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Control of Natrium Oxide (NOX) and Carbon Oxide (CO) through Catalyst Hydro Carbon Coffee Leather Waste on the Motor Fuel

Dani Irawan[1], Mujahid Wahyu[1], Nila Nurlina[1]

[1]Mechanical Engineering Department, Malang State Polytechnic, Campus Kediri, Indonesia
Lingkar Maskumambang Street No. 1 Kediri

Correspponding author: dani.irawan@polinema.ac.id

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ABSTRACT

The objective of this research to determine the effect of using HCL solution and coffee bean husk on levels of (Sodium Oxide) Nox and Carbon Oxide (CO). The method of this research is tru experiment on the process of carbon activation carried out by using HCL solution. The results showed that there was an effect of coffee beans and the use of HCL solutions on Nox and CO levels can reduce CO exhaust emissions in the range of 6.62-39.02% and reduce exhaust emissions of Nox in the range 13.08-39.05%)

Keywords: Motor Fuel, Exhoust Emission, Sodium Oxide , Carbon Oxide , Coffee Husk Waste

INTRODUCTION

Kediri is one of the coffee-producing areas, especially the land area used is 1,200 hectares with coffee production in 2015 of 7,763 tons [1]. Generally, the skin of the coffee fruit is used as fertilizer and spread back into the plantation area. However, the coffee bean hulls produced in the green bean processing industry are still not well utilized. From the results of field studies conducted by researchers in the coffee bean processing industry (Mojo, Ngancar, and Kandangan), the waste of coffee bean hulls produced by these industries is only piled up and then burned. Therefore it is necessary to have more optimal processing of coffee bean husks, which is used to reduce exhaust gas emissions in motorized vehicles. Motorized vehicles emit carbon moNoxide (CO), nitrogen oxides (NO), sulfur dioxide (SO2) and Hydro carbon (HC) so that they contribute 1/3 of the total air pollutant gases [2].

Petrol fossil fuel as the main fuel, and the increasing use of gasoline-fueled vehicles such as cars, motorbikes, public transportation results in increased levels of air pollution caused by emissions from gasoline-fueled vehicles. Several types of emissions include Carbon MoNoxide (CO), Hydrocarbon (HC), Nitrogen Dioxide (Nox) and Sulfur Dioxide (SO2), which have a negative impact on the health of the human body and erode the ozone layer in the atmosphere. Along with the problem of increasing the production of exhaust emissions from gasoline motorized vehicles, several alternatives have been implemented, one of which is by modifying the gasoline engine components which are expected to reduce the emission rate of carbon moNoxide and other toxic gases such as NO, HC SOx and so on [3].

The impact of pollution by motor vehicle exhaust is very large, especially related to health. Therefore, the development of combustion motor technology in the future is how to create a motor that has high efficiency and low emissions. Various attempts have been made by motor vehicle manufacturers, such as using a fuel injection system in the intake manifold controlled by Electronic Fuel Injection (EFI), adding a catalytic converter to the exhaust gas lines, and using the Air Induction System (AIS) [4].

The transportation sector in general contributes around 55-99% of greenhouse gases in the form of CO2 gas. The rapid increase in the number of vehicles and the limited application of emission control technology has made the transportation sector the largest source of air pollution in urban areas, causing population health problems in several developing countries [5].

Nitrogen oxides (NOX) is a gas emitted from the combustion of which a large part of NOX pollutants from the combustion in vehicle engines. NOX pollutants cause environmental impacts such as acid rain, the greenhouse effect, chemical photo smoke, and

ozone layer perforation. Meanwhile, carbon monoxide (CO) is also emitted from the combustion of vehicle engines where the gas is poisonous. CO gas blocks the flow of O2 and binds to blood hemiglobin so that the hemoglobin binds to CO to form COHb. COHb levels in the blood of more than 50% can cause death. Therefore, NOX and CO emissions in the combustion of vehicle engines need to be reduced so that they become environmentally friendly vehicles [6].

Research developed to reduce CO is developing in the mixing of fossil fuels with biofuels. Amanda, succeeded in reducing CO emissions in sedan car exhaust with an engine volume of 1.4 L by mixing fuel in the form of gasoline and natural gas (CH4) with ethanol. Research conducted by Randazzo and Sodre (2011) also shows that mixing diesel with biodiesel and ethanol has an impact on reducing carbon moNoxide emissions and also hydrocarbon gas in a 1.25 L 4-cylinder engine equipped with a turbo-charger [7].

Apart from mixing fuels, other research that has been developed to reduce CO and NOX is to add a catalyst as a CO and NOX reformer or better known as a converter catalyst. The reformer works by reacting CO with NOX to produce nitrogen and carbon dioxide, so that with this method the two pollutants (CO and NOX) can be reduced [8]. The converter catalysts that are usually installed in vehicle exhaust are in the form of pellets and monolithics with catalysts made of precious metals, including: Paladimum, Platinum, and Rodium. These precious metals have high specific activity, but have a high level of volatility, are easily oxidized and are easily damaged at temperatures0of 5000 – 9000C, thereby reducing catalyst activity [8]. In addition, these precious metals have low abundance and quite expensive prices, so it is necessary to develop catalysts that are inexpensive and have abundant availability.

Based on this background, to reduce the problem of environmental pollution, namely by creating a new breakthrough in the field of environmental renewal which is expected to help minimize air pollution. One way to reduce NOX is by utilizing coffee bean husks which have not been utilized and only become solid waste in the coffee bean processing industry. The coffee fruit has two types of skin, namely rind and skin, the waste from the coffee bean processing consisted of 48% of the pulp and 2-3% of the weight of the coffee bean shell or skin. The waste of coffee bean husk still contains lignocellulose so that it can be used as a raw material for making activated carbon which has a higher economic value than the original material [9].

Exhaust gas is first channeled into a silencer or muffler in the exhaust. Exhaust gas is the residual result of combustion of fuel in the engine. Exhaust gas can have a negative impact on the environment such as air pollution. To reduce the environmental impact caused by the exhaust gas, it is necessary to modify the exhaust or exhaust,

so that the exhaust gas particles that cause air pollution can be minimized. This research is aimed at utilizing coffee skin waste as an alternative raw material in the manufacture of activated carbon which can be used as an adsorbent for exhaust emissions in motorized vehicles.

The novelty of this research is that the carbon activation process is carried out using HCL solution. This is done to see the difference in the activation method and its effect on the absorption ability of activated carbon. There was no significant difference in the use of variations in the concentration of the activator solution on the adsorption capacity [10]. Therefore the concentration of the activator solution was chosen based on the results of other studies which showed the optimal absorption of activated carbon using ZnCl210% [11]. Based on the background of the objectives in this study was to determine the effect of using HCL solution and coffee bean husks on levels of (Sodium Oxide) Nox and Carbon Oxide (CO).

Catallic hydro carbon is a medium that functions to change and accelerate the rate of a chemical reaction, but there is no change in it. At exhaust gas from combustion in the combustion chamber of a motorized vehicle, the rate of chemical reaction rate of exhaust gases is generally processed at a very slow reaction rate, using a catalytic converter, the rate of chemical reaction of combustion gas changes will be accelerated by a process before finally being released into the resulting gas. Final combustion, in order to reduce the resulting gas emissions, at high temperatures will generally accelerate the chemical reactions of combustion gases [4].

The research results show that coffee bean skin can be used as a raw material for activated carbon so that it can add to the economic value of untapped agricultural waste. The use of activated carbon from coffee bean husks as an adsorbent to absorb exhaust gas emissions which in this study was carried out on the exhaust emissions of four-wheeled vehicles and can reduce CO exhaust emissions in the range of 6.62-39.02% and reduce Nox exhaust emissions in the range 13.08-39.05%. The absorption process of vehicle exhaust emissions is influenced by the activation process in which the activated carbon using 3% HCL solution provides better CO and Nox emission removal performance compared to the carbon activation process using ZnCl 210% solution. The absorption process also greatly influences the mechanism of contacting exhaust gas emissions with adsorbents. Based on the results obtained, activated carbon in the form of hollow briquettes provides a higher percentage of CO and Nox emission removal than activated carbon in the form of pellets. This is due to the difference in the surface area of the adsorbent in contact with the emission gas, where activated carbon with the hollow briquette form has a larger surface area [12].

Modified exhaust can reduce exhaust emissions of HC and CO, by using a modified exhaust in the idle position HC shows a result of 138 ppm while the standard 219.4 ppm has decreased by 81.4 ppm, and for CO, modified exhaust shows the result is 0.506% while the standard 1.488% has decreased by 0.982%, in the middle position the modified HC exhaust shows a result of 100.6 ppm while the standard 439.4 ppm has decreased by 338.8 ppm, and for CO modified exhaust shows a result of 1.082 % while the standard 1,814% decreased by 0.732%, when the maximum position of the modified HC exhaust showed a result of 70 ppm while the standard 152.4 ppm decreased by 82.4 ppm, and for modified exhaust CO showed a result of 0.484% while the standard was 1.372 % experienced a decrease of 0.888%. Based on this exposure, the carbon catalyst converter from coffee husk waste able to reduce CO and NOX levels in motorized vehicles [13].

RESEARCH METHODS

Mertode this research is true experiment carbon activation process is done by way of using aqueous HCL . This is done to see the difference in activation methods and their effect on the absorption ability of activated carbon.

Tools and Materials Used

The tools and materials used in this study are as follows:

Research Tools

1. Las carbide (Las Oxcy acetylene).
2. Tap senai (Tap Sney).
3. Cutting Wheel.
4. Woven Grinder.

Material

The material used in this research is the skin of the coffee beans obtained from the coffee bean processing industry. ZnCl2 (Merck Millipore) is used as a carbon activator. Starch (Merck Millipore) is used as an adhesive in the molding process for hollow briquettes and activated carbon pellets.

Exhaust gas emission testing procedure

Measurement of vehicle exhaust emissions (parameters CO and Nox) is measured using a Gas Combustion Analyzer (E-Instrument 8500) at 10 minute intervals. Contacting exhaust emissions with activated carbon is stopped when there has been an increase in the value of exhaust emissions and it does not change significantly. The percentage of removal of exhaust gas emissions is calculated from the average concentration of measured exhaust emissions when using adsorbents compared to the average concentration of exhaust emissions without using adsorbents.

The next step is memanaska n vehicles that will be tested emissions. Prepare emission test equipment with calibration or zero calibration. Once ready (stand by) input the probe into the exhaust being tested, then input the engine temperature gauge (RC3). At the time of testing, the engine speed variations are given from idle, middle and maximum rotation.

Press enter to start testing. Pressing hold for reading. After getting the reading results, press. Remove the probe from the exhaust under test, then remove the RC3 from the oil stick hole.

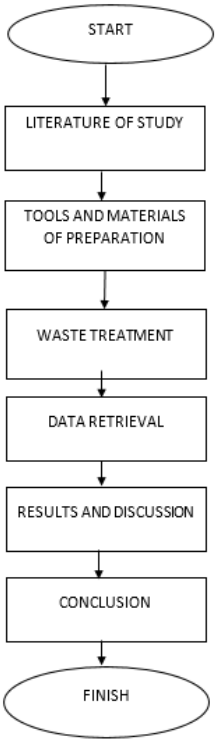

Figure 1. Process of the research

The flow diagram in Figure 1 describes the process of the research stage starting from the literature study, preparation of tools and materials, designing the resonator in the exhaust chamber, data collection, if it is not suitable then the resonator design will be carried out again in the exhaust chamber and if appropriate it will continue to the discussion. result, after the above process runs smoothly, the next stage is to draw conclusions from the entire series of stages above. Then, after concluding the process is complete and ends

RESULTS AND DISCUSSION

The process of absorption of exhaust emissions is reviewed by measuring the levels of CO and Nox in the exhaust gas of a diesel-engined four-wheeled vehicle when it is on (idle, engine speed ± 900 RPM) with an adsorption tube installed. The measurement conditions were carried out by varying the conditions of the tube, namely an empty tube, a tube containing carbon and a tube containing activated carbon. Absorption of CO Gas Emissions CO gas emissions with carbon before being activated, the longer (not absorbing emissions), the measured emissions will decrease, until at certain time intervals the levels of CO gas emissions begin to increase again. This shows that the adsorbent is getting saturated so that the absorption process of CO gas emissions is decreasing and over time there is no absorption of CO gas emission levels at all.

The reduction in CO gas emissions using activated carbon is also higher than the reduction in CO gas emissions using only unactivated carbon. The percentage of CO gas emission removal is calculated from the average concentration of CO gas emission using the adsorbent obtained during the time interval compared to the average CO gas emission concentration without using adsorbent. The removal of CO gas emissions in hollow briquette media using activated carbon with 2% HCL solution provided the largest allowance for CO gas emissions of 36.03%, while the removal of CO gas

emissions using activated carbon with 10% ZnCl2 solution was 23.24%. The same thing also happened to the removal of CO gas emissions in the media which decreased slightly, this happened because of the absorption or adsorption significantly for some time.

The ignition process takes place by means of pellet-shaped activated carbon. The activated carbon using 2% HCL solution capable of removing CO gas emissions by 16 , 50 %, while the activated carbon using ZnCl2 solution capable of removing CO gas emissions as much as 7.52%. This can be due to the activation process using HCL % is able to remove impurities on carbon better than activation using 8% ZnCl2.

Stated that the ability of ZnCl2 to activate (produce porosity) carbon precursors is based on its dehydration function [14]. During the activation process, ZnCl2 removes hydrogen and oxygen atoms from carbon materials as water rather than as oxygenated organic compounds. Whereas in the activation process using HCL, impurity and ash contained in the carbon dissolve into the HCL solution so that the pore number of activated carbon increases and can increase its adsorption capacity [15].

The reduction in Nox gas emissions using activated carbon was also higher than the reduction in Nox gas emissions, which only used unactivated carbon. The elimination of Nox gas emissions in hollow briquette media using activated carbon with 3% HCL solution provided the largest allowance for Nox gas emissions of 36.05%, while Nox gas emission removal using activated carbon with 10% ZnCl2 solution was 24.12%. The same thing also happened to the elimination of Nox gas emissions in pellet-shaped activated carbon media. The activated carbon using a 3% HCL solution capable of removing Nox gas emissions by 13 , 86 %, while the activated carbon using ZnCl2 solution capable of removing Nox gas emissions as much as 11.08%. Details of Nox emission removal percentage are presented in Table 4. It is higher than the carbon adsorbent that has not been activated. This is due to the unactivated carbon adsorbent there are still many impurities that close the pore cavity on the adsorbent surface.

Whereas on the activated carbon adsorbent, the pore surface looks cleaner and impurities that cover the pores have dissolved into the activation solution. Activation is a physical change in which the surface area of the carbon becomes larger because the hydrocarbons clogging the pores are freed. Research reports that activation is a physical change where the surface area of carbon increases sharply due to the removal of tar compounds and charcoal residue compounds. As the surface area increases, the pollutant particles absorbed will also increase [16].

In this study, a solution of HCL 3% indicate activation of the power activator which is better than 10% ZnCl2 solution.

Similar results were also reported by who reported that a greater reduction in CO, NO and Nox emissions from vehicle emissions was obtained by using activated carbon [11].

In this research, there are several obstacles, namely:

1. The study realization of carbon moNoxide (CO) emission test equipment for gasoline-fueled cars and diesel-fueled cars did not run optimally because the testing was quite short (time-limited) because the conditions in the field did not allow for a long time testing. .
2. *The Opacity Smoke Meter printer is* damaged, the *thermal paper is* loose, the *printer cartridge* cannot read and cannot be printed properly (vaguely).
3. The O_2 Sensor Filter runs out, so it cannot detect O_2 gas from the results of the vehicle exhaust emission test.
4. The RPM cable was not installed when testing the effect of the RPM indicator parameter and the RPM value did not appear.
5. The temperature cable was not installed when testing the effect of the temperature indicator parameter, the Temp value did not appear.

Testing of diesel car exhaust emissions using the *Opacity Smoke Meter* using the free acceleration test method (inspection mode) was not carried out because the testing time was quite short.

CONCLUSION

The results showed that coffee bean shells could be used as raw material for activated carbon so that it could add to the economic value of untapped agricultural waste. The use of activated carbon from coffee bean shells as an adsorbent for exhaust emissions in this study was carried out on the exhaust emissions of four-wheeled vehicles and can reduce CO exhaust emissions in the range of 6.62-39.02% and reduce exhaust emissions of Nox in the range 13.08-39.05%.

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