

THE EFFECT OF CARBON MONOXIDE (CO) AMBIENT ON CARBOXYHAEMOGLOBIN (COHB) EMISSION TESTING OFFICERS AT THE UPT PKB (TECHNICAL IMPLEMENTATION UNIT FOR MOTOR VEHICLES) IN YOGYAKARTA

O EFEITO DO MONÓXIDO DE CARBONO (CO) AMBIENTAL NOS INSPETORES RESPONSÁVEIS PELOS TESTES DE EMISSÃO DE CARBOXI-HEMOGLOBINA (COHB) NA UPT PKB (UNIDADE DE IMPLEMENTAÇÃO TÉCNICA PARA VEÍCULOS MOTORIZADOS) EM YOGYAKARTA

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Abstract

Carbon monoxide (CO) is a 'silent killer' because of its physical properties that are tasteless, colorless, and odorless, but in high concentrations can cause death. This study analyzes the effect of ambient CO on the COHb of motor vehicle testers at the UPT PKB motor vehicle testers in districts and cities in the province of D. I. I. Yogyakarta province. Testing by checking ambient CO from each location (motor vehicle testing) in Sleman 47.75 ppm, Yogyakarta 37.67 ppm, Bantul 29.25 ppm, Kulon Progo 24.88 ppm, Gunung Kidul 20.85 ppm. The quality standard set by the Government Regulation of the Republic of Indonesia No. 41 Year 1999 on National Ambient Air Quality Standard for CO is 24 ppm. The quality standard set by Government Regulation of the Republic of Indonesia No. 41 of 1999 concerning National Ambient Air Quality Standard for CO is 24 ppm. COHb measurement data from 76 respondents averaged 2.785 with normal COHb standards of <2% (less than two percent). From the results of this study it can be concluded that there is a significant relationship between environmental CO levels and blood COHb levels and with r of

Resumo

O monóxido de carbono (CO) é um "assassino silencioso" devido às suas propriedades físicas: é insípido, incolor e inodoro, mas, em altas concentrações, pode causar a morte. Este estudo analisa o efeito do CO ambiental sobre o COHb dos inspetores de veículos motorizados na UPT PKB, em distritos e cidades da província de D. I. I. Yogyakarta. Os testes de verificação do CO ambiental em cada local (inspeção de veículos motorizados) indicaram os seguintes valores: Sleman 47,75 ppm, Yogyakarta 37,67 ppm, Bantul 29,25 ppm, Kulon Progo 24,88 ppm, Gunung Kidul 20,85 ppm. O padrão de qualidade estabelecido pelo Regulamento do Governo da República da Indonésia nº 41 de 1999 sobre o Padrão Nacional de Qualidade do Ar Ambiente para CO é de 24 ppm. O padrão de qualidade estabelecido pelo Regulamento do Governo da República da Indonésia nº 41 de 1999 sobre o Padrão Nacional de Qualidade do Ar Ambiente para CO é de 24 ppm. Os dados de medição de COHb de 76 participantes apresentaram uma média de 2,785, com padrões normais de COHb <2% (menos de dois por cento). A partir dos resultados deste estudo,



0.715 indicates a strong level of relationship with the direction of the relationship (positive).

Keywords: CO. COHb. Emission.

pode-se concluir que existe uma relação significativa entre os níveis ambientais de CO e os níveis de COHb no sangue, e com r de 0,715, indica-se um forte nível de relação com a direção da relação (positiva).

Palavras-chave: CO. COHb. Emissão.

1 INTRODUCTION

Air in human life is the life support for living things in this universe [9]. Air also has a dominant influence on the quality of health of living things (12), including human life. Therefore, air quality is a major aspect that must be considered in order to improve the quality of human life (World Health Organization. Regional Office for Europe, 2021). In the context of human quality of life, air affects human quality of life both in the short and long term (10). The emergence of symptoms of health problems such as cough, allergies, flu is a short-term impact that can be immediately found when air quality is poor (11). Poor air quality will also have a long-term effect on the quality of human health by finding disorders in the internal organs of the human body such as the lungs, heart and other important organs (13).

Chemically, the composition of air is a mixture of Nitrogen (78%), Oxygen (20%), Argon (0.93%), Carbon dioxide (0.03%) and the remaining percentage is a combination of Neon (Ne), Helium (He), Methane (CH₄) and Hydrogen (H₂). If other gases are added that affect and disturb this composition, the air is said to be polluted (14). Transportation technology and environmentally unfriendly manufacturing technology are said to be significant causes of air quality deterioration because the two technological fields, especially transportation, produce nearly 60% of pollutants consisting of Carbon Monoxide (CO) (15). Carbon Monoxide that reacts with hemoglobin (Hb) in the blood has a significant effect on lung performance (16). Hemoglobin in the body's metabolism functions to carry oxygen in the form of oxy hemoglobin (O₂Hb) and CO₂ in the form of CO₂Hb from body cells to the lungs (17). Carbon Monoxide (CO) allows hemoglobin to form carboxyhemoglobin (COHb) which reduces the capacity of blood to carry oxygen throughout the body (18). This condition makes humans experience CO poisoning with effects such as dizziness, changes in lung function, increased heart rate, difficulty

breathing and abnormalities in the central nervous system, cardiovascular disorders and even heart attacks (19). It is evident that motor vehicles are the dominant cause of air pollution (20). Pollutants produced by motor vehicles are Carbon Monoxide (CO), nitrogen dioxide (NO₂), ozone (O₃), particulates (PM), and Sulfur dioxide (21).

2 MATERIALS AND METHODS

The method used for data collection in this study is Data collection is with secondary data taken from each Technical Implementation Unit (UPT) of the Periodic Test of Motorized Vehicles (UBKB) Regency and City located in the Province of D. I. Yogyakarta is information about the officer's name, position, shift schedule, length of service, and date of birth. Data analysis in this study is to use this technique, univariate analysis is an analysis conducted on each variable from the results of the study that will result in the distribution and presentation of each variable (22). Bivariate analysis is carried out on two variables that are thought to be related or correlated (22).

The data collection techniques in the study are as follows:

2.1 Primary data

In this study, researchers used a type of structured observation where observations have been systematically designed, about what will be observed, when and where. Observations are carried out with the following steps:

2.1.1 *CO ambien*

Measured using a measuring instrument called a CO meter, a CO meter is a tool commonly used to detect, analyze and measure the quantity of carbon monoxide in the air. The way it works is by attaching this tool in the environment or air that is known to have CO levels, and the tool will be located parallel to the human face when standing, in this case the testing officer. Measurement of ambient CO / environmental CO is carried out twice, namely before testing activities are carried out (morning) and when testing is carried out.

The following is an example of using a CO meter in the field.

Figure 1

Ambient CO Measurement Using a CO Meter



2.1.2 Spectrophotometer

Is the COHb measurement of motor vehicle testing officers, the method of use is to put 2 ml of acetate buffer into each test tube, then add 500 microns of blood into each tube with a pipette, then incubate for exactly 5 minutes at 55°C, then take the test tube from the water bath and immediately mix it in a glass. Chemicals. The cooled solution was then filtered into another tube using acetate buffer saturated filter paper. The filter should be transparent before the solution is measured on a spectrophotometer with a wavelength of 542 nm.

The following is an example image of a spectrophotometer:

Figure 2

Spectrophotometer



2.2 Secondary data

Data obtained from agencies related to this research include data from; Directorate of Land Transportation of the Ministry of Transportation (KEMENHUB), UPT PKB in Yogyakarta Province and Regional Transportation Management Agency (BPTD) of Yogyakarta Province.

3 RESULTS

3.1 Univariate analysis of environmental CO

Data collection of Environmental CO levels is carried out using a CO Meter which is placed for 60 minutes for each work area of the respondent. The National Ambient Air Quality Standard according to Government Regulation of the Republic of Indonesia No. 41 of 1999 is 30,000 $\mu\text{g}/\text{Nm}^3$ or equivalent to 24 ppm.

Table 1

Ambient CO value of UPT PKB in Yogyakarta

NO.	UPT PKB	Average Ambient CO (ppm)
1.	Sleman	47.75
2.	Yogyakarta	37.67
3.	Bantul	29.25
4.	Kulon Progo	24.88
5.	Gunung Kidul	20.85

UPT PKB Sleman Regency, Yogyakarta City, Bantul Regency and Gunung Kidul Regency Environmental CO levels that have exceeded the quality standard (24 ppm) then the environmental CO in this study will affect the COHb levels in the blood of respondents. UPT PKB Gunung Kidul Regency Environmental CO levels that do not exceed the quality standard, then the environmental CO in this study will not affect the COHb levels in the blood of respondents.

According to (23), COHb levels in the blood are influenced by air CO concentration and will reach a certain equilibrium. The level of CO in the air can be influenced by the trees in the terminal area. Trees that are able to absorb exhaust gases in

the air, one of which is the trembesi tree, based on research by Endes (25) states that one trembesi tree is able to absorb 28,442 kg of carbon dioxide gas each year, trembesi has a root system that is able to symbiotize with Rhizobium bacteria to bind nitrogen from the air, besides that it is also influenced by vehicles in the UPT PKB area that conduct periodic tests.

3.2 Univariate analysis of COhb of UPT PKB officers

Data collection of COHb levels by taking blood samples from each respondent. There was a total of 76 respondents who were willing to take blood samples to be tested using a Spectrophotomer. Based on the results of measuring COHb levels in UPT PKB officers in DIY Province, it shows that of the 76 respondents who had abnormal blood COHb levels ($\geq 2\%$) there were 39 respondents who were in the non-smoking habit category, in the range of examination results of blood COHb levels were 2.1-3.8% and 37 respondents had normal COHb levels ($< 2\%$) which the respondents were included in the smoking category. The highest COHb level received by respondents was 3,806 and the lowest COHb level was 2,280 with an average COHb level of 2,893. According to Wardhana (2004) COHb levels in the blood of 0.5% and 2.01% have not really felt the impact on the human body, while COHb concentrations of 3.2% have an impact on the central nervous system in humans. Olson (2007) states that the amount of COHb levels in the body is influenced by the amount of carbon monoxide gas concentration inhaled by the body.

Table 2

Relationship between environmental CO levels and COHb levels in D.I. Yogyakarta

		COHb	CO Ambien
COHb	r Value	.	.715**
	v value		.006
	N	76	76
CO Ambien	r Value	.315**	1.000
	v value	.006	.
	N	76	76

**Correlation is significant at the 0,01

Based on data from 76 respondents, the p-value between environmental CO levels and COHb levels is 0.006. With a p-value of 0.006 indicates that there is a significant relationship between environmental CO levels and COHb levels in the blood and with an r of 0.715 indicates a strong level of relationship with the direction of the relationship (positive), which means that the higher the environmental CO levels, the higher the COHb levels. The frequency of environmental CO levels varies with an average of 33,112 ppm with a minimum of 20.85 ppm and a maximum of 47.75 ppm. The average of 33,112 ppm has exceeded the quality standard set by the Government Regulation of the Republic of Indonesia No. 41 Year 1999 on National Ambient Air Quality Standard for CO is 24 ppm. This is due to the increase in the volume of vehicles entering and exiting, the number of road users in connection with their activities such as the start of more mandatory test vehicles conducting testing.

4 DISCUSSION

In the results obtained, the average level of environmental CO is 33.112 ppm and the COHb level is 2.785. According to (23) regarding equilibrium data between COHb in the blood and CO in the air, for environmental CO levels of 20 ppm, the equilibrium in the blood is 3.7. The COHb level of the research results does not match the theory mentioned by Wardhana. With a correlation level of 0.715 which shows a strong level of relationship because there are still 0.285 other confounding factors that cannot be controlled such as respondents who use PPE when working, high volume of mandatory test vehicles and adequate nutritional consumption when conducting research. In addition to factors within the respondent, there are external factors that cause the results of the study to be inconsistent with the theory, namely the speed of the air flow which causes not all environmental CO to be inhaled by officers.

The results of this study are in line with research conducted by (24) that there is a relationship between CO levels in the air and COHb levels in the blood.

5 CONCLUSIONS

From the results of this study it can be concluded that there is a significant relationship between environmental CO levels and blood COHb levels and with r of 0.715 indicates a strong level of relationship with the direction of the relationship (positive), which means that the higher the environmental CO levels, the higher the COHb levels.

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Authors' Contribution

All authors contributed equally to the development of this article.

Data availability

All datasets relevant to this study's findings are fully available within the article.

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