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THE EFFECT OF 10% BIOETANOL AND CARBON CLEANER MIXTURES WITH ENGINE GURAH TECHNIQUE ON THE LEVEL OF CO EMISSION IN COROLLA TWINCAM AE 92

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ABSTRACT

The purposes of this study were: (1) To determine the effect of using 10% bioethanol mixture on the level of CO emission in corolla twincam AE92; (2) To determine the effect of using carbon cleaner with engine gurah technique on the level of CO emission in corolla twincam AE92; and (3) To determine the effect of using carbon cleaner with engine gurah technique and 10% bioethanol mixture on the level of CO emission in corolla twincam AE92. This research was conducted in the workshop of DISHUB Kediri City. This research is using experimental method. The exhaust emission test used STARGAS 898 Technotest of gas analyzer. The result of study show: (1) There was a decrease in the percentage of CO gas levels of 0.756% when using 10% bioethanol mixture compared to using premium fuel; (2) There was a decrease in the percentage of CO gas levels of 0,268% when using carbon cleaner with engine gurah technique compared the condition before using carbon cleaner; (3) There was a decrease in the percentage of CO gas levels of 1,383% when using carbon cleaner with engine gurah technique and 10% bioethanol mixture compared the condition before using carbon cleaner and 10% bioethanol mixture.

Keywords: Bioetanol, Carbon Cleaner, Gurah, Emission, CO level

INTRODUCTION

Motor vehicles are one of the important needs today. This is confirmed by data showing that the number of motor vehicles both two-wheeled and four-wheeled vehicles increases every year. Consider the following table of motor vehicles.

Table 1. Number of Motor Vehicles Years of 2000-2016

Type	Year				
	2000	**2005**	**2010**	**2015**	**2016**
Motorcycle	13.563.017	28.531.831	61.078.188	98.881.267	105.150.082
Passanger Car	3.038.913	5.076.230	8.891.041	13.480.973	14.580.666

Source : (BPS, 2017)

The data above shows that every five-year period there is a significant increase in the number of motor vehicles. In the span of 2000 to 2005 there was a real increase 2.037.317 unit for passenger cars type and 14.968.814 unit for motorcycles type. In the span of 2005 to 2010, an increase of 3.814.811 unit for passanger cars and 32.546.357 unit for motorcycles. While, In the span of 2010 to 2015, an increase of 4.589.932 unit for passanger cars and 37.803.079 unit motorcycles.

(Jasiński, Markowski, & Pielecha, 2017) stated that the increase in the number of vehicles caused serious problems such as energy and environmental problems. In environmental problems, the increase in the number of motor vehicles is proportional to the increase in pollutant gases produced from the combustion of motor vehicles. (Arifin & Sukoco, 2009)stated that most of air pollution, 70% caused by pollution from the transportation sector.

The ideal or perfect combustion will produce carbon dioxide gas (CO_2) and water (H_2O). Because there are several factual reasons that occur in the engine, the ideal combustion process does not occur. The combustion becomes not ideal and produces pollutant gases such as CO, HC, NOx dan SO_2 which is harmful to the health of the body.

(Manzetti & Andersen, 2016) in his research study stated that the result of vehicle exhaust can cause various diseases such as allergies, asthma, cardio-pulmonary effects, cardiovascular problems, and the most dangerous is carciogenesis. For this reason, it is necessary to maintain air quality by controlling vehicle exhaust emissions and even the need for discourse to replace conventional fueled vehicles, especially in urban and busy transportation routes.

(Guerrieri, Caffrey, & Rao, 1995) stated that by controlling exhaust emissions, vehicles that meet exhaust emissions in Slovakia Republik, from 2007-2014, vehicles that pass the emissions test always above 95% of the total number of vehicles available. In 2014, of the amount 1.065.451 unit vehicles, 97.93% or 1.043.397 unit, pass the exhaust emission standard. The control has maintained air quality in Slovakia and minimized the presence of pollutant gases which could endanger health.

Adding an addictive mixture can help control and improve the quality of vehicle

exhaust. (Doğan, Erol, Yaman, & Kodanli, 2017) stated that based on calculation his research, addition of ethanol to gasoline can reduce CO, CO_2 dan NOx. At 2000 rpm, 100% of gasoline produces CO gas concentration of 0.58%, while for ethanol and gasoline mixtures E10, E20 and E30 each of the CO gas concentrations generated is 0.53%; 0.55%; and 0.56%. The lowest CO gas level is produced at 2500 rpm with E10 fuel.

(Costagliola, Prati, & Murena, 2016) also states that the addition of ethanol to gasoline can reduce CO gas levels and other particles from the exhaust gas. The results showed that by comparing G30 fuel (30% ethanol addition) and G0 (without addition), it can reduce almost 80% of CO gas on conventional scooter vehicles. While the hybrid scooter reaches almost 65% of CO gas levels that can be lowered. This is also linear with the results of the study of (Li dkk., 2015) which concluded that the concentration of Hydrocarbon (HC) and Carbonmonookside (CO) gas using M15 fuel (85% gasoline and 15% methanol) decreased as much as 11-34.5%.

Keeping the engine in a fit condition is also one way to maintain combustion quality and exhaust emissions. The condition of a fit engine will maintain combustion to remain in perfect combustion, so that incomplete combustion does not occur which can produce harmful pollutant gases. (Denton, 2006) states that there are several reasons that can produce high CO and HC gas concentrations (Nurtanto, Ramdani, & Nurhaji, 2017). Because of which is a mixture of fuel and air that is too rich, dirty air filters, damage to the catalytic container and damage to the engine management system. Sindonews.com (2015) wrote that one of the automotive equipment companies FEMAX has launched gurah engine equipment to clean the engine to keep the engine's condition fit. Basic gurah engine is the use of carbon cleaner liquid that is inserted into the combustion chamber and simultaneously will clean the carbon crust in the engine cylinder. Research using a carbon cleaner on diesel vehicles can reduce fuel consumption and levels of vehicle exhaust gas concentration. (Wu, Xie, Wang, & Roskilly, 2018) states that the use of B10E4N30 fuel (Biodiesel, bieotanol and carbon coated aluminum) can reduce fuel consumption by an average of 6%, reduce NOx levels by 6% and CO by 19%.

The purposes of this study were: (1) To determine the effect of using 10% bioethanol mixture on the level of CO emission in corolla twincam AE92; (2) To determine the effect of using carbon cleaner with engine gurah technique on the level of CO emission in corolla twincam AE92; and (3) To determine the effect of using carbon cleaner with engine gurah technique and 10% bioethanol mixture on the level of CO emission in corolla twincam AE92.

(Arifin & Sukoco, 2009) stated that the combustion gases consist mostly of non-toxic gases such as N_2 (nitrogen), CO_2 (carbon dioxide) and H_2O (water vapor). The other half is a toxic gas such as NOx, HC and CO. Popular in the exhaust gases are toxic gases. On the gasoline engine the amount of exhaust emissions coincides with the large amount of the mixture of air and fuel, because the entry into the cylinder is a mixture between air and fuel. (Daryanto, 2011) stated that in the exhaust step occurs the exhaust gas discharges from the cylinder through the exhaust valve.

(Denton, 2006) described the negative effects of toxic gases from combustion. CO gas mixed with blood hemoglobin will inhibit the flow of oxygen in the blood and potentially the occurrence of poisoning in the blood. HC gas potentially damages the human respiratory system (throat) when inhaled and is a carcinogenic gas. NOx gas has the potential to disrupt the respiratory system, and when mixed with nitric acid can damage the tracheal and lung tract.

The cause of the presence of toxic gases from combustion is very varied. CO gas is caused due to insufficient oxygen (air) in combustion so that incomplete combustion occurs. Gas HC is caused by the reason that around the walls of the combustion chamber have a low temperature so that they are unable to burn, missfire and there is an over lap intake valve (both valves are equally open). NOx gas arises if the combustion temperature exceeds 2000°C.

Efforts to control exhaust emissions are also carried out by the government through the Minister of Environment Regulation No. 05 of 2006. Based on these regulations, the maximum amount of CO gas content below 2007 is 4.5%, 1200 ppm HC. Vehicles above 2007, the maximum CO gas content is 1.5%, and HC gas is 200 ppm.

Based on this theory, the vehicle exhaust gas is the combustion residual gas which can be either toxic gas or non-toxic gas. Toxic gases such as CO, NOx and HC gas. The process to determine the presence of toxic gases in the exhaust gas by using an analyzer gas equipment.

The combustion process on a combustion motor can produce carbon crust around the walls of the combustion chamber. (Ravel, 2016) stated that vehicles that have been used for a long time will cause carbon crust or deposits in the engine combustion chamber. This makes the combustion system not maximal which leads to energy that is not optimal and wasteful of fuel. So we need a carbon cleaner to remove the deposit. The liquid has a detergent content to be able to clean deposits in the combustion chamber, is easily soluble in all types of fuel and has oxidation properties to prevent corrosion.

The work process of carbon cleaner is done by the engine gurah technique. This technique is carried out without the process of starting the engine. Enough carbon cleaner

is inserted, left to stand for a while, then vacuumed carbon cleaner liquid that has been mixed with crust using a vacuum tool.

The combustion process on the internal combustion engine should be ideal. The following is an ideal chemical combustion reaction.

$$2\ C_8H_{18} + 25\ O_2 \longrightarrow 16\ CO_2 + 18\ H_2O$$

Based on these reactions, the fuel mixed with oxygen will burn ideally and only produce CO_2 and H_2O. The not ideal combustion process can be seen with the following reaction.

$$C_8H_{18} + O_2 + N_2 \longrightarrow CO + CO_2 + HC + NOx$$
$$SO_2 + \text{other particles}$$

Based on these reactions, the fuel mixed with oxygen will burn not ideal and produces some harmful gases such as CO, HC, NOx and SO2.

Based on this theory, a carbon cleaner is a carbon crust cleaning liquid or deposit that is in the combustion chamber which can cause an incomplete combustion process.

Bioethanol is now one of the alternative fuels. In almost all parts of the world, bioethanol is an interesting research object, because it has the potential to become a source of fuel for vehicles. Large countries have produced it massively for this purpose, such as the USA and Brazil. Currently new bioethanol accounts for 10% of the world's vehicle fuel needs (Ingale, Joshi, & Gupte, 2014).

Bioethanol's potential to be an alternative fuel for petroleum is supported by several things. (Ingale dkk., 2014)stated that there are several things that make potential biomass including biotanol future such as the increase in world oil prices, depletion of oil resources, political instability of oil producing countries, and environmental challenges.

Bioethanol is ethanol from the biomass fermentation process with the help of microorganisms. The raw material for making bioethanol is sugary, starchy and fibrous. In the USA, bioethanol is produced from corn based ingredients. While in Brazil, bioethanol is produced from sugar cane. (Atmojo, 2010) states that bioethanol (bioethanol) is ethanol (ethyl alcohol) whose production process uses natural raw materials and biological processes, in contrast to synthetic ethanol obtained from the chemical synthesis of hydrocarbon compounds. Ethanol used for fuel is called Fuel Grade Ethanol (FGE) with a purity level of 99.5%.

Based on this theory, bioethanol is ethanol from the fermentation process with the help of microorganisms from natural raw materials, which for fuel requirements reaches 99.5%.

RESEARCH METHOD

This research is a type of quantitative research. Quantitative methods are used if we want to know the effect of certain treatments / treatments on others. For this purpose, the right method is the experimental method.

The experiment planned in this study was using a 10% bioethanol mixture into vehicle fuel and the process of using a carbon cleaner with the engine gurah technique to remove carbon scale in the engine combustion chamber. The use of 10% bioethanol mixture and carbon cleaner as independent variables and reducing CO gas emissions as the dependent variable.

The data collection technique is by measuring the exhaust gas levels of the Corolla twincam AE92 vehicle in 1991 using the STARGAS 898 Technotest gas analyzer as follows:

1. Testing the exhaust emissions data CO of the corolla twincam AE92 vehicle with premium fuel before being treated
2. Testing of exhaust emissions data CO corolla twincam AE92 vehicles with 10% and 90% premium bioethanol mixtures.
3. Testing of exhaust emissions data CO of the corolla twincam AE92 vehicle with premium fuel after being given carbon clenaer treatment with the engine gurah technique
4. Testing of exhaust emissions data of CO corolla twincam AE92 vehicles with 10% and 90% premium bioethanol fuel after being given carbon clenaer treatment with the engine gurah technique.

This research was conducted in the workshop of Department of Transportation Kediri City. The data collected were analyzed using descriptive statistical analysis. As for facilitating understanding the design of this research, it can be seen in the research flow diagram as follows.

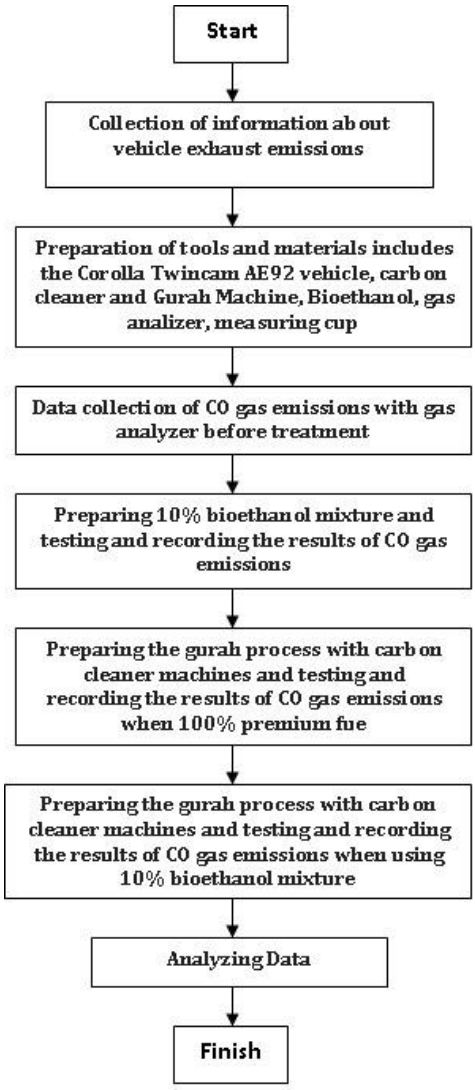

Fig 1. Research Flow Chart

RESULT AND ANALYSIS

This picture shows the exhaust gas emission test process of the corolla twincam AE92.

Fig 2. The exhaust gas emission test process of the corolla twincam AE92

Data obtained from the results of testing the level of exhaust emissions at the time before being given the treatment as follows.

Table 2. Corolla Twincam AE92 Exhaust Emissions Test Results Without Treatment

CO Level (%)	HC Level (ppm)
2.119	353

Based on the table, it can be seen that before being given treatment for the corolla twincam AE92 vehicle, CO exhaust gas levels reached 2.119%. Based on the data obtained from the output of the gas analyzer, the level of gas HC as another pollutant gas reaches 353 ppm.

Gas emission testing was carried out again by giving treatment in the form of using a 10% bioethanol mixture into the premium fuel used by the corolla twincam AE92. The following data obtained from the results of testing the emission levels of the exhaust gases at the first treatment, namely the use of 10% bioethanol mixture.

Table 3. Corolla Twincam AE92 Exhaust Emissions Test Results at First Treatment

CO Level (%)	HC Level (ppm)
1.363	187

Based on the table, it can be seen that with the use of a 10% bioethanol mixture on the corolla twincam AE92 vehicle, CO exhaust gas levels reached 1,363%. Based on the data obtained from the output of the gas analyzer, the level of gas HC as another pollutant gas reaches 187 ppm.

Gas emission testing is done again by giving treatment in the form of using a carbon cleaner with the engine gurah technique. Testing still uses premium fuel used by the Corolla Twincam AE92. The following data obtained from the results of testing the level of exhaust emissions at the time after the second treatment, namely the provision of carbon cleaner with the engine gurah technique.

Table 4. Corolla Twincam AE92 Exhaust Emissions Test Results at Second Treatment

CO Level (%)	HC Level (ppm)
1.851	336

Based on the table, it can be seen that after the carbon cleaner process with the engine gurah technique for the corolla twincam AE92 vehicle, CO exhaust gas levels reached 1.851%. Based on the data obtained from the output of the gas analyzer, the level of gas HC as another pollutant gas reaches 336 ppm.

Gas emission testing was carried out again by giving treatment in the form of using a 10% bioethanol mixture into the premium fuel used by the corolla twincam AE92. The following data obtained from the results of testing the level of exhaust emissions at the time after the third treatment, namely the use of 10% bioethanol mixture after the treatment of carbon cleaner with engine gurah technique.

Table 5. Corolla Twincam AE92 Exhaust Emissions Test Results at Third Treatment

CO Level (%)	HC Level (ppm)
0.736	179

Based on the table, it can be seen that after the carbon cleaner process with the engine gurah technique on the corolla twincam AE92 vehicle and the use of 10% bioethanol mixture, CO exhaust gas content reached 0.736%. Based on the data obtained from the output of the gas analyzer, the level of gas HC as another pollutant gas reaches 176 ppm.

The following is a combined data of CO gas emission levels which are processed from the table of results of the corolla twincam AE92 exhaust emissions test.

Table 6. Combined results of Corolla Twincam AE92Exhaust Gas Emissions

Treatment	CO Level (%)
Without Treatment	2.119
1	1.363
2	1.851
3	0.736

Based on the table it can be concluded that the use of 10% bioethanol mixture into premium fuel used by the Corolla Twincam AE 92 vehicle can reduce CO gas emission levels. CO gas emission levels of 2.119% at the stage before the treatment process decreased to 1.363% at the first treatment process. The CO level decreased to 0.736% in the third treatment, namely the use of a 10% bioethanol mixture after the process of using a carbon cleaner with the engine gurah technique. The following diagram visualizes the process of reducing CO gas content in the use of a 10% bioethanol mixture.

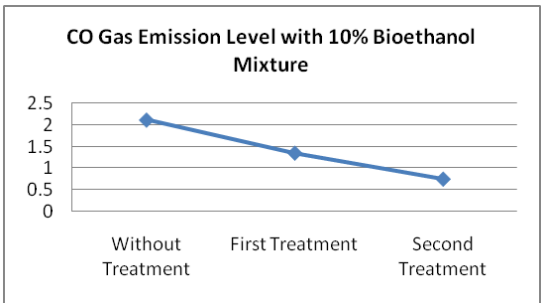

Fig 1. CO Gas Emission Level with 10% Bioethanol Mixture

At the untreated stage towards the first process, the CO gas content drops by 0.756%. The decrease if it is proportioned is 35.6%. As for the process of using a carbon cleaner using the engine gurah technique, CO exhaust gas levels decreased by 1.356%. The decrease if it is proportioned is 63.9%. This value is almost 1.7 times compared to before the process of using a carbon cleaner with the engine gurah technique.

The results of this study further reinforce the results of previous studies. Dogan et al (2017) states that based on his research calculations, the addition of ethanol

to gasoline can reduce CO, CO2 and Nox gas. Costagliola, Prati & Murena (2016) also stated that the addition of ethanol to gasoline can reduce gas levels of CO and other particles from the exhaust gas. The results showed that by comparing G30 fuel (30% ethanol addition) and G0 (without addition), it can reduce almost 80% of CO gas on conventional scooter vehicles. Whereas (Li dkk., 2015) concluded that the concentration of Hydrocarbon (HC) and Carbonmonookside (CO) gases using M15 fuel (85% gasoline and 15% methanol) decreased as much as 11-34.5%.

Based on six table, it can be concluded that there is a decrease in the level of CO exhaust emissions between before the process of using a carbon cleaner with the engine gurah technique and afterwards. CO gas emission levels at the stage before treatment amounted to 2.119%. Whereas after the process of using a carbon cleaner with the engine gurah technique, the CO gas content becomes 1.851%. The following is a visualization diagram of the process of reducing CO gas levels in the use of a carbon cleaner with the engine gurah technique.

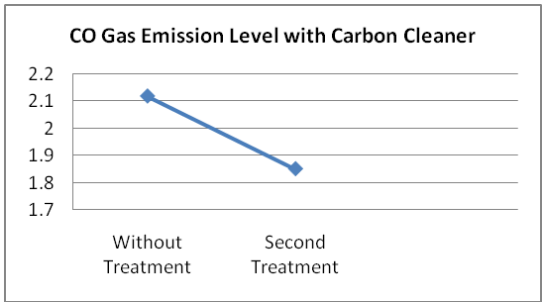

Fig 2. CO Gas Emission Level with carbon cleaner by the engine gurah technique.

At the untreated stage towards the third process, the CO flue gas level drops by only 0.268%. In this third process, the fuel used is premium, there is no other mixture. The decrease is if it is pegged at 12%.

Thus it is true what (Ravel, 2016) stated that vehicles that have been used for a long time will cause carbon crust or deposit in the engine combustion chamber. This makes the combustion system not maximal which leads to energy that is not optimal and wasteful of fuel. Vehicles that are wasteful of fuel as stated by (Denton, 2006) will produce high CO and HC gas concentrations. The use of carbon cleaner with the technique of gurah machine can reduce the concentration of CO gas.

CONCLUTION

Based on the results and discussion, it can be concluded as follows.

1. There was a decrease in the percentage of CO gas levels of 0.756% or 35.6% when using a 10% bioethanol mixture compared to using premium fuel only.
2. There was a decrease in the percentage of CO gas levels of 0.268% or 12% when using a carbon cleaner compared to conditions before using a carbon cleaner.
3. There was a decrease in the percentage of CO gas levels of 1,383% or 63.9% when using carbon cleaner and bioethanol mixture 10% compared to the conditions before using carbon cleaner and 10% bioethanol mixture

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