Flexural strength of car spoiler materials made from rattan fiber composites

by Prof. Dr. Ir. Agustinus Purna Irawan

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Abstract. This study aims to obtain the flexural strength of the material of automobile spoiler products obtained from the free market that are made of plastic materials. The values of the strengths obtained are used as comparative data for the development of automobile spoiler products based on composite materials of epoxy rattan fibers. Flexural strength testing refers to ASTM D 730-03. Based on the research results, the flexural strength of spoiler product from plastic material is 55.72 ± 3.53 MPa, while the flexural strength of spoiler product made of epoxy rattan fiber composite material is 45.37 ± 0.89 MPa. The difference between the two flexural strength results is 8.9%. The results of SEM testing on the spoiler material show that the material has a little void due to the manufacturing process that can reduce the power of the spoiler product. Voids also occur in composite material of epoxy rattan fibers due to manufacturing imperfections. Based on the data of the flexural strengths obtained, it can be concluded that the epoxy rattan fiber composite material can potentially replace the plastic material in the manufacturing of spoiler products. The results of this study can be used as a reference in the development of car spoiler products.

1. Introduction

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. Car spoiler products are selling well, especially as accessories on cars, although there is another very important function that is related to car aerodynamics system [1], [2], [3]. Opportunity of product development of accessories component in car is still very big, with increasing number of cars in Indonesia and society's passion for accessories product that can beautify the look of its car. This study aims to produce good quality products, with cheap prices and utilizethe local potential of Indonesia is abundant and has not been utilized properly [4], [5], [6]. If this research can be implemented well, then the potential development of product spoiler car based rattan fiber composite is very open. The focus of this research is to test the flexural strength of epoxy rattan fiber composite material.

The flexural streng this related to the shape of the spoiler that is elongated but slim, so it needs good flexural strength so as not to have deflection when installed in the car, mainly due to wind loads, vibration loads due to por roads and due to tightening of spoiler mounting bolts to the car body.

2. Method and materials

2.1. Sample preparation

The test sample was made from epoxy rattan fiber composite material by hand lay up from woven rattan fiber then laminated with epoxy resin. The test sample is made according to the size of the flexural test. For comparison data, a spoilers test sample obtained from the market, made of ABS plastic.

2.2. Method

Test methods implemented to obtain flexural strength refer to ASTM D 730-03 from epoxy rattan fiber composite test samples and automobile spoiler products from the free market. To observe the condition of the test sample, a morphological test was performed by Scanning Electron Microscope (SEM). The test results are then analyzed and compared to obtain the flexural strength data required by the car spoiler product [7], [8], [9], [10], [11].

3. Results and discussion

3.1. Result test of rattan fiber epoxy composite materials

Flexural testing of automobile spoiler material from epoxy rattan fiber composites manufactured by lamination process with pressure and vacuum, performed by using ASTM 730-03 standard [12],[13]. The results of flexural testing as follows:

Machine test : Universal Testing AGS-G
Test speed : 1.75 mm/min
Room : 23^{0}C, 58% RH
Standard : ASTM 730-03
Pretension : 0.5 MPa

Figure1. Test sample of rattan epoxy composite materials

Table 1. Result test of rattan epoxy composite materials

No. Sample	t (mm)	b (mm)	Flexural Strength (MPa)
1	4.78	11.68	46.21
2	4.38	12.17	44.27
3	4.50	12.13	44.06
4	4.60	12.14	45.37

5	4.38	11.78	46.12
6	4.35	12.23	46.17
Average	4.49	12.02	45.37
SD	0.17	0.23	0.89

3.2. Result test of ABS plastic for spoiler product

Flexural testing of automobile spoiler material from ABS plastic obtained from the market, is done by using ASTM D730-03 standard. The test sample is made by cutting off the finished spoiler product. The results of flexural testing as follows:

Machine test : Universal Testing AGS-G
Test speed : 1.75 mm/min
Room : 23^{0}C, 58% RH
Standard : ASTM 730-03
Pretension : 0.5 MPa

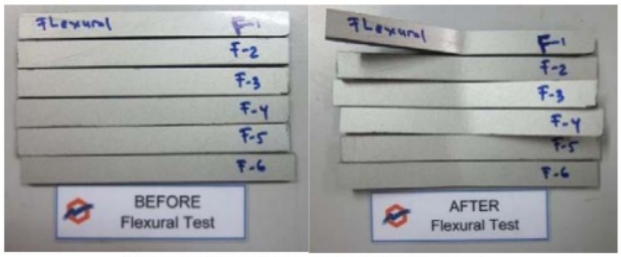

Figure 2. Test sample of ABS plastic

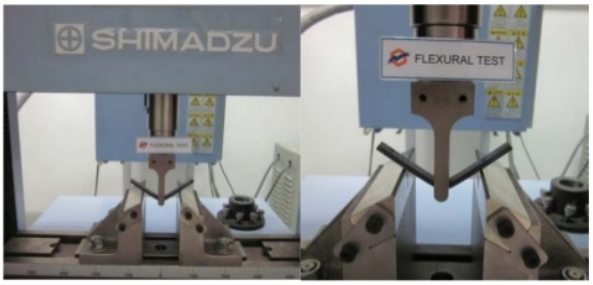

Figure 3. Flexural test machine

Table 2. Result test of ABS plastic materials

No. Sample	t (mm)	b (mm)	Flexural Strength (MPa)
1	4.33	11.59	53.25
2	4.44	12.21	54.78
3	3.48	12.33	53.21

4	3.84	11.89	56.71
5	3.30	12.10	62.42
6	3.98	12.17	53.93
Average	3.89	12.06	55.72
SD	0.45	0.23	3.53

Based on the result of flexural strength test, the average flexural strength of epoxy rattan fiber composite material is 45.35 ± 0.89 MPa (table 1) and th eaverage flexural strength of ABS plastic material is 55.72 ± 3.53 MPa (table 2). The flexural strength difference that occurs less than 10%, so this result is still quite good. The improvement of the epoxy rattan fiber composite manufacturing process can improve the flexural strength better.

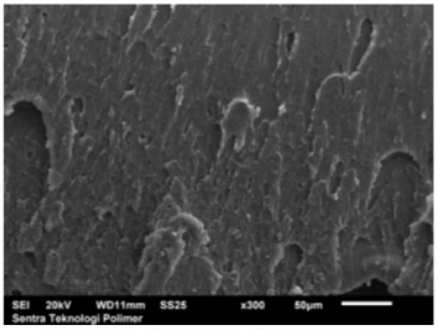

Figure 4. SEM test of ABS Plastic

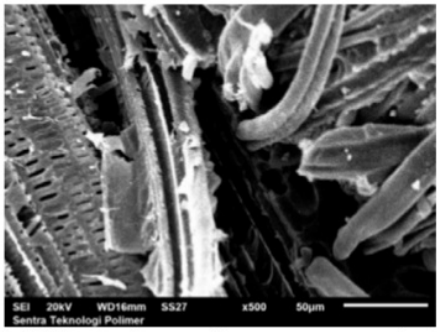

Figure 5. SEM test of rattan fiber epoxy composite materials

The SEM analysis of the ABS plastic test sample (figure 4) shows that the material interface is better when compared to the epoxy rattan composite (figure 5). The number of voids that occur 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 [14], [15], [16], [17].

4. Conclusion

A research has been conducted to obtain the flexural strength of epoxy rattan fiber composite material as an alternative material for making car spoiler products. As a comparison data is the flexural strength of car spoiler products with ABS plastic materials that are widely obtained in the free market. The flexural strength difference is less than 10%. The flexural strength of the epoxy rattan fiber composite has the opportunity to be used as a material for automobile spoiler products by improving the manufacturing process.

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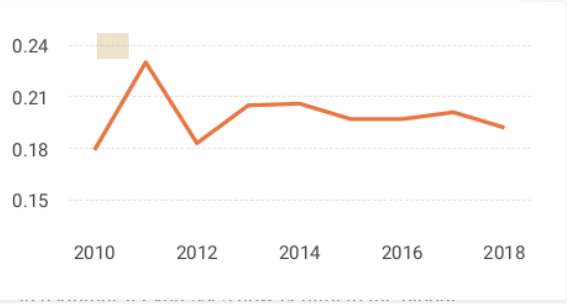
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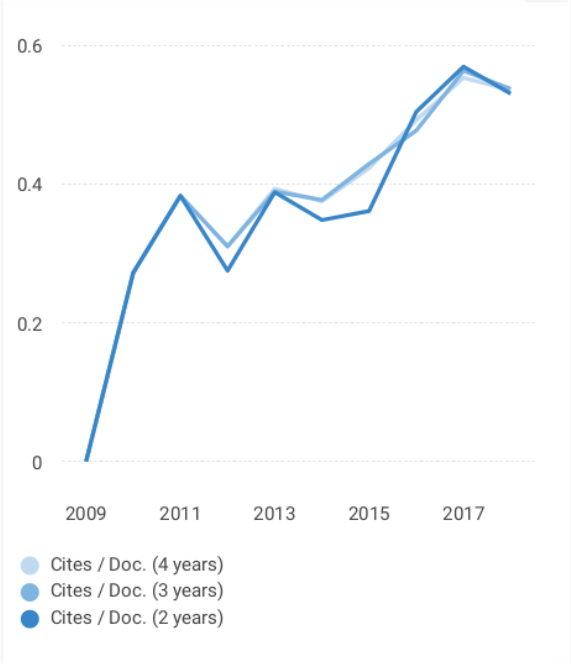
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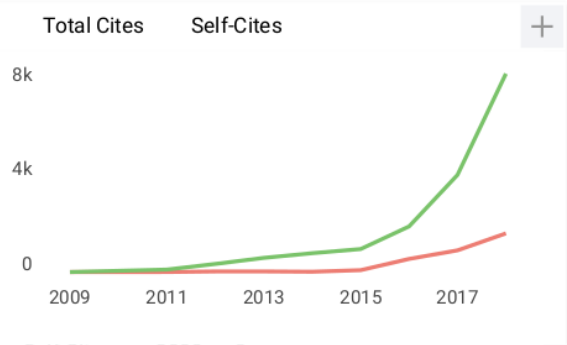
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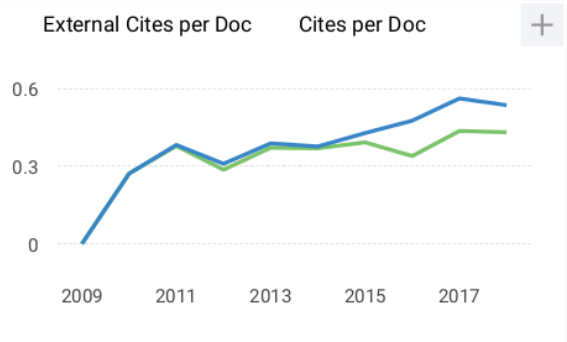
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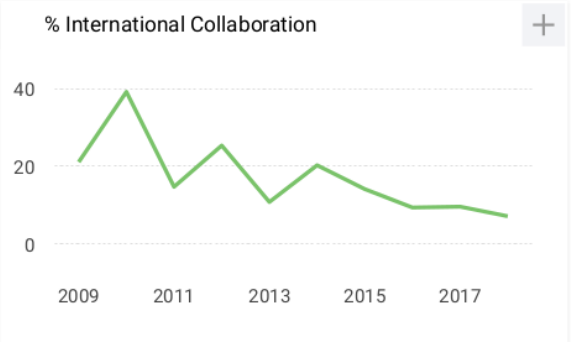
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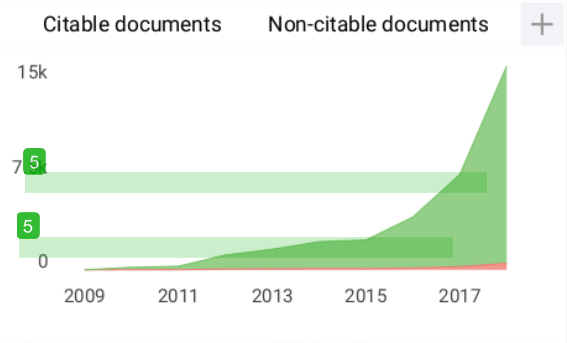
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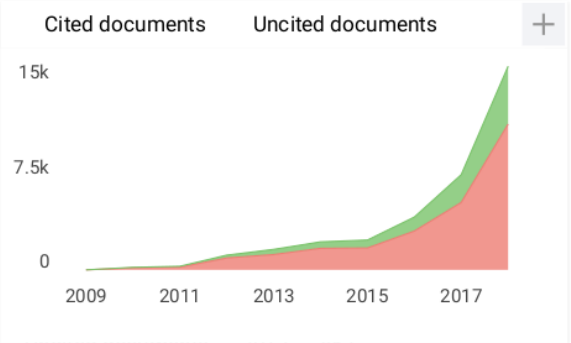
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