Effect of Motorcycle Mechanic Working Period towards the level of Exposure to Heavy Metal Plumbum (Pb) in Blood

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Air quality can be seen from the high level of air pollution that occurs in the environment, the lower level of air pollution caused by motor vehicle exhaust gas or smoke from the factory means the air quality is good, whereas if the air has been contaminated with exhaust gas from motor vehicles or smoke from the factory means that the environment has poor air quality or is not good for human health and the environment. The purpose of this study was to determine and review the effect of the working lives of mechanic officers in motorcycle workshops with Pb heavy metal levels originating from motor vehicle fumes, especially motorcycles. Participants in the subject of this study involved 10 workers with 1-6 years of service in Bandung Kulon District, Bandung Regency, West Java. The research method used is a descriptive study using the Atomic Absorption Spectrofotometry (AAS) method to check the description of Plumbum (Pb) levels in the blood of workshop workers. The results of this study indicate that the longer the service life of workshop workers with the intensity of motor vehicle smoke exposure, the higher the level of heavy metal plumbum in the blood (Pb) contained in the blood. The description of the inspection results leads to the health problems of the workshop workers.

Key words: *Working period, Motorcycle mechanic, Motor vehicle smoke, Exposure to heavy metals, Plumbum.*

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Introduction

Air pollution can cause both environmental and health problems (Fardiaz in Ramadhani, 2018). This condition occurs due to the introduction of toxic or toxic pollutants or pollutants (Rosita and Widiarti 2018). One type of heavy metal that is harmful to health is lead (Pb). PB is a heavy metal that is very dangerous for health (Ardillah, 2016). Pb is physically soft, blackish brown in color, and easily purified from mining. Pb has an atomic number 82, atomic weight 207.21 and valence 2-4 (Alsuhendra and Ridawati, 2013). PB has a toxic effect that is disrupting kidney function, digestion, nervous system, decreasing the number of spermatozoa and spontaneous abortion (Rosita and Widiarti, 2018).

The use of gasoline means increasing levels of Lead / Lead (Pb) as a result of motor vehicle exhaust emissions in the air which also increases air pollution, without exception in human health (Khotijah, Sjarifah, Mahendra, Widyaningsih, Setyawan, 2017). Pollution by motor vehicles comes from the smoke coming out of the exhaust. The smoke is the result of burning fuel in the form of gasoline, diesel and gas. The main air pollution substances contained in motor vehicle exhaust gases are CO gas, various hydrocarbon compounds, nitrogen oxides (NOx), sulfur (SOx) and particulates can cause both environmental and health disturbances (Ramadhani, 2018).

At this time one of the most dangerous air pollutants is lead metal or often called lead (Pb). PB has the nature of accumulating in the body so it is very dangerous for human health in the long term. In addition, Pb is a type of heavy metal that is included in the B3 classification (Eka and Mukono 2017). Motorized vehicle as a technological product in its operation requires oil fuel. Plumbum (Pb), is one of the main pollutants produced. By the activity of burning motor vehicle fuel oil. Black lead is added to gasoline to increase the octane value and as an anti-knock additive, in the form of Tetra Ethyl Lead (TEL) or Tetra Methyl Lead (TML). Lead added to fuel oil is the main source of Pb pollution in urban air (Ardillah, 2016).

Lead or in everyday life is better known by the name of lead, in the scientific language is called plumbum, and this metal is symbolized by Pb. This metal is included in the group of metals group IV-A in the Periodic Table of chemical elements. Has an atomic number (NA) 82 with an atomic weight weight (BA) 207.2 (Palar, 2012). Organic lead components such as tetraethyl plumbum can be absorbed immediately by the body through the skin and mucous membranes. Organic plumbum is absorbed mainly through the digestive and respiratory tract and is the main source of Tin in the body (Hasmi, 2018).

The source of Pb pollution can be divided into two, namely natural lead found in land and surface water or sea and lead from human activities such as burning fuel smoke (Rosita and Widiarti, 2018). Based on this, the people who are at high risk of exposure to Pb are workshop workers (mechanics). This is because the mechanic works every day in the workshop environment where there is a high interaction with vehicle activity and is at high risk of exposure to Pb.

One way to measure Pb levels in the blood is to use the Atomic Absorption Spectrophotometry (AAS) method. (Kumalawati 2016) AAS analysis method is a relatively simple method that is also selective and very sensitive. Aside from being sensitive, AAS is also easy and the time needed is fast (Rosita and Widiarti, 2018). In the research of Rosita and Widiarti (2018) the research method used was quantitative research with research subjects as car painting workshop workers with observational designs with cross-sectional approaches. Rosita and Widiarti, (2018)

have examined the levels of Pb / Plumbum in the blood of car painting employees in Pekanbaru using the analysis of the Atomic Absorption Spectrophotometry (AAS) method. The results showed that the IV sample of 6 years of service period contained Pb 0.019 mg / dL, sample V of 10 years of service period contained Pb 0.027 mg / dL and the sample VI of 10 years of service period contained Pb 0.042 mg / dL (Rosita and Widiarti 2018). According to the Minister of Health (2002) in the Decree of the Minister of Health of the Republic of Indonesia number 1406 / MENKES / SK / IX / 2002 concerning the standard Pb the threshold value of the Pb level in adult blood specimens is 0.01-0.025 mg / L (Rosita and Widiarti, 2018).

Research Method

Research Sample

The sample is part of the population element that results from the sampling strategy (Swarjana, 2015). The sample used in this study was the motorcycle workshop workers in the Bandung District of Kulon. The sampling technique used in this study is the Purposive Sampling Technique or the determination of samples in accordance with the criteria of working period of less than 5 years that have been determined by researchers.

Design and Procedure

This type of research is descriptive. Descriptive research is a research method that describes the phenomena to be studied. In this study, the taking of the blood of a motorcycle repair shop worker as a sample, and the measurement of Plumbum (Pb) heavy metal content in the blood of a motorcycle repair shop worker using the Atomic Absorption Spectrophotometry (AAS) method.

Results and Discussion

This research was conducted on June 19-26, 2019 at the Central Laboratory of Padjadjaran University. The sample used in this study was the blood of motorcycle repair shop workers in the Bandung District of Kulon and was tested with the Atomic Absorption Spectrophotometry (AAS) method.

Making a standard curve of Heavy Metal Plumbum (Pb)

Before measuring the Pb heavy metal content of the workshop worker, first searching for the absorbance value of the standard solution is then presented in the form of a calibration curve. This measurement is based on research conducted in determining the absorbance value and standard curve of Plumbum solution. In Atomic Absorption Spectrofotometry (AAS), absorbance or concentration measurements are made based on a series of solutions at a wavelength of 283.3 nm.

Presentation of absorbance results that have been measured from five rows of standard solutions with different concentrations at a wavelength of 283.3 nm can be seen from Table 1.

Table 1. Absorbance Value of Standard Solution for Heavy Metal Plumbum (Pb)

Concentration (mg/L)	Absorbance
0	0,0000
1	0,0109
2	0,0199

3	0,0291
4	0,0387
5	0,0480

Table 1 is the absorbance data from the results of the measurement of five standard Pb solution solutions measured using Atomic Absorption Spectrofotometry (AAS) at a wavelength of 283.3 nm. The absorbance results increase with increasing value of the concentration of the standard solution where the highest absorbance value is the standard solution of 5 mg / L with an absorbance value of 0.0480. From the standard series measurements, then poured into the calibration curve with the linear line equation $y = ax + b$, where y is the absorbance value and x is the concentration. Presentation of standard calibration curves can be seen in Figure 1.

In the linearity test the determination of regression R^2 from the calibration curve standard, the correlation coefficient is obtained. The line equation produced in Figure 1 obtained by channeling the absorbance value of the standard Pb solution with the concentration of the standard Pb series. Correlation coefficient values indicate a strong relationship between the concentration of solution (x-axis) and absorbance (y-axis). The regression coefficient value obtained is $R^2 = 0.9991$, this means that the value of R^2 is close to ideal and the resulting equation can be used to determine the Pb level in the blood sample of workshop workers in the Bandung Kulon District.
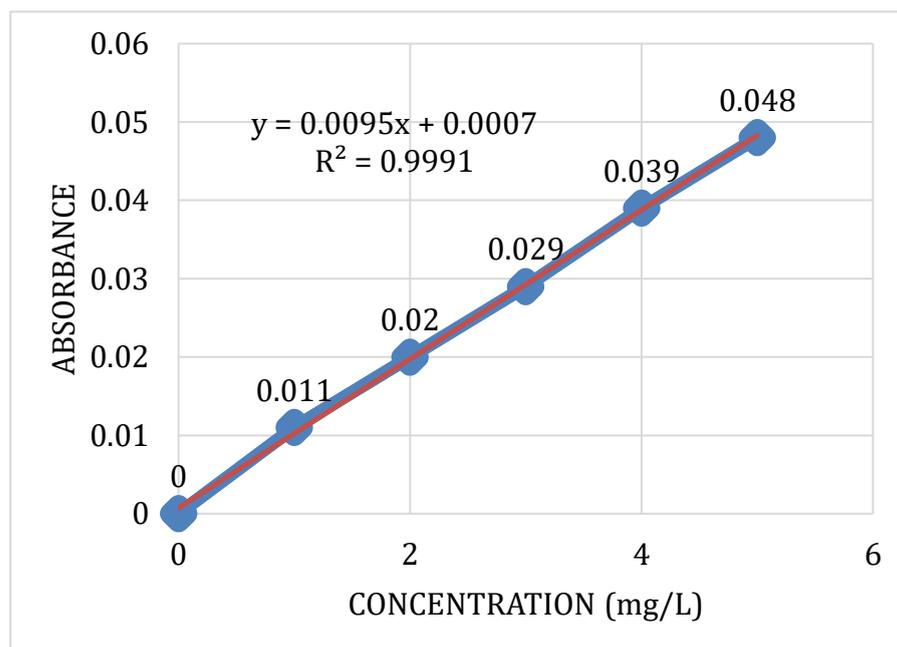

Figure 1. Standard Curve of Plumbum Solution (Pb)

The results of examination of Plumbum (Pb) levels in the blood of motorcycle repair shop workers The technique of checking Pb levels in blood samples of workshop workers in the Bandung Kulon District using the Atomic Absorption Spectrophotometry (AAS) method. The equation of the line on the standard solution curve obtained is $y = 0.0095x + 0.0007$.

Table 2. Data from the Measurement of Plumbum Heavy Metal (Pb) in the blood of workshop workers

No	Samples	Smoking Habit	Length of work (Year)	Concentration (mg/L)
1	Sample 01	Yes	3	1,01
2	Sample 02	Yes	2	1,09
3	Sample 03	Yes	5	1,30
4	Sample 04	Yes	4	1,11
5	Sample 05	Yes	3	1,11
6	Sample 06	Yes	5	1,16
7	Sample 07	Yes	1	1,01
8	Sample 08	Yes	3,5	1,12
9	Sample 09	Yes	4	1,16
10	Sample 10	Yes	6	1,31

Table 2 shows the levels of Plumbum (Pb) heavy metals after measurements using the Atomic Absorption Spectrofotometry (AAS) method. One of the criteria for sampling is the blood of workshop workers who have a service life of 1-6 years. From these results it can be seen that the study conducted on the measurement of Plumbum Heavy Metal (Pb) levels in motorbike repair workers in the Bandung District of Kulon. used with a total sample of 10 samples. The minimum yield is 1.01 mg / L with a service period of 1 year and 3 years while the highest yield of the 10 samples examined is the value of 1.31 mg / L with a work period of 6 years. To see the relationship between work duration and the concentration of Pb in the blood of workshop workers can be seen in Figure 2.
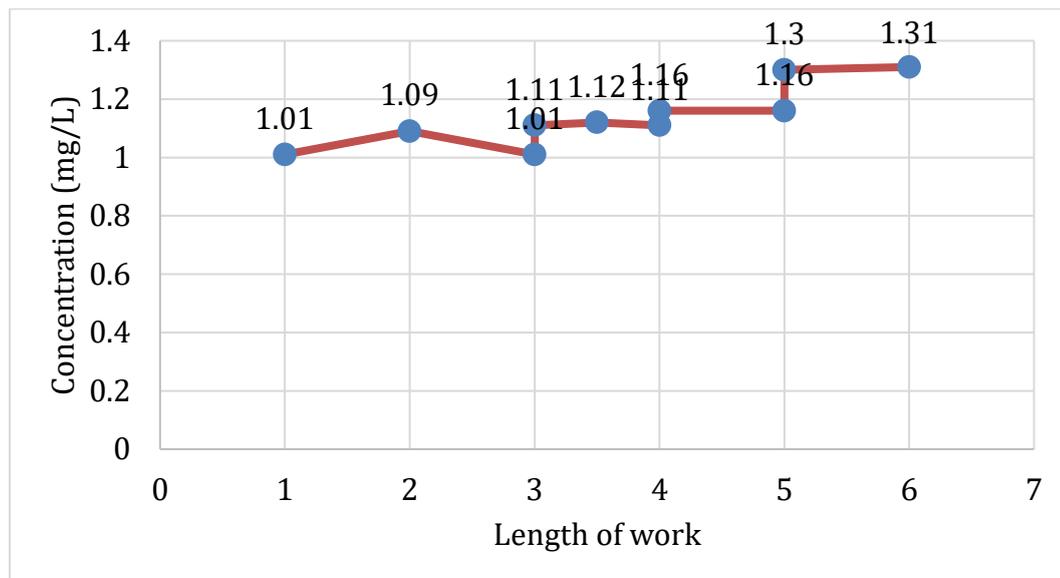
Figure 2. Graph of the results of examination of Plumbum (Pb) levels in the blood of workshop workers with a vulnerable working period of 1 year to 6 years.

Before checking the lead level of Plumbum (Pb) in the blood of workshop workers in the Bandung Kulon District using the Atomic Absorption Spectrofotometry (AAS) method, a standard curve with a concentration value of 0 mg / L with a concentration of 0.001, 1 mg / L with an absorbance value of 0.0109 , 2 mg / L with an absorbance of 0.0199, 3 mg / L with an absorbance of 0.0291, 4 mg / L with an absorbance of 0.0387 and 5 mg / L with an absorbance of 0.0480. The standard solution was prepared from a solution of Pb 1000 mg / L and HNO3 0.5 mol / L. A standard solution is a solution that contains precisely known concentrations of an element or substance, which functions as the making of a standard curve whose concentration is known. According to the results that have been studied Plumbum levels in the blood of workshop workers obtained from samples one to 10 have a high enough value of the normal threshold value with the smallest value of 1.01 and the largest value of 1.31 mg / L. Based on the graph that has been illustrated in 4.3, the longer it works, the higher the value of Pb levels in the blood, while in graph 4.3 there is a decrease in yield levels, namely in sample 01 with the results of 1.01 mg / L and a 3-year service period while previously sampled 02 results obtained levels of 1.09 mg / L with a work period of 2 years.

Conclusion

Based on the results of research conducted it can be concluded that the service life of a motor vehicle repair shop mechanic influences the level of exposure to heavy metal Plumbum (Pb) in the blood, which exceeds the normal threshold with the lowest value of 1.01 and the highest value of 1.31 mg / L . The longer the service period of the mechanic's workshop with exposure to motor vehicle fumes in it, the greater the level of Plumbum (Pb) particles in the blood is higher too, so the health threat is also greater.

Acknowledgements

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