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The impact of adding PH adjuster additives on the performance of the radiator in 160 cc Vario motorcycles

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Abstract: The vehicle's power comes from the engine, which uses combustion to transform the chemical energy of the fuel into mechanical energy. The combustion temperature will have an impact on the engine's operating temperature if this situation is not adequately cooled. According to some literature, the PH adjuster additive is a combination of chemicals that works to raise the PH and alkalinity of water to improve the state of the water atoms for the cooling process. However, the process of cooling a vehicle radiator with water from the engine is very hot, so further study is required. Additionally, this PH adjuster may condition the water to your specifications. The purpose of this study is to ascertain the outcome of adding the PH adjuster additive composition to the radiator water of the 160 cc Vario motorcycle. The approach is a descriptive methodology based on the outcomes of experiments. According to research based on the experiments carried out in this study, adding 3% PH Adjuster additives at 1000 rpm will produce the best engine performance. The amount of additives added also had an impact on the radiator performance of the 160 cc Vario motorcycle.

Keywords: PH Adjuster; rpm; ANOVA

1. INTRODUCTION

Motorcycles are single- or dual-passenger motorized vehicles. Motorcycles typically have two wheels powered by an electric or gas motor. The motorbike's engine produces power that is transferred to the back wheels via a transmission system, allowing the motorcycle to move forward [1]. According to information provided by the Indonesian Motorcycle Industry Association (AISI), domestic motorcycle sales would total 5.22 million units by the end of 2022. This surpasses the 2022 objective, which was originally set at 5.1 million units, and represents an increase of 3.36% compared to domestic sales in 2021 in the range of 5.05 million units [2]. Because they are simple to operate and can travel fast on roads that are challenging for large means of transportation to access, motorbikes can be inferred to be a form of transportation that is widely used by the community [3].

The supporting systems on bikes, particularly the electrical system, fuel system, lubrication system, and cooling system, are generally the same despite the wide variety of motorcycle kinds and brands available on the market [4]. According to its purpose, each system operates. Every component on a motorcycle that needs electricity, from lights to combustion or ignition, is distributed by the electrical system in a significant way. The purpose of the fuel system is to store gasoline and provide it to the engine cylinders in the form of a fuel-and-air mixture, both of which happen inside the engine. The lubrication system on a motorcycle is a system that offers the best lubrication for the machine's moving parts [5]. The objective is to lessen wear and friction while maintaining a safe engine temperature. Engine oil, an oil pump, an oil filter, and lubrication lines make up the lubrication system [6]. The primary lubricating medium is engine oil, and the oil pump controls the flow of oil through the lubrication system [7]. The lubrication channels direct the oil to the components that require lubrication, while the oil filter removes debris and other impurities from the oil. Reduced friction, avoided overheating, and increased motorbike engine life are all benefits of an efficient lubrication system [8].

When the combustion process takes place, the motor cooling system has the job of bringing the engine's temperature down in order to generate mechanical power that can move the engine. Heat is produced as a result of combustion, and this heat must be managed to prevent damage to other engine components. In order for the cooling system to protect the engine and keep it from overheating, which produces excessive heat that shortens component lifespan and causes wear and tear, damage to the components must not occur. In order to prevent engine overheating and provide optimal performance, the cooling system entails a number of procedures [9]. The engine block, the lubrication, the water scavenging, and the water jacket are the principal targets of the cooling system's constituent parts [10].

The engine will operate well at temperatures between 800 C and 900 C, but it must be cooled because higher temperatures would alter the nature and structure of the engine's components [11]. through order to dissipate heat from the water coolant that has been circulated through the cooling system, an engine needs a radiator. As a result, leaks in the radiator must be avoided in order to prevent the water coolant from running out soon [9]. The producer has developed a solution for employing long-lasting coolant specifically for this use. As a result, the water coolant doesn't freeze, it lasts a long time, and it also has the ability to keep metal parts from rusting. To preserve the performance of the radiator on the engine, the water coolant must be refreshed at specific intervals in order to be functional [12].

Research on the impact of water coolant on engines, specifically investigating the usage of water coolant on diesel engine power, has been conducted on diesel engines. The research's findings indicate that the addition of water coolant has an impact on engine power [13]. The results of this study's investigation into the impact of coolant changes on the engine temperature of 125cc automatic motorbikes showed a statistically significant relationship between the two variables [14]. According to research on the Kawasaki D'tracker 150 motorbike engine and the influence of the air cooler on engine temperature, using cooling devices for the motorcycle engine is quite successful and can lower engine heat by up to 22% [15].

It is stated in some literature that the PH Adjuster additive is a combination of chemical compounds that functions to raise the PH of water and the alkalinity of the water so that the atomic condition of the water for the cooling process is better [16]. However, because the radiator cooling process for a vehicle uses water that is heated up from the engine, more research is needed to determine whether the PH Adjuster is able to condition the water as desired..

2. METHOD

The research stage starts with a literature review to identify previous studies that have addressed the issue at hand. Next, materials and testing equipment are prepared, the engine is started until it reaches the desired rpm, testing is conducted, and data is collected up to three times every five minutes. The results are then analyzed, discussed, and conclusions are drawn.

The analytical method used SPSS version 27 processing, whereas the data processing technique used descriptive techniques based on experimental outcomes. Calculations will be done during processing to determine the radiator's inlet temperature (T in) and outflow temperature (T out) values. Vario 160 cc motorcycles' PH Adjuster additives' compositions were changed at 1000, 3000, and 5000 rpm.

3. RESULTS AND DISCUSSION

3.1 Variable data description

Description of independent variable data, the outcomes of monitoring the PH Adjuster Additive for several rpm variations (1000, 3000, and 5000) over the course of 3 treatments with a 2 minute time lag.

Table 1. The results of the initial trial with several PH Adjuster Additives

Prosentase PH Adjuster	rpm	T in (^{0}C)	T out (^{0}C)
PH Adjuster 0 %	1000	53,4	44,8
	3000	66,0	62,9

	5000	77,8	76,1
	1000	50,4	38,3
PH Adjuster 3 %	3000	58,8	52,3
	5000	75,6	75,2
	1000	41,3	36,7
PH Adjuster 5 %	3000	57,3	47,5
	5000	74,3	73,2

The outcomes of the first experiment are displayed in Table 1. The test was conducted by varying the PH adjuster's composition by 0%, 3%, and 5% while testing at 1000, 3000, and 5000 rpm; following this, the entry and exit temperatures were measured using the aforementioned information. As an illustration, the percentage of the PH adjuster at 1000 rpm is 0% according to the test results. There is a discrepancy between the inlet temperature and the outlet temperature, which is 53.4°C for the inlet and 44.8°C for the exit. The PH adjuster is set to 3% at the same rpm. The intake temperature is higher than the output temperature from the first test giving PH 0% to 5% as a result of this happening to the 5% PH adjuster.

The tests were stopped after the first test was finished and resumed only two minutes later. The outcomes of the second test are displayed in **Table 2**.

Table 2. Experiments for the two variations of PH adjuster additives

Percentage PH Adjuster	rpm	T in (^{0}C)	T out (^{0}C)
	1000	72,3	65,7
PH Adjuster 0 %	3000	81,1	75,8
	5000	79,5	77,4
	1000	62,9	54,9
PH Adjuster 3 %	3000	78,8	57,9
	5000	78,9	77,3
	1000	59,4	54,1
PH Adjuster 5 %	3000	73,3	53,8
	5000	77,5	75,4

The findings of the second experiment are shown in **Table 2**. The test was conducted by varying the PH adjuster's composition by 0%, 3%, and 5% while testing at 1000, 3000, and 5000 rpm, and the inlet and outlet temperatures were measured using the aforementioned information. As an illustration, the percentage of the PH adjuster at 1000 rpm is 0% according to the test results. When the PH adjuster is set to 3% at the same rpm and the inlet and exit temperatures are 72.3°C and 65.7°C, respectively, there is a disparity between the two temperatures. This also occurred with the 5% PH adjuster, causing the input temperature to be higher than the output temperature from the first test giving PH 0% to 5%. The second repetition on the PH adjuster with a 0% initial temperature was greater than in the first test, according to the data above.

The tests were halted and restarted after the second test was finished, with the results of the third test appearing in Table 3.

Table 3. Experiments on the three PH Adjuster Additives variants

Percentage PH Adjuster	rpm	T in (^{0}C)	T out (^{0}C)
	1000	80,5	70,3
PH Adjuster 0 %	3000	85,0	82,9
	5000	83,7	79,8
	1000	64,2	61,5
PH Adjuster 3 %	3000	82,2	75,5
	5000	82,6	78,2
	1000	61,4	56,5
PH Adjuster 5 %	3000	78,1	72,3
	5000	80,2	77,8

The findings of the second experiment are shown in **Table 2**. The test was conducted by varying the PH adjuster's composition by 0%, 3%, and 5% while testing at 1000, 3000, and 5000 rpm, and the inlet and outlet temperatures were measured using the aforementioned information. As an illustration, the percentage of the PH adjuster at 1000 rpm is 0% according to the test results. There is a discrepancy between the inlet temperature and the outlet temperature, which is 80.5°C for the inlet and 70.3°C for the exit. The PH adjuster is set at 3% at the same rpm. This also occurred with the 5% PH adjuster, causing the input temperature to be higher than the output temperature from the first test giving PH 0% to 5%. The initial temperature increased from the second test to the third repetition on the PH adjuster 0%, reaching 80.5 ºC.

3.2 Data description dependent variable

In a study or analysis, the dependent variable is a variable whose value depends on other factors. The variable you intend to measure, forecast, or explain in the context of your research is known as the dependent variable. The dependent variable in a study is frequently the outcome or impact of the independent variable or causes under investigation. Find the average amount of heat dissipation for each variation in rpm using the results of heat dissipation for each known measurement.

Table 4. Heat dissipation of 0% PH Adjuster Additive variations

Trial Series	Rpm 1000 (°C)	Rpm 3000 (°C)	Rpm 5000 (°C)
1	8,6	3,1	1,7
2	6,6	5,3	2,1
3	10,2	2,1	3,9
Average	8,46	3,5	2,56

Table 4. The exhaust data above shows the discrepancy between those test findings and those shown in **Table 1**. This is done by comparing the starting temperature at the radiator's heat dissipation, as in the previous test. It is entered into table 4 based on the findings of these computations. It then searches for the average outcomes of each table column.

Table 5. Heat dissipation of 3% PH adjuster additive variations

Trial Series	Rpm 1000 (°C)	Rpm 3000 (°C)	Rpm 5000 (°C)
1	12,1	6,5	0,4
2	8,0	20,9	1,6
3	2,7	6,7	4,4
Average	7,6	11,36	2,13

Table 5. The exhaust data above shows the discrepancy between those test findings and those shown in **Table 1**. This is done by comparing the starting temperature at the radiator's heat dissipation, as in the previous test. It is entered into table 5 based on the findings of these computations. It then searches for the average outcomes of each table column.

Table 6. Heat dissipation of 5% PH adjuster additive variations

Trial Series	Rpm 1000 (°C)	Rpm 3000 (°C)	Rpm 5000 (°C)
1	4,6	9,8	1,1
2	5,3	19,5	2,1
3	4,9	5,8	2,4
Average	4,93	11,7	1,86

Table 6. The discrepancy between the exhaust data above and the test results in **Table 1** can be found by comparing the beginning temperature at the radiator's heat dissipation, as in the first test. It is entered into table 6 based on the findings of these computations. It then searches for the average outcomes of each table column.

3.3 ANOVA calculations

A statistical technique called analysis of variance (ANOVA) is used to compare the means of three or more different groups or treatments. Whether there are substantial differences between the groups can be determined by this study. The group under consideration is the adjustment of the PH Adjuster additive and the variation of the rpm for the heat produced by the radiator of the 160 cc vario motorbike. One-Way ANOVA, a test utilized when only one factor or group affects the dependent variable, is the analysis of variation employed. Three stages of testing are used to carry out the analysis, and they are as follows:

Normality Tests (Tests of Normality)

Utilizing the Shapiro-Wilk test, we can perform the residual normality test.

- Null Hypothesis (H0): Sample data comes from a normally distributed population
- Alternative Hypothesis (H1): The data sample does not come from a normally distributed population

The null hypothesis is rejected in this test if the resulting p-value (significant) is less than the preset significance level, which is typically 0.05. This indicates that the data did not come from a population with a regularly distributed population. In contrast, if the p value exceeds the designated level of significance, the null hypothesis can be accepted, indicating that the data are drawn from a population with a regularly distributed distribution [17].

The results of the normality test based on experimental data on heat dissipation from the motorcycle's 160cc radiator are listed below.

Table 7. Tests of Normality for variations in 0% PH Adjuster Additives

		Tests of Normality					
		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	RPM	Statistic	df	Sig.	Statistic	df	Sig.
Results	RPM1000	.196	3	.	.996	3	.878
	RPM3000	.263	3	.	.955	3	.593
	RPM5000	.321	3	.	.881	3	.328

a. Lilliefors Significance Correction

Based on Table 7, Tests of Normality for Variations of 0% PH Adjuster Additives, it can be seen that the values for Shapiro-Wilk at RPM 1000, 3000, and 5000 are 0.878, 0.593, and 0.328, respectively. This indicates that the results of the Tests of Normality for 0% PH Adjuster Additives show a value Significance Correction on Shapiro-Wilk above a significant P value of 0.05, which.

Table 8. Tests of normality for variations in 3% PH adjuster additives

		Tests of Normality					
		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	RPM	Statistic	df	Sig.	Statistic	df	Sig.
Result	RPM1000	.200	3	.	.995	3	.859
	RPM3000	.381	3	.	.760	3	.023
	RPM5000	.269	3	.	.949	3	.567

a. Lilliefors Significance Correction

Table 8: Tests of Normality for Variations in 3% PH Adjuster Additives, indicates that H0 is acceptable because the Shapiro-Wilk significant value is greater than the significant P value of 0.05. This can be deduced from the information shown on the Tests of Normality findings, which showed values of 0.859, 0.023, and 0.567 at rpm 1000, 3000, and 5,000. This indicates that the data sample originates from a population with a normal distribution.

Table 9. Tests of normality for variations in 3% PH adjuster additives

	Tests of Normality	
RPM	Kolmogorov-Smirnov[a]	Shapiro-Wilk

		Statistic	df	Sig.	Statistic	df	Sig.
Result	RPM1000	.204	3	.	.993	3	.843
	RPM3000	.273	3	.	.945	3	.550
	RPM5000	.301	3	.	.912	3	.424

a. Lilliefors Significance Correction

a) Tests of Normality for Variations in 5% PH Adjuster Additives, Table 9, reveals that the significant value is in Shapiro-Wilk, the significant P value is 0.05, which indicates that H0 is accepted. Based on the significant values dispersed from the test results at 1000, 3000, and 5000 rpm with results of 0.843, 0.550, and 0.424, it can be concluded that data samples come from populations that are regularly distributed.

a. Homogeneity Test (Test of Homogeneity of Variances)

Based on the evaluation of the homogeneity test results based on the resulting p-value, the homogeneity test results are then interpreted. If the p-value exceeds the threshold for significance (e.g., 0.05), there is insufficient data to refute the hypothesis of variance homogeneity. This demonstrates that the groups are homogeneous and share the same variance. The assumption of homogeneity of variance must be rejected if the p-value is less than the level of significance, and the variation between groups is then thought to be significantly different [18].

The Levene Test technique was employed in this investigation to determine whether the variance between groups was the same or noticeably different. To determine if the variation between groups is significant, this test analyzes the absolute differences between the observed data and the group means [19].

The p-value constraint is employed in Levene's test to determine whether to reject or not to reject the null hypothesis. The groups have the same variance, according to the null hypothesis of Levene's test. The following list of frequently applied p-value constraints

There is insufficient data to reject the null hypothesis if the p-value is higher than the level of significance provided (e.g., σ = 0.05). As a result, the assumption of homogeneity of variance is satisfied and the differences between groups are regarded as equal. If the p-value is less than the specified level of significance, then there is sufficient evidence to reject the null hypothesis. This indicates that there is a significant difference between the variances of the groups being compared and the assumption of homogeneity of variance is not met. The following are the results of the Test of Homogeneity of Variances using the Levene test method.

Table 10. Test of homogeneity of variances on variations of 0% PH adjuster additives

Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Result	Based on Mean	.206	2	6	.819
	Based on Median	.161	2	6	.855
	Based on Median and with adjusted df	.161	2	5.908	.855
	Based on trimmed mean	.204	2	6	.821

Accordingly, the significant value is 0.05% when using the justification in Table 10. In order for the 0% PH Adjuster Additive variation to pass the Test of Homogeneity of Variances, it was approved. based on the outcomes with values of 0.206, 0.161, 0.161, and 0.204.

Table 11. Test of homogeneity of variances on variations of 3% PH adjuster additives

Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Results	Based on Mean	3.714	2	6	.089
	Based on Median	.356	2	6	.714
	Based on Median and with adjusted df	.356	2	2.591	.730
	Based on trimmed mean	3.184	2	6	.114

Table 11's results for the Test of Homogeneity of Variances on variations of 3% PH Adjuster Additives reveal a significant p value of 0.05%. So that the 3% PH Adjuster Additive variation's Test of Homogeneity of Variances was approved. Based on the outcomes, which have a value of 3.714, 0356, 0356, and 3,184

Table 12. Test of Homogeneity of variances on variations of 5% PH Adjuster Additives

Test of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
Results	Based on Mean	7.621	2	6	.023
	Based on Median	2.237	2	6	.188
	Based on Median and with adjusted df	2.237	2	2.052	.305
	Based on trimmed mean	7.077	2	6	.026

Table 12's results for the Test of Homogeneity of Variances on variations in 6% PH Adjuster Additives reveal a significant p value of 0.05%. So that the 6% PH Adjuster Additive variation's Test of Homogeneity of Variances was approved. The outcomes of the tests run demonstrate that a distinct Hypothesis test is produced by nonparametric tests. Summary, that is, in testing 0% PH Adjuster Additive with a significant value of 0.055, 3% PH Adjuster Additive with a value of 0.113, and 5% PH Adjuster Additive with a value of 0.027, meaning that the addition of 5% PH Adjuster Additive has no effect and that H0 is rejected despite the Tests of Normality and Tests of Homogeneity of Variances having p values above 0.05.

3 CONCLUSION

Based on the findings of the aforementioned tests, it can be said that the usage of the quantity of the PH Adjuster Additive composition has a considerable impact on the rpm of the heat dissipated in the radiator of the 160 cc vario motorcycle. In light of this, it can be said that the PH Adjuster, when used at the recommended dosage for the composition, is capable of adjusting the water's PH. when a 3% PH Adjuster Additive is applied at 1000 rpm, this produces heat dissipation, which improves engine performance.

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