matrix is not easier to happen if the specimen were loaded by central transverse flexure loading or one direction.

The pattern of natural fibers composites should be contains fibers oriented on at least two axes, in order to provide great strength and stiffness [4]. Zouari B(2007) carried out yarn process by varying parameter for the simulation in fact to apply the mechanical law behavior in tension along their direction.

Influence of the orientations parameters on the impact behavior

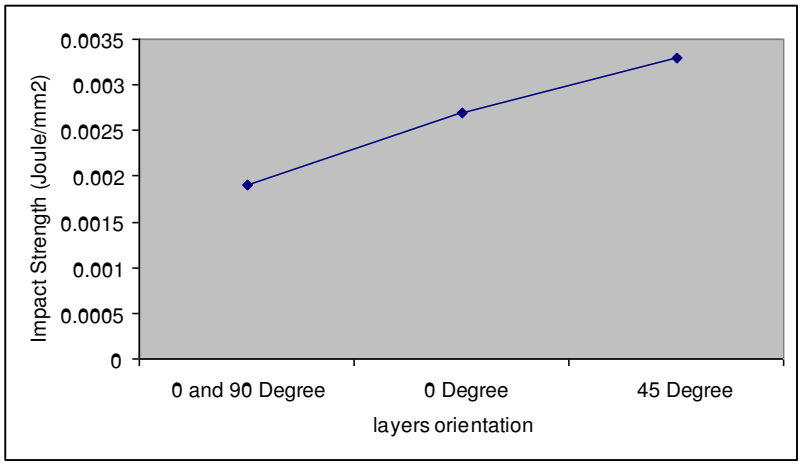


Figure 6. Impact strength vs fibers orientation

From the impact tests it is also apparent that if the orientation layers to combine 0 degree with 90 degree, the impact value is increased, Fig 6. These effect is not related to bending test given in Fig 5. Figure 6 provides further evidence of how the impact resistance is increase if the orientation layers performed in the one directions i.e. 45 degree. This is because 45 degree of fibers orientation can cause slip between fiber and matrix that makes is not easier to release interfacial bonding.

This mechanical performance is depend on the fabrication process in which composite natural fibers is very difficult to reach uniform by hand lay up fabricated. But one thing is certain that orientation of fibers will be effected by the orientation of load. And, the results give the indication of the effect of the fiber surface treatment.

Figure 7. Fiber orientation wall tile product

In addition, Fig 7, the use of orientation layers on wall tile production offers an economic strength approach to the industry. These invitation will accur to those in the art and good appearance on aestheticaly and be matched with typical calour of transparent natural furniture.

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