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Tensile strength of car spoiler product based on ABS plastic and rattan fiber epoxy composite materials

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Tensile strength of car spoiler product based on ABS plastic and rattan fiber epoxy composite materials

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Abstract. This study aims to obtain the tensile strength of the car spoiler product material made from ABS Plastic. Spoiler products are obtained from free markets that produce car accessories. Tensile strength obtained will be used as comparative data for the development of composite material based spoiler car products reinforced with rattan fiber with epoxy matrix. Tensile strength testing refers to the ASTM D3039/D3039M testing standard. Based on the results of the study, the average tensile strength of ABS Plastic obtained was 34.61 ± 0.67 MPa with an average strain of 5.53 ± 0.89 mm/mm. The average tensile strength of rattan fiber epoxy composite obtained was 26.71 ± 1.18 MPa, while the strain is 4.48 ± 0.87 mm/mm.Based on the results of SEM testing, it can be seen that the material is a little void due to the manufacturing process. Voids that occur will reduce the strength of the spoiler product. The results of this study will be one of the references in product development for car spoilers. Keywords: tensile strength, SEM, car spoiler products.

1. Introduction

The development of automotive products in Indonesia opens opportunities for the development of supporting components and accessories components. One of the accessories products that are widely used is car spoiler (Figure 1). A car spoiler is an accessories component that has two functions, car aerodynamics and aesthetics [1], [2], [3], [4]. Spoilers can reduce the drag when the car moves on the highway with a certain speed. The resistance test is carried out by testing in the wind tunnel [5], [6], [7], [8], [9]. Most spoiler products in Indonesia are made from plastic materials, especially ABS plastic. Spoilers have the opportunity to be developed using other materials, especially Indonesian natural fiber composites.This study aims to develop a rattan fiber-reinforced composite material with an epoxy polymer matrix to be implemented in the development of automotive component products especially car spoiler products. This study aims to produce good quality products with cheap prices and utilizing the local potential of Indonesia which is abundant and has not been utilized properly [1], [10], [11], [12]. The focus of this research is to obtain the tensile strength of the car spoiler product material currently on the market, as comparative data in preparing replacement materials. Tensile strength data will be used as a comparison material in the development of composite spoiler car product with rattan fiber reinforced with epoxy matrix.

Figure 1. Car spoiler product

2. Method and materials

The test sample is made from ABS Plastic and epoxy rattan fiber composite material by hand. The composite material ismade from woven rattan fiber and then laminated with epoxy resin. Test methods implemented to obtain tensile strength refer to ASTM D3039 / D3039M from epoxy rattan fiber composite test samples (Figure 2) and automobile spoiler products based on ABS Plastic from the free market (Figure 3) [1], [10], [12]. To observe the condition of the test sample, a morphological test is performed by Scanning Electron Microscope (SEM) [13], [14]. Tensile testing is done with speed of 5 mm/min, using Universal Testing AGS-G testing machine. The temperature of the test chamber is 23^0C with 52% humidity. The pressure of the Pretension Universal Testing machine is set at 0.5 MPa. Test samples are not given special treatment and tested immediately after being cut from spoilers.

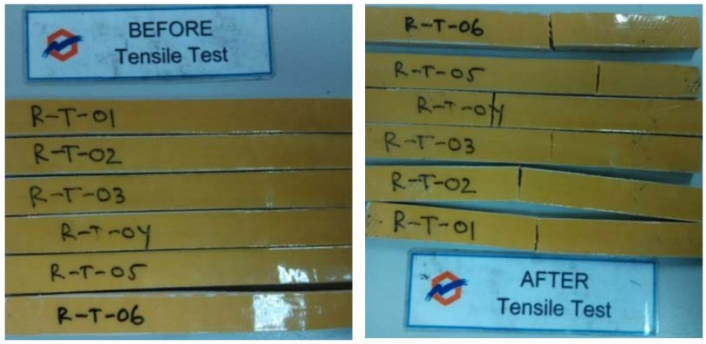

Figure 2. Sample test of car spoilers made from rattan fiber epoxy composite material

Figure 3. Sample test of car spoilers made from ABS plastic material and universal testing

3. Results and discussion

This research aims to develop car spoiler products with natural fiber composite materials, especially rattan fiber. Spoilers are much needed as a component of car accessories so that the car has a good look. The need for car spoilers opens up opportunities for the development of

car spoiler products from alternative materials, especially natural fibers that are abundant in Indonesia. The development of new materials requires reference of the mechanical characteristics of materials for the manufacturing of new spoiler products. In this case, a reengineering process has been carried out on products that are already on the market. In this reengineering process, tensile testing of spoiler product material has been carried out [4], [15].

Based on the result of tensile strength test (Figure 4), the average tensile strength of ABS Plastic material is 34.61 ± 0.67 MPa and strain:5.53 ± 0.89 mm/mm.

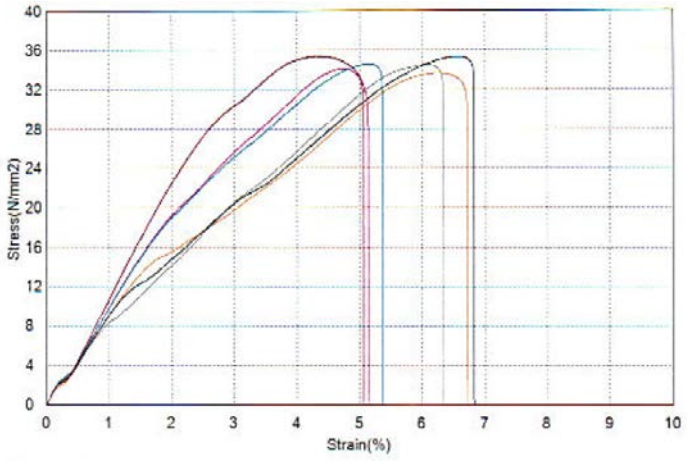

Figure 4. Tensile strength and strain of ABS plastic material from spoiler product

Table 1. Tensile strength and strain of spoiler car made from rattan epoxy composites materials

Sample	Tensile strength (MPa)	Strain (mm/mm)
1	23.78	1.95
2	23.45	3.82
3	24.99	2.89
4	24.43	3.32
5	26.71	4.48
6	24.05	2.94
Average	24.57	3.24
Maximum	26.71	4.48
SD	1.18	0.87

The maximum tensile strength of rattan epoxy composites material is 26.71 ± 1.18 MPa, while the strain is 4.48 ± 0.87mm/mm.Based of the test result, there is a difference in tensile strength of 22.8%. The difference in the results of tensile testing can occur due to the selection of an incorrect test sample. The greatest tensile strength will be obtained from continuous fiber composites carried in the direction of the fiber direction. The selection of test samples is very important to produce good tensile strength. The differences in tensile strength also occur due to voids in epoxy fiber rattan composite material test samples. Void in composite materials will result in a decrease in tensile strength.The improvement of the epoxy rattan fiber composite manufacturing process can improve the tensile strength. The Scanning Electron Microscope (SEM) analysis of the ABS plastic test sample (Figure 5) shows that the

material interface is better compared to the epoxy rattan composite (Figure 6) [1], [12], [16], [17]. Voids are more common in epoxy rattan composite material. It is necessary to refine the manufacturing process of epoxy rattan fiber composite materials so that the strength difference can be reduced and the voids that occur can be reduced. A good spoiler design will increase the comfort and ergonomics of the car. Therefore, it is necessary to design and choose spoiler material that can increase the comfort and safety of the car [4], [15].

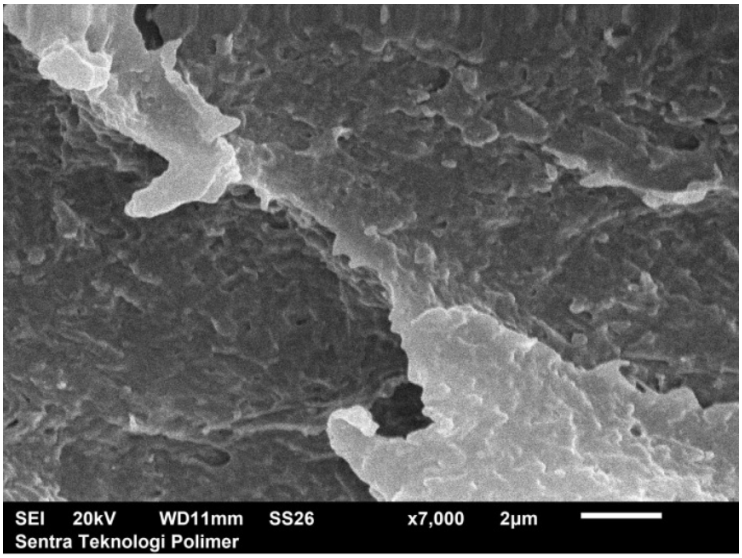

Figure 5. Morphological analysis of spoiler product from ABS Plastic by SEM

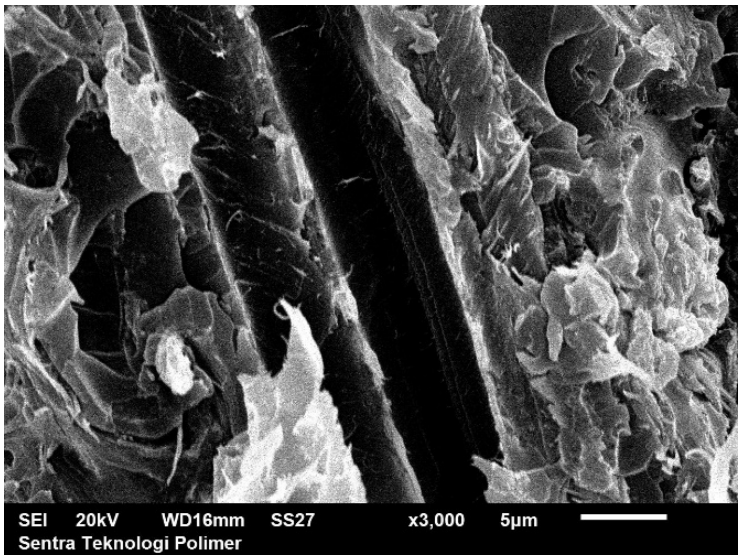

Figure 6. Morphological analysis of spoiler product from epoxy rattan fiber composite material by SEM

4. Conclusion

A research has been conducted to obtain the tensile strength of epoxy rattan fiber composite material as an alternative material for making car spoiler products. As a comparison data is the tensile strength of car spoiler products with ABS plastic materials that

are widely obtained in the free market. The tensile strength difference is 22.8%. The tensile strength of the epoxy rattan fiber composite makes it possible to be used as a material for automobile spoiler products by improving the manufacturing process.

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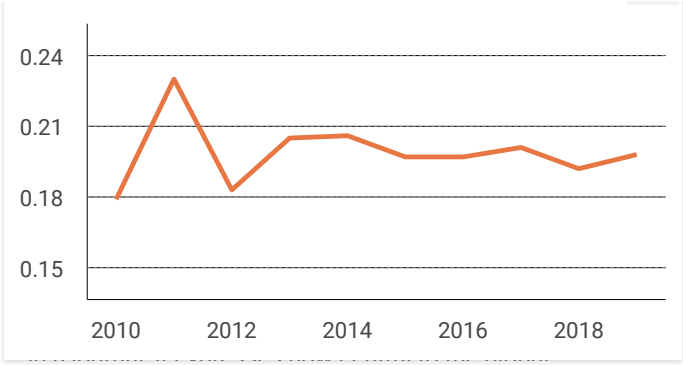
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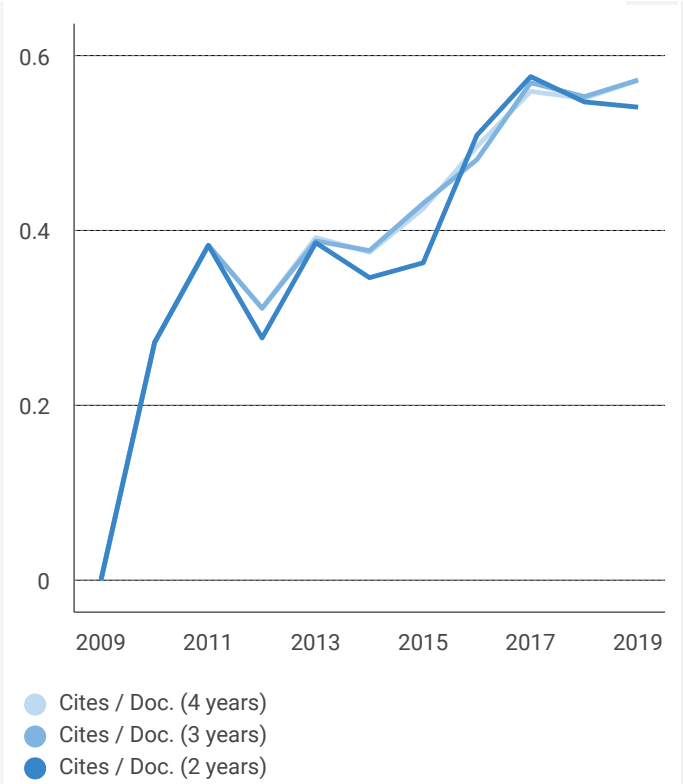
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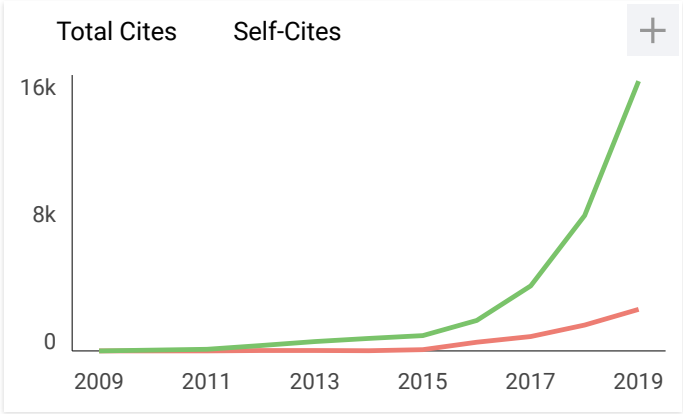
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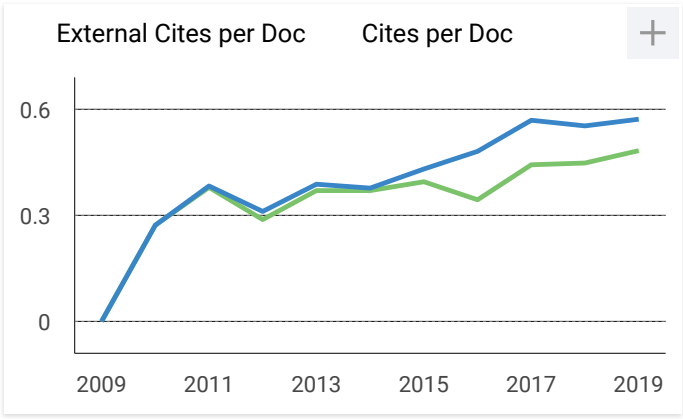
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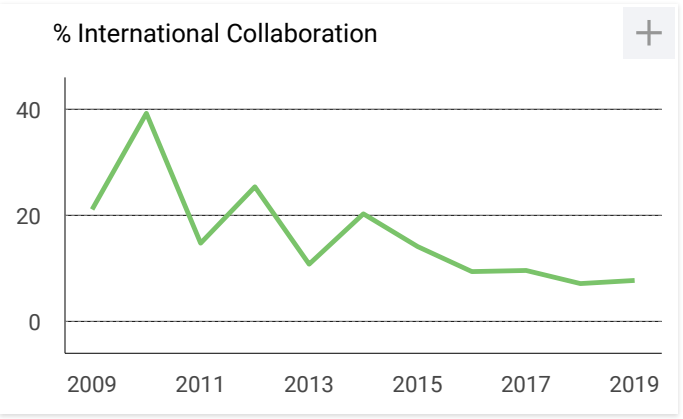
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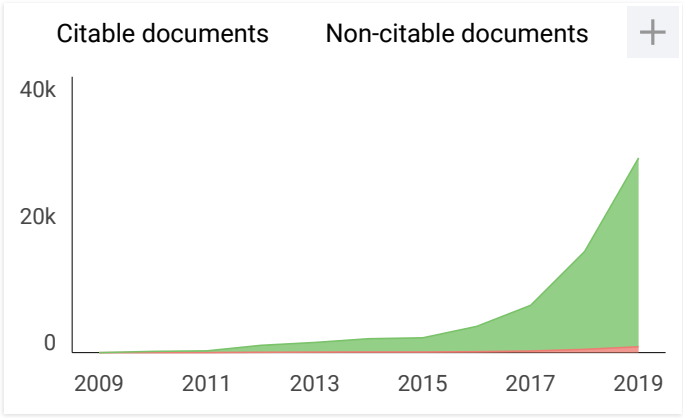
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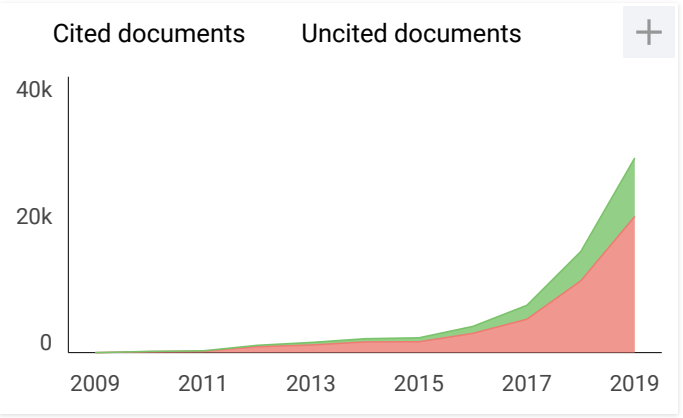
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