The 4th ICIBA 2015, International Conference on
Information Technology and Engineering Application
Palembang-Indonesia, 20-21 February 2015

Glass Fiber Composites and Polypropylene Construction, Application for Aluminum Boat

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Abstract

Polypropylene (PP) including a type of plastic which ranks second on the most number of types of plastic waste after the type of High Density Polyethylene (HDPE). Glass fibers have superior mechanical properties of natural fibers. Because it has good mechanical properties of glass fibers currently plays an important role in the use of composite reinforcement. Aluminum has particularly lightweight and corrosion resistant properties. Of mechanical properties owned fiber glass, aluminum and PP waste can be utilized as composite reinforcement and matrix materials. This research was carried out by hand lay-up methods. Comparison of fiber volume fraction of glass, plastic and aluminum type of PP in this study are set 5x5 mm with a variation of 0% fiber glass 100% matrix, 15% fiber glass 85% matrix, 30% fiber glass 70% matrix, 45% fiber glass 55% matrix, and 60% fiber glass 40% matrix.

Keywords : *Composite, aluminum, fiber glass, bending test, impact test, the plastic waste*

1 INTRODUCTION

Indonesia is a maritime country, it earned the nickname because two thirds widespread throughout Indonesia is the ocean which means more water than land. Sea separates the islands located in Indonesia, for the uniting of all we need a means of water transportation. Boat, is one of the most traditional transportation wood raw material, over time and the times, wood has more steps and expensive. Aluminum has several properties that support the transport of water to be applied.

Aluminum is a material that has the strength and the severity level of the ratio is very good compared to other materials that are often used as a material for ship construction. So also with a relatively light weight compared to other materials as the main ingredient in the construction of ships such as steel, ferro cement, wood and even though.

In real life - the results are found from the waste products that become a problem. One of them is a pile of garbage that can be one of the causes of natural disasters, flooding one.

Problems caused by the large number of plastic waste was even getting worse due to the lack of processing of the waste itself.

One of the top ranks garbage is garbage based on the amount of polypropylene plastic types. Polypropylene is a type of plastic that is often used because it has chemical resistance properties (Sahwan, 2005). One way to overcome this is by stacking bins for recycling (recycle), made of plastic waste into new materials that have added value to the function and strength of materials by adding reinforcing materials called composite materials.

Composite materials are a combination of two or more components or materials that have some characteristics that may not be owned by each of these components. The use of composite materials with the matrix and filler (filler) has become a popular type of plastic to replace metal in industry. This is due to the severity of components made of metal, which is a relatively difficult process of its formation, can experienced corrosion and high production costs.

Based on the description above, the researchers conducted a study to utilize optimally polypropylene plastic waste by making it as matrices in composites reinforced with glass fiber (fiberglass) which is then coated on metal materials, namely aluminum. With a simple processing and searching for the best volume fraction of the matrix and fibers on the mechanical properties of the resulting composites will help increase the quality, usability and protecting the environment.

2 EXPERIMENTAL DETAILS

2.1 Composite

COMPOSITE MATERIAL is a macroscopic combination of two or more different materials, can be identified with the inside of them. Composites are used not only for its structural properties, but also for electrical, temperature, tribological, and environmental applications. Modern composite materials are usually optimized to achieve a certain balance of properties required for various applications. Given the variety of materials that can be considered as composites produced and variety of uses composite materials that can be designed, composite itdak can stand alone, simple, and usability can be adjusted.

2.2 Classification of Composites

Composite fiber based amplifier can be categorized by chemical composition, morfologistruktural, and commercial functions. Composites are usually classified in two different levels. The first level of classification is usually made in conjunction with the main elements of the matrix. Composite main classes including organic composites - matrix (OMCS), metal-matrix composite (MMC), and ceramic-matrix composites (CMC).

The term "organic matrix composites" are generally considered to be included in the second class composites: polymer composites - matrix (PMC) and carbon-matrix composites (often referred to as carbon-carbon composites). Carbon composites - matrix is usually formed from PMC to incorporate extra steps carbonization and original density matrix polymer. In the research and development community, intermetallic - matrix composite (be set up) is sometimes listed as a different classification of the MMC. However, the most important application of (be set up) does not exist, and in practice these materials do not provide a radical difference of nature relative to the MMC. In each of these systems, usually the entire

matrix in the continuous phase in all the components (Carl Zweben, 1998).

2.3 Fiber Composite Materials

The main element is a composite fiber, fiber composite material made up of fibers that are bound by a matrix of interconnected.

Fiber composite material consisting of two kinds, namely

1. long fibers (continuous fiber)
2. fiber (short fiber and whisker).

Composite materials generally use plastic because plastic is easy to come by and easy treatment, rather than metallic materials that require materials themselves.

2.4 Polypropylene (PP)

Several researchers have conducted studies on the use of polypropylene as a matrix in a composite of them, Research on polypropylene is also done by creating a composite with 3 types of mixtures, the first pure polypropylene matrix (without fibers), both with 30% polypropylene fiber jute, polypropylene third with 30% sisal fiber. From research obtained on the best tensile strength polypropylene fiber flax plus 30% to the value of 32.0 Mpa then polypropylene sisal plus 30% of 26.6 MPa and a final pure polypropylene its strength of 26.0 MPa (Bourmad et al, 2008).

Research using polypropylene as matrix reinforcement 2 types of fiber that pandanus fiber and banana stem fiber and polypropylene fiber pandanus formulate that has better tensile strength compared with the banana stem fiber polypropylene (Maulida, 2006).

Polypropylene has a low density compared to other types of plastic and polypropylene have a fairly high melting point (190C up to 200C), while the crystallisation point between 130oC up to 135oC. Polypropylene has a resistance to chemicals (chemical resistance) is high, but impact resistance (impact strength) is low (Mujiarto, 2005).

2.5 Fiber Glass

Plastic fiber glass (glass-reinforced plastic - GRP), which is also known as plastic is reinforced by glass fibers (glass fiber-reinforced plastic - GFRP), is a reinforced polymer. This polymer is made of plastic materials reinforced by fine fibers made of glass. This material is also known as GFK which is a continuation of Glasfaserverstrkter Kunststoff, or are generally more familiarly known by the glass fibers are used in the process of strengthening, which in the English language called fiberglass. GRP is a lightweight and strong material with many uses, such as in the manufacture of boats, cars, water tanks, roofing, piping, coating, motorcycle delivery box, promotional umbrella, fiberglass etc. booth. Fiberglass or glass fiber is often translated into molten glass is drawn into a thin fiber with a diameter of about 0.005 mm - 0.01 mm. These fibers can be spun into yarn or woven into fabric, which is then impregnated with a resin material so that it becomes a strong and corrosion resistant.

2.6 Aluminum

The ancient Greeks and Romans used alum in medicine as an astringent, and in the dyeing process. In 1761 De Morveau suggested the name "alumine" for the base in alum. In 1807,

Table 1: Studied composition formula (%)

No	Polypropylene	Fiber Glass	Al
1	100	0	10 x 10 x 55 (mm)
2	85	15	10 x 10 x 55 (mm)
3	70	30	10 x 10 x 55 (mm)
4	55	45	10 x 10 x 55 (mm)
5	40	60	10 x 10 x 55 (mm)

Davy gave a proposal to name the Aluminum metal, although in the end agreed to replace it with Aluminum. The last name is the same as the name of a lot of other metallic elements that end with "ium". (Totten and MacKenzie, 2003).

2.7 Mechanical Properties of Materials

After producing specimens of experiments comparing the volume fraction, the composite materials usually will do some testing in between load testing, drag, tap, slide or latitude, bending, and density to determine the physical and mechanical properties of the material examined. However, in this study only focused on the characters generated by the bend test results, and test a notch. Additional measurements are required when there are changes in the system variables occur as.

2.7.1 Studied composition formula (%)

Relative volume of the element, the element of nature, and the process of manufacture. Experiments can be time consuming and expensive. Mechanics-based models and methods semiempiris determining composite properties so that it can be useful to predict the effect of a large number of system variables.

2.7.2 Impact Test

Impact testing is a test used to determine the purpose of a brittleness or ductility material (specimen) to be tested by the sudden imposition of the object to be tested statistically.

2.7.3 Bending Test

In this test will be used Hydraulic Universal Material Tester with JIS Z 2248 standard to determine the plastic deformation will occur at a particular angle of curvature. To determine the magnitude of the angle of curvature that can be given to a material then tested the arch.

3 RESEARCH METHODOLOGY

3.1 Flow Chart

Research methodology in the schematic below:

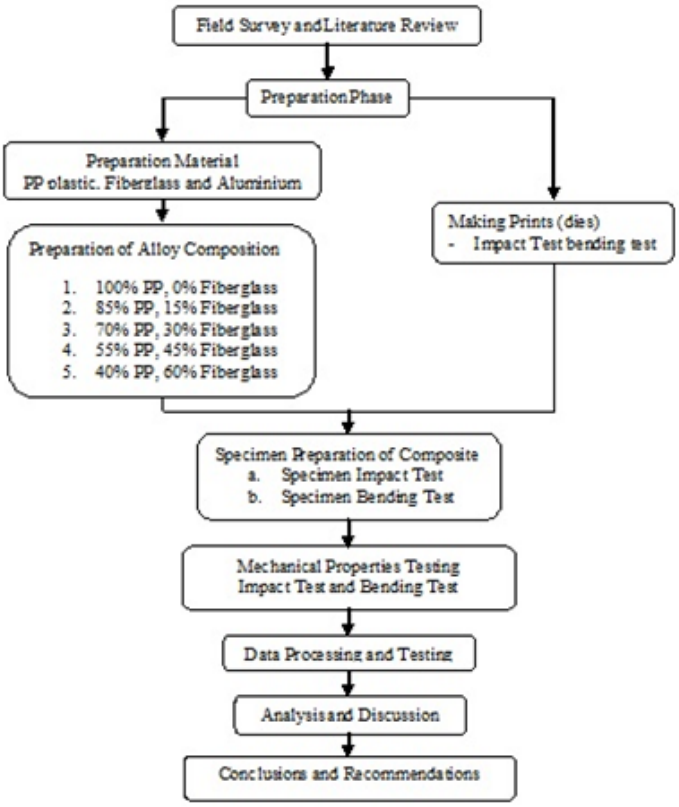


Figure 1: Research methodology

4 DATA ANALYSIS AND DISCUSSION

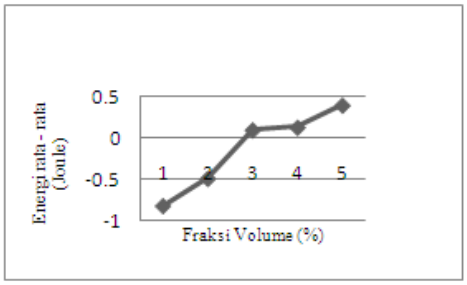
Making plastic matrix composite materials with the former type of glass fiber reinforced polypropylene done using hand lay-up methods. Samples were prepared then testing, such as tensile testing and impact testing.

Tests performed on each - each different sample variation of the volume fraction, namely:

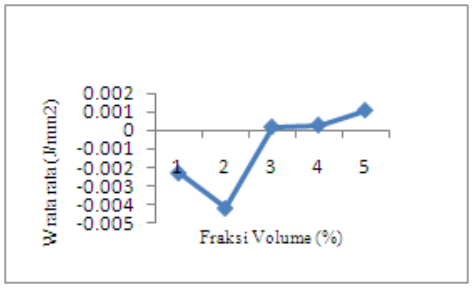
1. 0% = Matrix 100% with 0% reinforcement aluminum reinforcement as much as 3 specimens
2. Matrix 15% = 85% to 15% of reinforcing aluminum reinforcement as much as 3 specimens
3. Matrix 30% = 70% to 30% of reinforcing aluminum reinforcement as much as 3 specimens
4. Matrix 45% = 55% to 45% of reinforcing aluminum reinforcement as much as 3 specimens
5. Matrix 60% = 40% to 60% of reinforcing aluminum reinforcement as much as 3 specimens

4.1 Impack test

From the impact test data obtained, and then viewed in graphical form, as follows :

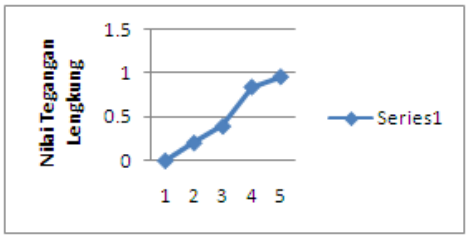


Graph showing the relationship between energy Impack (E) average - average volume fraction of the variation in the ratio



4.2 Bending Test

Based on the test results and test data processing bending plastic matrix composite materials with the former type of glass fiber reinforced polypropylene obtained average value of the voltage - the highest average obtained from the variation of the matrix volume fraction 60% to 40% in the amount of reinforcement kgf/mm2 0.956, while the average value of the voltage - lowest average obtained from the variation of the matrix volume fraction of 100% with 0% reinforcement is equal to 0 kgf/mm2.



5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

Based on the research that has been conducted on composite materials bermatriks glass fiber reinforced plastic waste by hand lay-up method, it can be deduced as follows:

1. The more the percentage of glass fibers, the resulting mechanical properties, the better.
2. The optimum conditions obtained in this study is the comparison of the variation occurs in 40% volume fraction of matrix types of polypropylene plastic waste with 60% glass fiber reinforcement.

5.2 Advice

This study was conducted only on the volume fraction of 0% to 60% then for further research is recommended to increase the glass fiber volume fraction above 60% in the composite mixture to find a limit on the effect of raising the value of mechanical fiber composite. Further testing is also recommended for the temperature difference to get the best temperature in the recycling of waste polypropylene.

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