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Analysis of the effect of temperature on tire's durability on *engkel* truck vehicle

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Abstract: Tires are a very important component of a vehicle, a variety of charges are imposed on the tires when the vehicle is stationary or moving. The various loading styles directly rest on the air trapped in the tire, and cause the rise of pressure to flow in accordance with the magnitude of the various forces it receives. The rise in tire pressure mainly occurs when the vehicle is in motion, where the tire gets a compressive force from the constant load of the vehicle and the shock load due to the road contour. High pressure and rising and falling causes heat on the tire which then heat is moved to the rubber tire layer. Besides also because of the heat when the surface of the tire tread rub against the road during acceleration and braking. Assuming that heat is the main cause of tire damage then this study will try to analyze the influence of tire rubber temperature on the ability of work to withstand the air pressure in the tire. The loading received by the tire rubber coating is assumed to be the same as the tensile test that will be applied to the tire when used. This tensile test will be carried out on the rubber tire layer by heat treatment before it is tested. Temperature treatment starts from a temperature of 30 until 110 with a range of 20 degrees, with the expected stress value and the best strain obtained at that temperature range. The tire samples used in this study are two of the most used tire brands on Engkel truck trucks which are the most widely used truck types. With tensile test the tire performance is generally very good at low temperature up to 70 degree temperature, above 70 degree temperature tire performance began to decrease due to the increased strain on the tire material so that the ability to resist high pressure by the pneumatic force of the wind inside the tire decreased relative Against the increase in tire temperature**.**

1. Introduction

Tires are a component that needs attention in a vehicle. A variety of loading styles are worn on the tires, both when the vehicle is in motion or still. The three forces acting on the tire are normal or vertical forces caused by the weight of the vehicle, the longitudinal force due to the acceleration or braking force and the lateral or lateral forces caused by the vehicle's centrifugal force. [2] The force causes damage along with the duration of use and when it gets excessive force and shock force it will cause the rupture of the tire. Various kinds of excessive force that may occur in the tire caused by various things such as vehicle load is too high, road damage, collision with uneven road surface, and foreign objects that can stick on the tires that cause tire pressure leak.

In the vehicle of goods or material dimension of vehicle and tire become limiting ability of vehicle transport so often at stake its ability to economical value of vehicle transport become feasible. For example a medium-sized truck carrying 2-axis 2-axis of sand that should carry 5 tonnes of sand today with an economical calculation is used to carry sand weighing approximately 12 tons. This is what causes the rapid destruction of vehicle components, especially tires or the occurrence of tire breaks in

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transit. Based on experience passed on from generation to generation, truck drivers try to overcome and anticipate the breaking of tires and the rapid wear of tires by way of stopping the roadside to lower the temperature of the tire known as "Ngeban". If it is felt the tire temperature is cold enough then the truckers continue the journey. In a roadside survey conducted on Jalan Mahendradatta there are many trucks loaded with sand stopping around Lembeng Beach with a duration of half to 1 hour. From the interview it is known that they are cooling the tires (ngeban) as mentioned above, from the interview also found that if ngeban not done then the tires become too hot and can cause tire breaks and fast tire wear. From interviews also obtained the long use of tires and brands of tires are often used.

Theoretically the breakdown or breakup of the tire is due to the amount of air pressure inside the tire due to the various forces that rest on the air captured in the tire. Pressure and force that rests on the air trapped in the tire increases the tire pressure in all directions equally. Pressure or excessive force does not necessarily cause a tire break even though it is pressurized above the tire specification capability. However, due to the presence of lateral and longitudinal forces when moving or rotating, the pressure on the tire changes and causes a change in temperature. The pressure change accumulates and is proportional to the length of rotation or movement of the tire without stopping, the accumulation causing heat or temperature changes in the air in the tire, which then moves on the tire rubber layer. This heat damages the tire, causing wear and tear [3]. Increased tire temperature in addition to the ups and downs of air pressure in the tire is actually also caused by the friction of the tread of the tread with the road during acceleration and braking. The only way to cool the tire back is to stop the roadside or silence until the temperature of the tire back cold. Based on the background above this study takes the theme of analyzing the effect of temperature on tire resistance. In this study a study of the effect of temperature on durability and tire elasticity. From this study will get the value of a certain temperature where the tire has the best performance capabilities. The object of this study is the most widely used tire on the truck Engkle which is the most used middle-class commercial truck in the area of Bali.

Based on the above background, then taken the formulation of the problem as follows:

1. How does temperature influence truck tire performance with tensile test?
2. What is the best working temperature of each tire brand that is widely used in Engkel trucks?

2 Research Methods

The method used is to test the object directly studied in this case is in the form of an armor truck tire. The tires are sampled in the form of Engkel truck tires with the size of alloy wheels 60 ring 16 with the size of bias 750 tires brand Bridgestone and Gajah Tunggal brand. As shown in Figure 1, each tire will be split / cut off the left and right blanket into 5 specimens. The total specimens were 10 specimens.

On a predetermined day the data will be taken in the form of stress and strain of each specimen by first providing heat treatment by inserting it into the microwave and setting the microwave heat degree in accordance with the specimen's planned heat. The first specimen is heated to a temperature of 30 or more to be obtained after the specimen is tested at that temperature. Furthermore, after checking the specimen heat is then mounted on a tensile test choke and measured tension and strain. And so on until all the specimens get heated and tested from a temperature of 30 to 110 degrees Celsius with an increase of 20 degrees.

After all data obtained then input and tabulation of data in microsof excel to obtain the graph and compare one graph with other graph. From the graph it can be seen the tendency of the graph line to further narrated in the analysis results.

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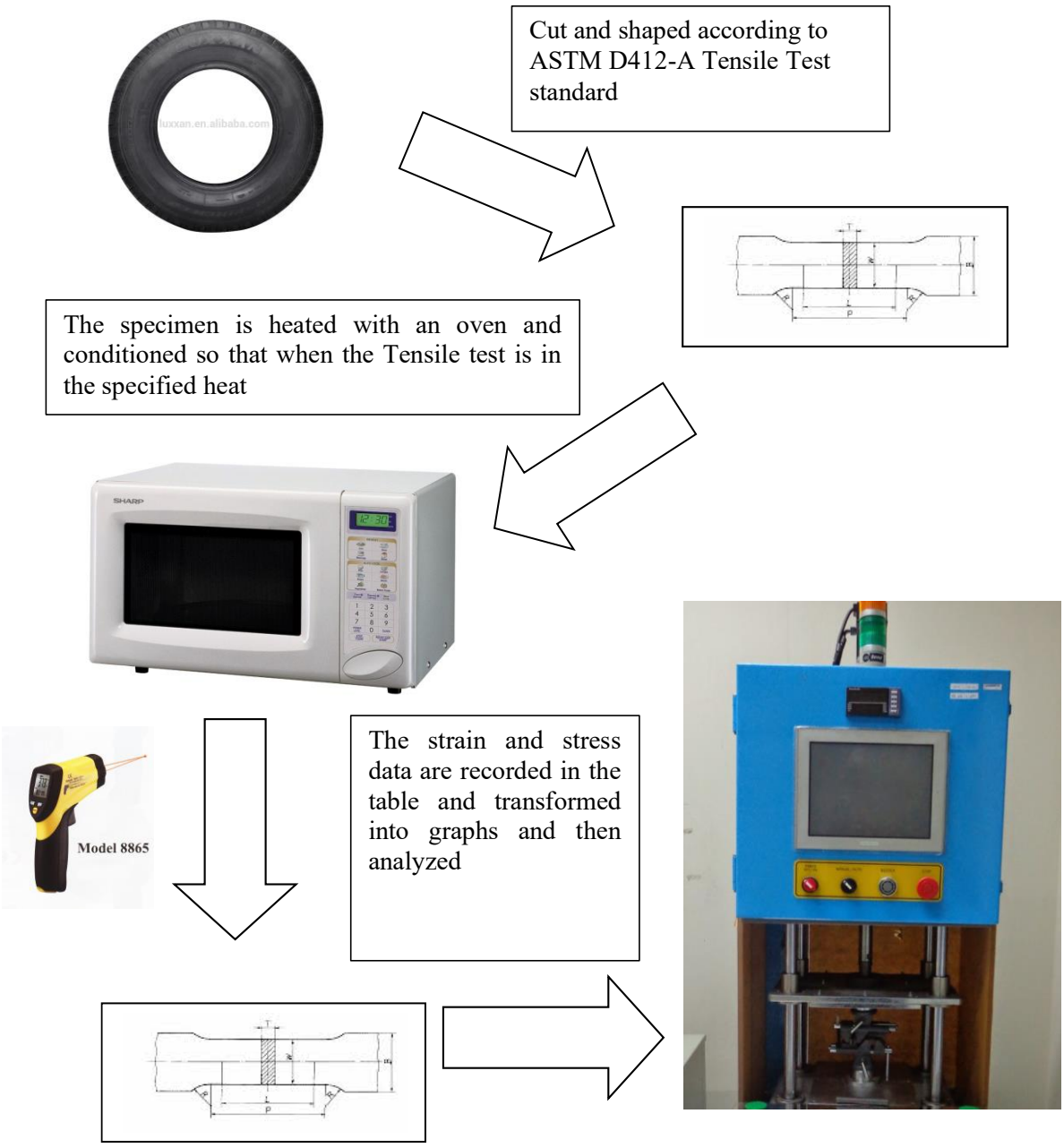

Figure 1. Test Flow

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3 Results and Discussion

From 5 specimens on each tire brand, 10 data were recapitulated as shown below:

Table1. Recapitulation of Tension and Strain

No	Temperature (°C)	Tension (Kgf/mm^2)		Strain mm/mm	
		Tension No A	Tension No B	Strain No A	Strain No B
1	30	0.6	0.5	1.9189	1.831
2	50	0.3	0.3	1.9159	1.8059
3	70	0.3	0.3	1.9395	1.8177
4	90	0.3	0.3	1.9895	1.8959
5	110	0.2	0.2	2.1294	1.9294

From the table above then transformed into a graph as shown in Figure 2

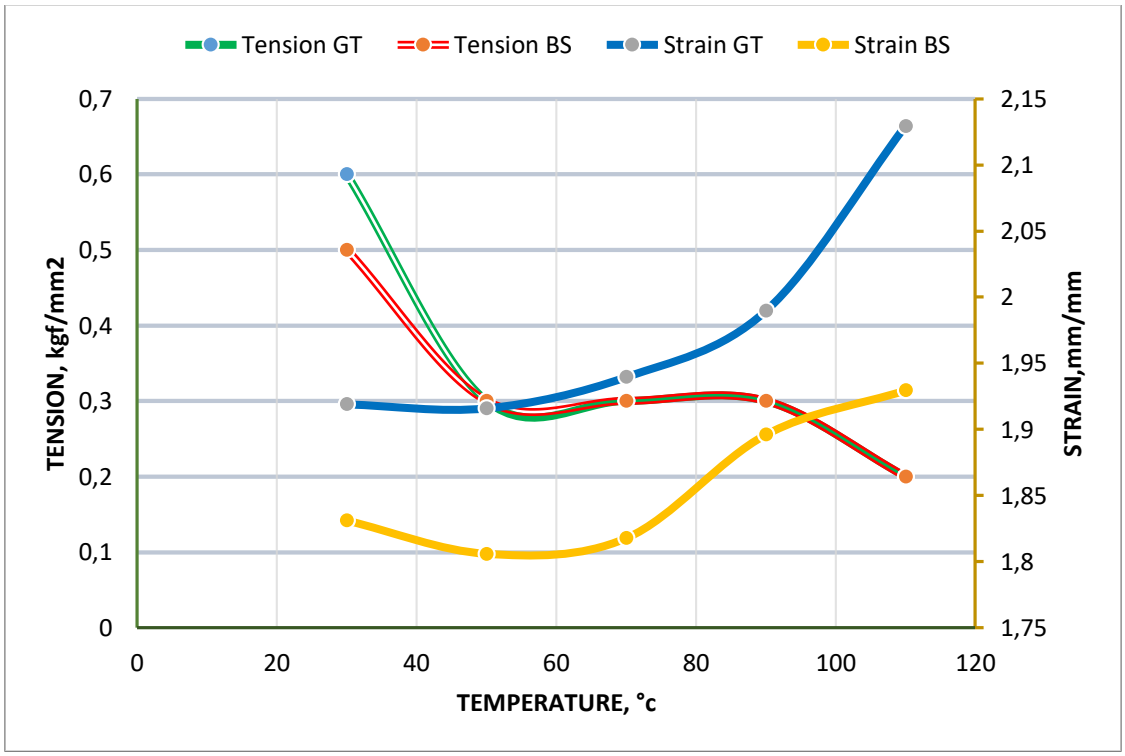

Figure 2. Graphics Effect of temperature on tension stress and strain

From the graph, the tire strain B (BS) is relatively lower than the A (GT) tires at all temperatures. While in the second tire voltage has almost the same value only tire voltage A (GT) at a temperature of 30 ° C has a higher voltage but at other temperatures the same value with tire B (BS). From the graph above it can also be seen from the strain perfomance both tires are relatively good at low temperatures but decreased at temperatures above 90 ° C seen from the stress while viewed from the strain, the performance of both tires decreased at a temperature of 50 to 60 ° C.

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4 Conclusion

The conclusions that can be drawn from the results of this study are as follows:

1 With tensile test the tire performance is generally very good at low temperatures up to 70 degrees, above 70 degrees the performance of tires began to decline due to the increased strain on the tire material so that the ability to resist high pressure by the pneumatic force of the wind inside the tire decreased relative to the increase Tire temperature.

2 For the best performance A (GT) tires at low temperatures up to 70 degrees, as well as B (BS) tires, although generally at low temperature the performance of B (BS) tires is relatively better than A.

Reference

[1] Prasetya Hari Akademi Teknologi Kulit.Yogyakarta. Arang Aktif Serbuk Gergaji Bahan Pengisi Untuk Pembuatan Kompon Ban Luar Kendaraan Bermotor. Jurnal Riset Industri, Vol. VI. Palembang. 2012.

[2] Ian Hardianto Siahaan, Ninuk Djonoadji, Amelia Sugondo. Analisa Gaya Pada Roda Kendaraan Pada Berbagai Kecepatan. Product Innovation and Development Centre Petra Christian University. Jurusan Teknik Mesin, Fakultas Teknologi Industri-Universitas Kristen Petra. Laboratorium Pengaturan dan Uji Konstruksi, Universitas Kristen Petra Surabaya .2006

[3] Rahmaniar, marlina.. Pengaruh Ukuran Partikel Nano Sulfur Terhadap Sifat Fisis Karet

[4] Jurnal of Industrial Reasearch, Komponen Kendaraan Bermotor., Vol. IV. Jakarta.

[5] Wikipedia, 2012, Ban, diakses dari http://id.wikipedia.org/wiki/Ban

[6] Wikibooks.org. wiki. Moda. Transportasi/Moda. Transportasi Jalan diakses dari http://id.wikipedia.org/wiki/Ban