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Ethanol Concentration Variations on Arak Bali influence to Torque, Power and Spesific Fuel Consumption of Engine

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----------**ABSTRACT**----------
Increased motor vehicle population will affect the increase in fuel oil consumption. The existence of oil is now very limited and not renewable. And therefore required an alternative fuel. The author conducted research using Arak Bali as a substitute fuel. Because Arak Bali has physical properties similar to gasoline fuel, such as flammable in air atmospheric conditions. How is the writer doing research on the effects of the use of Arak Bali to Torque, Power and Specific fuel consumption of the four Stroke engine. Testing was conducted on a four-stroke engine with a compression ratio of 7.8, concentration of Arak Bali are: 81.2%, 88.7%, 93.4%, 95.6%, testing was conducted on the variation of the engine speeds are: 1000 rpm , 1500 rpm , 2000 rpm , 2500 rpm and 3000 rpm. The result is that variations in the concentration of Arak Bali and engine speed at the same compression ratio can improve the performance generated from machine. The best Arak Bali to used fuel is Arak Bali with a concentration of 88.7% compared with the use of premium fuel. At 88.7% concentration of Arak Bali can produced torque and power greater than premium fuel, and specific fuel consumption lower than premium fuel.
Keywords: Arak Bali, concentration, engine, performance.

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I. INTRODUCTION

The development of the tourism industry is one industry that boosts the economy of Indonesia. The smoothness of the tourism industry is very dependent on transport. The development of transport causing an increase in the population of engine vehicles is very large. Increased population engine vehicles will affect the rising need for fuel oil. Inversely proportional to the increase in vehicle population, energy resources petroleum fuels has decreased and began experiencing shortages, so the effect on oil prices, and the impact on the high cost of operating a vehicle engine. Because oil is a fuel that cannot be renewed, the need to start thinking about the use of substitute fuels.

In Indonesia there are a variety of alternative energy sources, such as solar energy, water energy, wind energy and bio energy. Bio energy grouped into biogas, biomass, biodiesel and bio ethanol. Nothing special in Bali known as arak Bali. Arak Bali is a type of liquor obtained from the process of fermentation and distillation plant liquids that contain carbohydrates, such as coconut sap or palm. The process of distillation of the sap of coconut, palm or palm can produce Arak Bali with a concentration greater than 80%. Arak Bali is not suitable for drinking but very suitable as fuel. Because Arak Bali has physical properties similar to the physical properties of premium fuel. Lodging in Bali, Arak Bali current utilization of the new wine on stage as liquor for consumption and ritual paraphernalia. Seeing these problems, the authors are interested in doing research into how effect of Arak Bali as a substitute fuel premium on the performance of the four stroke engine.

II. BASIC THEORY

Combustion is a rapid chemical reaction between oxygen and combustible, with the onset of light and generated heat. Spontaneous combustion is a combustion in which the material undergoes oxidation slowly so that the heat produced is not released, but the materials used to raise the temperature slowly until it reaches a temperature of flame. In the fuel in general there are only two important elements, namely carbon and hydrogen. Good combustion is to obtain the release of all the heat contained, as well as reduce the amount of heat that is lost due to incomplete combustion, heat absorbed excess combustion air and the heat absorbed by the walls of the cylinder. Complete combustion where all the elements that can be burned to form carbon dioxide gas and gas dihidrogen oxide [1].

As is known, oxygen for combustion is obtained from the air consisting of 21% oxygen and 79% nitrogen. If needed 1 lb of oxygen, then it means it takes 4.5 lb air. Nitrogen gas which fills 79% of the air does not participate in the combustion reaction but suck the heat from the combustion reaction. To determine the proper amount of oxygen in each combustion, is not an easy thing, in general used the excess air factor. The advantage

to avoid waste of fuel, but reduces the heat of combustion. For this there is an excess of air maintained between 5 until 15 % [2].
In combustion, no term primary air is the air that is mixed with fuel prior to combustion, secondary air is air that entered the combustion chamber after the burner through the space surrounding the burner tip or through other places and tertiary air that entered the air outside the combustion chamber [2]. The balance of fuel, air and heat in the combustion process is as follows:

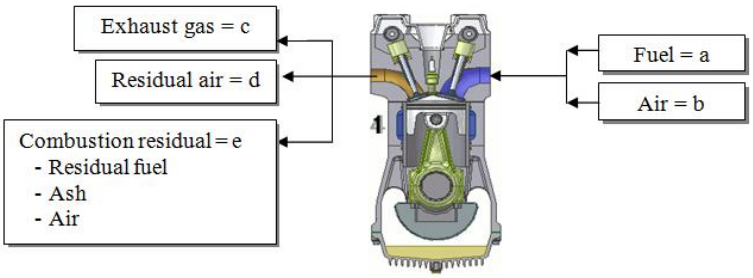

Figure 1. Balance of combustion process [3].

1.1. Fuel

Fuel is material that produces energy, physically fuel can be differentiated into three namely: Solid fuel, Liquid fuels and Gas fuel. Fuel used in vehicles is a liquid fuel is gasoline or diesel. Has begun to try the use of ethanol as an alternative fuel to replace fossil fuels [2].

1.2. Fuel Ethanol

Alternative fuel that special attention is ethanol (*ethyl alcohol*), clear liquid without color and unique aroma. Because it is non-toxic, This material is widely used as a solvent in the pharmaceutical, food and beverage industry. A mixture of ethanol with water gives a sweet taste, but at higher concentrations will give a burning sensation. Ethanol with molecular formula C_2H_5OH is alcohol, which is a group of chemical compounds containing compound hydroxyl-OH which is attached to the carbon. Chosen ethanol as an alternative fuel, because of a clean burning, easily manufactured [2].

1.3. Arak Bali

Arak Bali is a typical drink produced from several types of plants such as coconut tree, palm, and palm. Results of plant species is one of them in the form of juice, obtained by tapping virgin tree that has not bloomed. A Virgin can be tapped for 10 until 30 days with the results obtained from 0.5 until 1 liter of juice per day. Nira can easily experience the natural yeast fermentation because contains natural yeast. Fermentation will expire for one day after the sugar in the juice is converted exhausted, sap will contain alcohol. With sap distillation technology produces Arak Bali.

III. RESEARCH METHODS

The stages of the research to be carried out is like the diagram below:

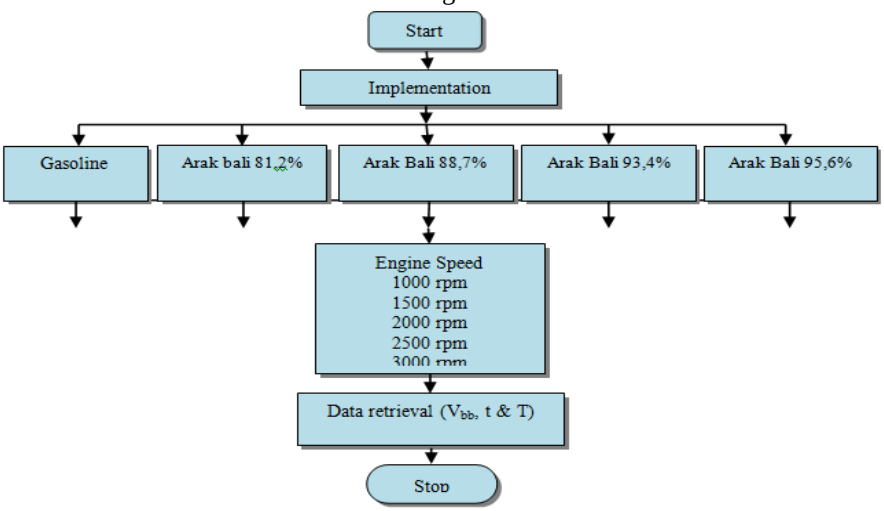

Figure 2. Flowchart for research steps.

Figure 3. Research Steps

IV. DISCUSSION

The effect of variations in engine rotation chart and variation concentration of Arak Bali for torque, power and specific fuel consumption on the four-stroke engine shown as the picture below. Figure 4 shows the relationship between the rotation of the engine torque and uses gasoline and each concentration fuel arak bali, seen that with the higher rotation the engine torque produced is getting smaller. The greatest torque generated by fuel Arak Bali concentration of 88.7%, at 1000 rpm torque produced by 1.012619 Nm. To fuel Arak Bali with a concentration of 95.6% experienced a drastic reduction in torque, reduced torque generated reaches 0.175 Nm.

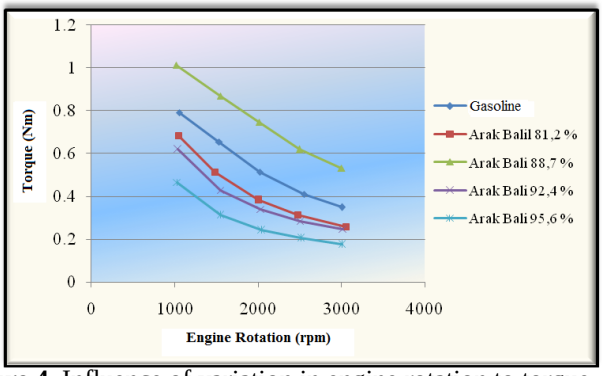

Figure 4. Influence of variation in engine rotation to torque.

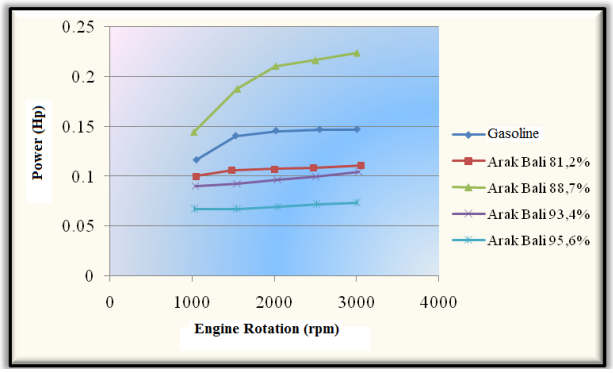

Figure 5. Influence of variation in engine rotation to power.

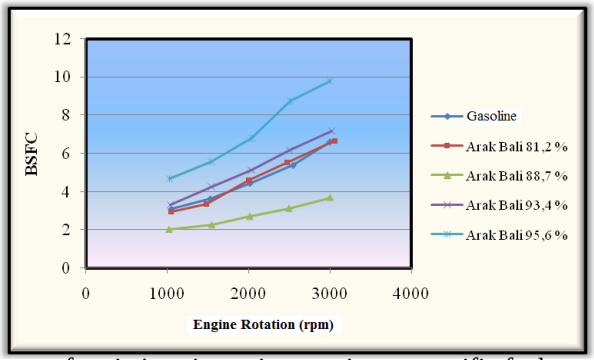

Figure 6. Influence of variations in engine rotation to specific fuel consumption

Figure 5 shows the variation of the spin machine to power with fuel different, the higher the engine rotation to increase the power generated, and looks at the use of fuel ethanol 95.6% at engine speed of 3000 rpm increased power equal to 0.07389352 Hp. At arak bali 93.4% at 3000 rpm rotation results in increased power of 0.10439007 Hp. For arak bali 88.7% increased power of 0.22414858 Hp at 3000 rpm.
From figure 6 the influence of rotation on the engine to specific fuel consumption, shows the engine rotation higher rate of specific fuel consumption higher. At rpm 1000 to 3000 rpm for fuel ethanol 88.7% specific fuel consumption required increased respectively by 2.0128354 kg/hp.jam to 3.6872970 kg/hp.jam. From the graph is also seen in 81.2% Arak Bali fuel and gasoline specific fuel consumption of an increase that is almost the same as gasoline.

4.1. The influence of concentration Arak Bali to torque, power and specific fuel consumption.

Fuel variation affects the torque produced. The greatest torque occurs at 3000 rpm the engine uses fuel arak bali concentration of 88.7% . Due to the use of fuel Arak Bali 88.7% is in accordance with the engine compression ratio of 7.8 to achieve optimal engine performance. The greatest power is generated in the use of fuel ethanol 88.7%, but the decline occurred in increasing concentrations of ethanol. While the use of premium fuel at the same engine speed, the power generated is smaller than the 88.7% arak bali. Where fuel arak bali with the greater concentration has a higher octane value anyway, but the use of fuel with a higher octane rating required a large compression ratio engine. While on ethanol 81.2%, 93.4% and 95.6% decreased power, because events detonation in the cylinder chamber causing knocking sound, that causes the power generated is small compared to gasoline. From the above discussion overall was very obvious that the results of tests that have been done show 88.7% ethanol to produce the most effective performance in the same compression ratio.

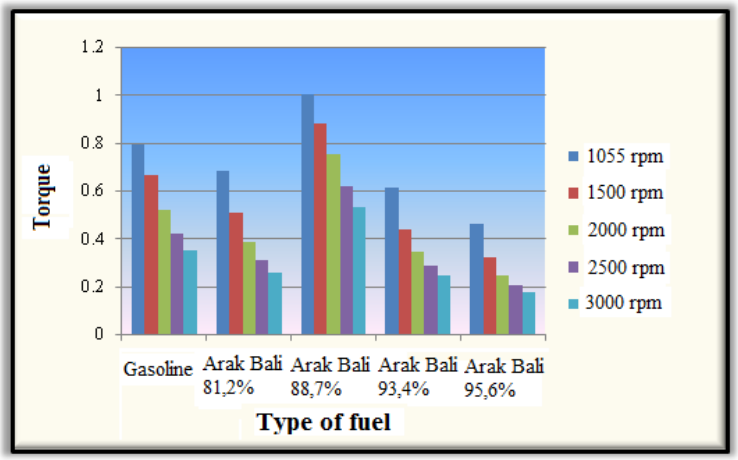

Figure 7. Comparison of fuel type to torque of four stroke engine

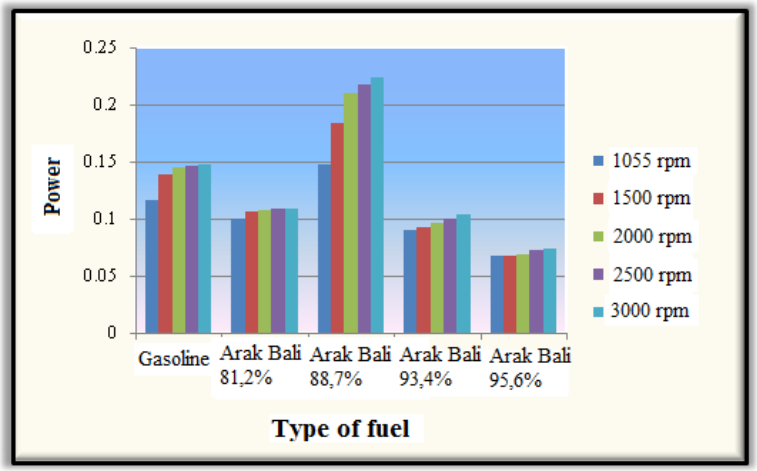

Figure 8. Comparison of fuel type to power of four stroke engine

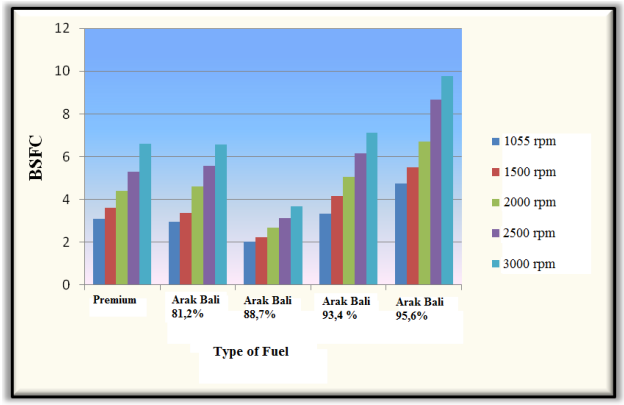

Figure 9. Comparison of fuel type to specific fuel consumption of four stroke engine

From the figure 7, 8, and 9, respectively showing the effect of variations in fuel on performance namely: torque, power (BHP) and specific fuel consumption, it appears that the most maximum performance resulting in 88.7 % Arak Bali fuel. Where the effect of variations in the fuel against the torque to 88.7 % Arak Bali fuel produce the greatest torque, compared with 81.2% Arak Bali fuel, 93.4%, 95.6% and gasoline. The influence of the type of fuel to power (BHP), looks at the use of fuel Arak Bali 88.7% yield the greatest power, at engine rotation 3000 rpm the power generated by 0.224142 Hp. The influence of the type of fuel to the break specific fuel consumption (BSFC) also seen, specific fuel consumption produced at the lowest by used 88.7% Arak Bali. The magnitude of the specific fuel consumption at engine rotation 1055 rpm is 2.029260 kg/hp.jam.

V. SUMMARY

Changes in the spin machine can alter the performance generated. This change occurs where the lower the engine rotation that in certain circumstances the greater the torque produced. The higher the spin machine to spin conditions produced greater power, specific fuel consumption increases. The use of fuel also affects the performance of a four-stroke engine. Arak Bali concentration of 81.2%, 88.7%, 93.4% and 95.6% occurred resulting differences in performance. Fuel use Arak Bali most good for the engine with a compression ratio of 7.8 is Arak Bali concentration of 88.7%. Of torque, the power generated is larger and specific fuel consumption of less than premium fuel.

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