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COMPARISON OF THE EFFECT OF SUXXX, V-POXXX FUEL AND THEIR MIXTURES ON R15 MOTORCYCLE ENGINE PERFORMENCE

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ABSTRACT

General Background: With the increase in motorcycle usage worldwide, optimizing engine performance through fuel selection has become a focus, as fuel type significantly impacts torque, power, and specific fuel consumption. **Specific Background:** Public motorcycle transportation options include various fuel types, such as suxxx and v-poxxx, as well as blends with ethanol, which are commonly used for enhanced engine efficiency. **Knowledge Gap:** There is limited research directly comparing the performance impacts of suxxx, v-poxxx, and their mixtures, especially with ethanol, on motorcycles over a range of RPMs. **Aims:** This study aims to evaluate the differences in motorbike performance using pure suxxx, v-poxxx, a 50-50 blend of suxxx and v-poxxx, and an 85-15 blend of suxxx and ethanol by examining torque, power, and specific fuel consumption (SFC) on an R15 motorbike through dynotest trials. **Results:** Findings indicate that v-poxxx, with its higher octane level, provides superior torque, power, and SFC compared to suxxx and mixed fuels, especially at low and high RPMs. Meanwhile, the 85% suxxx and 15% ethanol blend achieves the best SFC but has slightly lower torque and power at specific RPMs compared to v-poxxx. **Novelty:** This study provides comparative insights into the effectiveness of mixed ethanol fuels in motorcycles, identifying performance variances across a range of RPMs, which is less explored in the context of motorcycle engines. **Implications:** The results suggest that high-octane fuels enhance engine performance, while ethanol mixtures could serve as efficient alternatives for fuel savings. These insights are valuable for consumers and manufacturers aiming to optimize fuel usage for different riding conditions.

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INTRODUCTION

In Indonesia, motorcycles are one of the most widely used means of transportation.[1] Motorcycles are also one of the means of transportation that are in great demand by the public, especially automatic[2], as a result of which there is a need for fuel as an energy source from the transportation[3]. For transportation tools used using a drive in the form of an engine,[4] A combustion motor is a change of heat energy into mechanical energy with the existence of heat as a source of power, so it should use fuel and combustion as a source of heat.[5] The fuel used in vehicles is commonly called fuel or short for fuel oil, this fuel comes from fossils that can one day run out and it is even estimated that in the next 53 years the world will begin to have difficulties with petroleum.[6]

What is an important factor for vehicle users is the rate of fuel consumption,[7] The rate of fuel consumption is influenced by four factors, namely: the vehicle, the environment, the driver and the condition of the traffic.[8] Because with the increase in petroleum, petroleum reserves are decreasing while oil demand continues to increase.[9]

This is in accordance with the government's policy in the energy sector, which strives to use fuel as efficiently as possible, considering that petroleum is a non-renewable energy source.[10] This crisis has caused humans to change their mindset on research and use from non-renewable energy to renewable energy, one of which comes from biomass processed into ethanol.[11] For the addition of ethanol, the fuel causes an increase in the octane value, causing the performance produced by the motorcycle to increase.[12]

Therefore I am interested in researching how the torque, power, and specific fuel consumption produced by the R15 motorcycle using suxxx fuel, v-poxxx, a mixture of 50% suxxx with 50% v-poxxx and a mixture of suxxx15% with 85% ethanol.

METHODS

The research method used is the observation method, the method in this study is to record the results of each stage in the research where on each fuel is tested with a predetermined RPM, namely 2000 RPM to 6000 RPM.[13]

Fuel Consumption :

1. Suxxx
2. V-poxxx
3. Mixed 50% suxxx with 50% V-poxxx
4. Blend of 85% suxxx with 15% ethanol

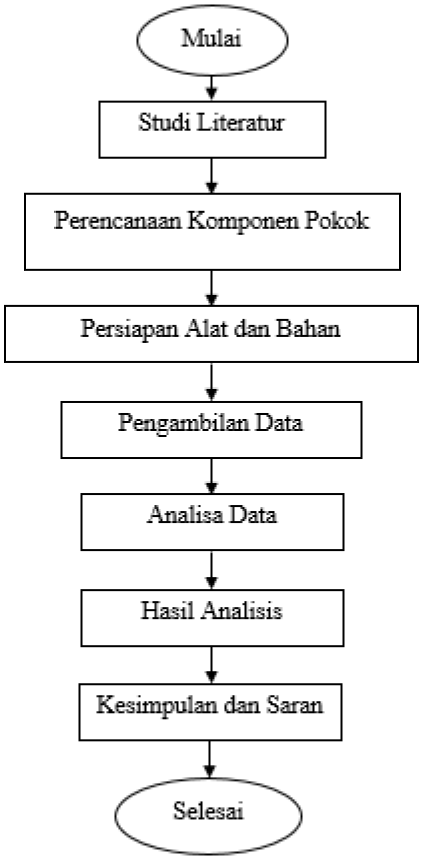

Figure .1 Research Flow Diagram

RESULT AND DISSCUSION

A. The testing procedure in this study is as follows:

1. Torque and power

   Data collection is carried out using a dynotest tool, this dynotest can measure the performance of the engine, one of which is the torque and power values automatically,[14] The data collection method is:
   a. Prepare the vehicle and daynotest tools to be used in the test
   b. Place the motor to be used for the test on the dynotest and the rear wheel position is on the roller
   c. Turn on the dyotest and settings on the computer
   d. Fill the tank with fuel
   e. Turn on the engine and leave it in a few minutes to warm up
   f. Set the engine rotation to a stationary position
   g. Adjust the rotation of the engine to obtain the torque value for each variation of engine rotation on the fuel to be used
   h. Torque and power values appear and can be read on the monitor screen
2. Fuel consumption

   Fuel consumption is the rate of current or the number of fuel turbines consumed by each unit of power produced,[15] This specific fuel consumption calculation is used to find out the amount of fuel needed to produce power in a given time. The data collection method is:
   a. Preparing tools and materials
   b. Remove the motorcycle tank and replace it with a tengki that has been customized by giving a burette or measuring cup on it that is connected to a hose
   c. Fill the measuring cup with the fuel to be tested
   d. Start the engine
   e. Set RPM from 2000 to 6000
   f. Turn on the stopwatch to time each fuel 2 minutes

B. Power calculation

$$W = \frac{2\pi n T}{60000}$$

Where:
W = Power (kW)
n = Engine Rotation (rpm)
T = Torsi (Nm)
Suxxx calculation at RPM 2000

W = ?

n = 2000

T = 2.1

$$W = \frac{2\pi nT}{60000} = \frac{2 \,.\, 3{,}14 \,.\, 2000 \,.2{,}1}{60000} = 0{,}4396kW$$

$$= 0{,}58\ HP$$

C. SFC calculation

Fuel consumption suxxx at 2000 RPM

$$\text{SFC} = \frac{\text{F}}{\text{P}} = (\frac{\text{kg}}{\text{jam}}.\text{hp})$$

SFC = Specific fuel consumption (kg/HP-h)

F = Fuel weight in one hour (kg/h)

P = Power (HP)

- Amount of fuel consumed (S) = 10 ml
- Time it takes to burn fuel t = 2 minutes
- So that the volume produced every minute:
  $$V_{ms} = \frac{10}{2} = 5\ ml\ setiap\ menitnya$$
- Then the weight of the fuel required in one hour:
  $$b = \frac{V_{ms}}{menit}\ x\ 60\ menit = 5\ x\ 60 = 300\ {}^{ml}/_{jam}$$
- Fuel weight required in one hour
  $$F = \rho_{bb} x\ b = 0{,}70\ gr\ cm^3\ x\ 300$$
  $$= 210\ gr = 0{,}21\ kg$$
- The specific fuel consumption for the suxxx at 2000 rpm with 0.58 hp, are:
  $$SFC_{suxxx} = \frac{F}{P}\ kg\ jam.hp$$
  With P = load = 0.58 hp
  I have a SFC = $\frac{0{,}21}{0{,}58} = 0{,}3620\ kg\ hp - jam$

D. Analysis Results

Table. 1 Comparison of torque on fuel consumption variations

RPM	Torque (N.M)			
	suxxx	v-poxxx	Sv 50%	Se 85%/15%
2000	2,1	3,49	2,12	3,03
2500	2,66	3,67	2,67	3,49
3000	3,22	3,85	3,22	3,95
3500	3,78	4,03	3,79	4,41
4000	4,31	4,36	4,32	4,87
4500	4,88	4,93	4,86	5,03
5000	5,38	5,5	5,43	5,51
5500	5,88	6,06	5,97	6,06
6000	6,57	6,64	6,52	6,62

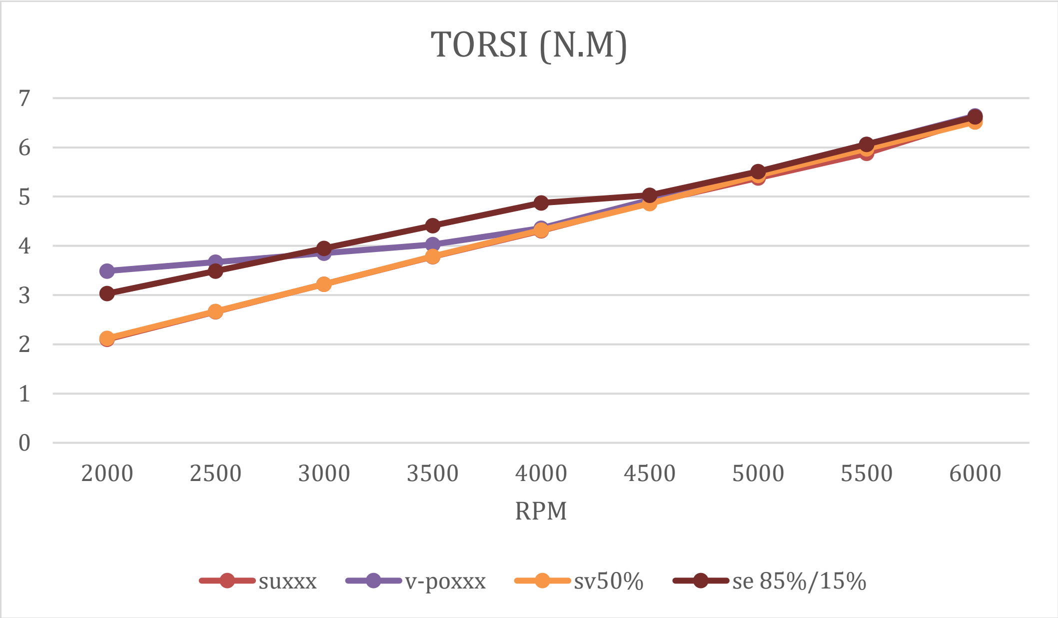

Fig. 2 Torque comparison on fuel consumption variations

The torque produced by v-poxxx fuel from 2000 rpm to 6000 rpm is higher than the torque of suxxx fuel and a fuel mixture of 50% suxxx with v-poxxx 50%, while the fuel mixture of 85% suxxx with 15% ethanol has the highest torque value compared to other fuels. It's just that at 2000, 2500 and 6000 rpm v-poxxx fuel has a higher torque value than a mixture of 85% suxxx fuel with 15% ethanol, this proves that the mixture of 85% suxxx fuel with 15% ethanol has a torque advantage at the middle rpm of the v-poxxx fuel, while at the lower and upper rpm the v-poxxx is superior.

Table. 2 Power comparison on fuel usage variations

RPM	Power (HP)			
	suxxx	v-poxxx	sv50%	SE80%/15%
2000	0,58	0,97	0,59	0,85
2500	0,93	1,28	0,94	1,22
3000	1,35	1,62	1,35	1,66
3500	1,85	1,97	1,86	2,16
4000	2,41	2,44	2,42	2,73
4500	3,08	3,11	3,06	3,17
5000	3,77	3,85	3,81	3,86
5500	4,53	4,67	4,6	4,67
6000	5,53	5,59	5,49	5,57

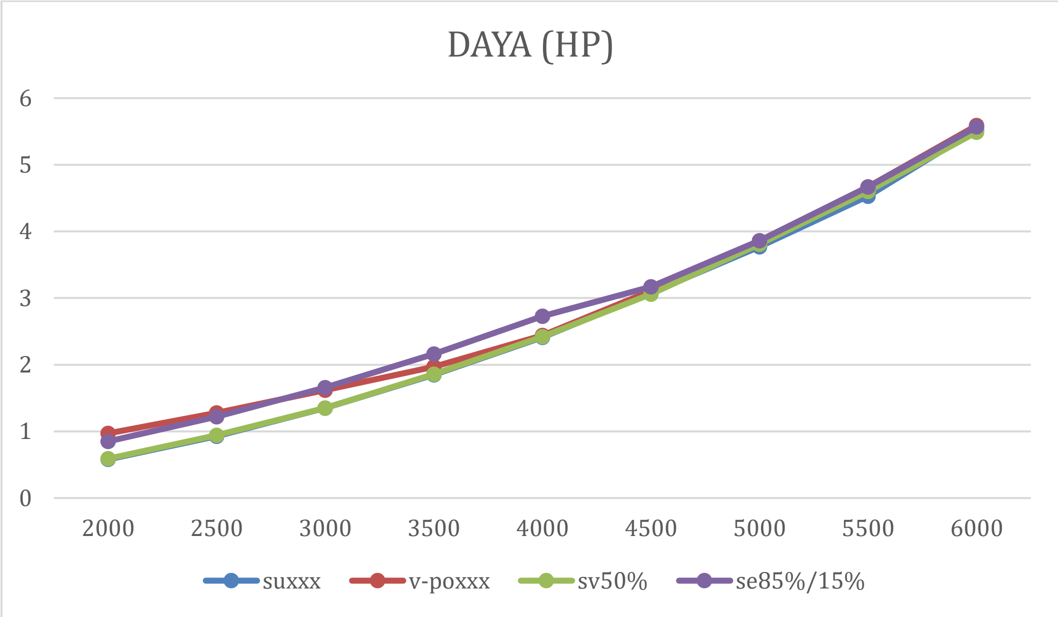

Fig. 3 Comparison of power on fuel consumption variations

At 2000 rpm to 6000 rpm v-poxxx fuel has a higher power value than suxxx fuel and a fuel mixture of 50% suxxx with v-poxxx 50%, while a fuel mixture of 50% suxxx with v-poxxx 50% has a higher power value than fuel suxxx. For the highest power value obtained in a fuel mixture of 85% suxxx with 15% ethanol, it's just that at rpm 2000, 2500, and 6000 v-poxxx fuel has a higher power than a fuel mixture of 85% suxxx with 15% ethanol, this indicates that the fuel mixture of 85% suxxx with 15% ethanol only has a higher power value at the middle rpm of v-poxxx fuel, Meanwhile, at the lower rpm and upper rpm, the V-POXXX fuel is superior.

Table. 3 Comparison of specific fuel consumption on fuel use variations

	Specific Fuel Consumption (SFC) (kg/HP-jam)			
RPM)	suxxx	v-poxxx	SV 50%	SE 85% and 15%
2000	0,362	0,0865	0,2847	0,0741
3000	0,2177	0,1037	0,1555	0,0885
4000	0,1394	0,086	0,1041	0,0769
5000	0,1002	0,0763	0,0992	0,0652
6000	0,1063	0,0826	0,0918	0,0867

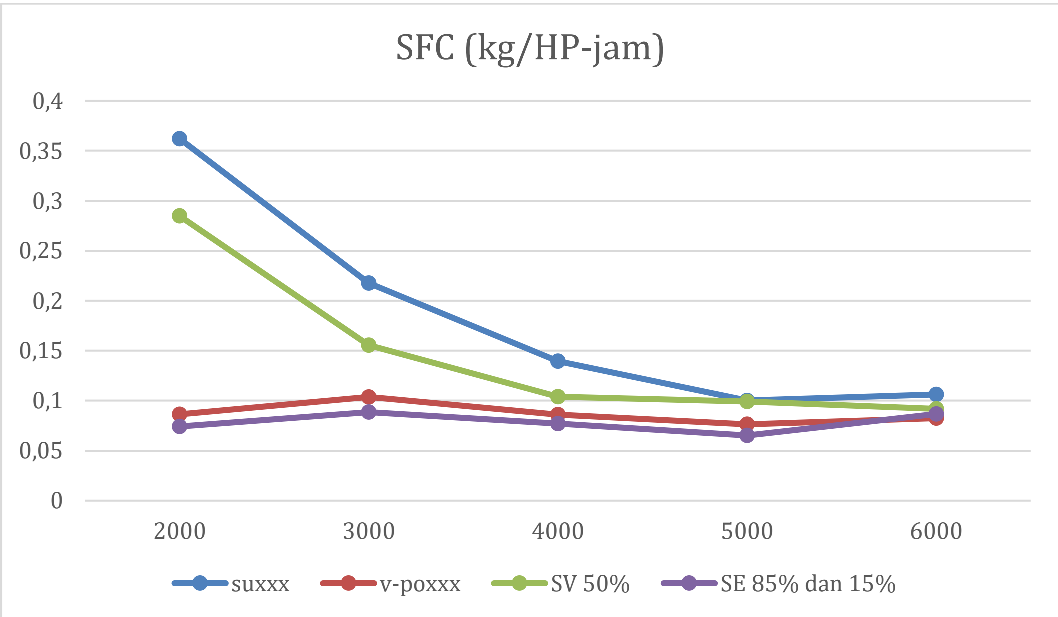

Fig. 4 Comparison of specific fuel consumption on fuel use variations

According to the results of the data, the fuel consumption of suxxx fuel, v-poxxx, a fuel mixture of suxxx 50% with v-poxxx 50%, and a mixture of suxxx 85% with ethanol 15% have different variations in specific fuel consumption. Where the best consumption of specific ingredients is found in a fuel mixture of 85% suxxx with 15% ethanol, after that v-poxxx, a mixture of 50% suxxx with v-poxxx 50%, and the lowest suxxx. From the results of the data, it can be seen that the addition of ethanol to fuel can affect the increase in torque, power, and specific fuel consumption values and the size or size of the octane value can affect the compression of the engine itself, so that the octane value determines how well it affects the performance of the motorcycle engine

CONCLUSION

Fundamental Finding: This study demonstrates that high-octane fuels, particularly v-poxxx, provide superior motorcycle engine performance in terms of torque, power, and specific fuel consumption (SFC) compared to suxxx and various fuel mixtures, with v-poxxx consistently delivering optimal results at both low and high RPMs. **Implication:** These findings suggest that using higher-octane fuels can enhance motorbike efficiency and performance, which may benefit consumers and manufacturers focused on maximizing engine output and fuel economy. **Limitation:** The study is limited by its focus on a single motorcycle model (R15) and a specific range of RPMs, potentially reducing the generalizability of the findings across other vehicle types or different operational conditions. **Further Research:** Future studies should extend this analysis to a broader range of motorcycle models and operational environments, as well as explore the long-term effects of ethanol fuel blends on engine wear and environmental impact, to develop a more comprehensive understanding of fuel options for optimized engine performance.

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