

LAMPIRAN

Lampiran 1

KARTU KONSULTASI KTI

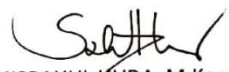
Nama Mahasiswa : Triya Utami Ramadiantaru

Judul KTI : Evaluasi Kadar Timbal (Pb) Dalam Darah Dan Rambut Pekerja Stasiun
Pengisian Bahan Bakar Umum (SPBU) (Studi Pustaka)

Pembimbing Utama : Dr. Agus Purnomo, S.Si., MKM

No.	Tanggal	Kegiatan	Paraf
1.	30/12/2020	Perbaikan judul dan tujuan	f
2.	04/01/2021	Perbaikan judul dan tujuan	f
3.	13/01/2021	Perbaikan bab 1, bab 2, bab 3	f
4.	19/01/2021	Perbaikan bab 1 dan bab 2	f
5.	27/01/2021	Perbaikan bab 2 dan bab 3	f
6.	18/02/2021	Perbaikan bab 1 dan bab 3	f
7.	25/02/2021	Perbaikan bab 1, bab 2, bab 3	f
8.	01/03/2021	Perbaikan bab 1	f
9.	04/03/2021	Acc Seminar Proposal	f
10.	20/04/2021	Perbaikan bab 2	f
11.	25/04/2021	Perbaikan bab 2	f
12.	02/06/2021	Acc Perbaikan Seminar Proposal	f
13.	07/06/2021	Perbaikan bab 4	f
14.	18/06/2021	Perbaikan bab 4	f.

Ketua Prodi TLM Program Diploma Tiga


MISBAHUL HUDA, M.Kes
 NIP. 196912221997032001

KARTU KONSULTASI KTI

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 Pembimbing Utama : Dr. Agus Purnomo, S.Si., MKM

No.	Tanggal	Kegiatan	Paraf
15.	22/06/2021	Perbaikan bab 4	
16.	12/07/2021	Perbaikan Kesimpulan bab 5	
17.	26/07/2021	Acc →	
18.	12/08/2021	Perbaikan Penulisan dan bab 4	
19.	20/08/2021	Perbaikan bab 2 dan bab 4	
20.	16/09/2021	Acc perbaikan dan cetak	

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Lampiran 2

KARTU KONSULTASI KTI

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Judul KTI : Evaluasi Kadar Timbal (Pb) Dalam Darah Dan Rambut Pekerja Stasiun Pengisian Bahan Bakar Umum (SPBU) (Studi Pustaka)

Pembimbing Pendamping : Rodhiansyah Djayasinga, S.Pd., M.Si.

No.	Tanggal	Kegiatan	Paraf
1.	23/12/2020	Perbaikan bab 1	✓
2.	18/01/2021	Perbaikan bab 2	✓
3.	15/02/2021	Perbaikan bab 3	✓
4.	19/02/2021	Acc Seminar Proposal	✓
5.	03/04/2021	Perbaikan bab 1 dan bab 2	✓
6.	07/04/2021	Perbaikan bab 1 dan bab 2	✓
7.	05/05/2021	Acc Perbaikan Proposal	✓
8.	29/05/2021	Perbaikan bab 4	✓
9.	28/05/2021	Perbaikan bab 4	✓
10.	02/06/2021	Perbaikan bab 4	✓
11.	22/06/2021	Perbaikan bab 4 dan bab 5	✓
12.	12/07/2021	acc seminar.	✓
13.	10/09/2021	acc perbaikan & cetak	✓
14.			

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Lampiran 3

HASIL OUTPUT DATA ANALISIS UJI STATISTIK PERBEDAAN KADAR Pb DALAM DARAH DAN RAMBUT PEKERJA SPBU

A. Kadar ion logam Pb pada darah

Statistics

Kadar ion logam Pb pada darah

($\mu\text{g/mL}$)

N	Valid	10
	Missing	0
Mean		.0280
Median		.0200
Mode		.02
Std. Deviation		.01989
Minimum		.01
Maximum		.07

Kadar ion logam Pb pada darah ($\mu\text{g/mL}$)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.01	1	10.0	10.0	10.0
	.02	7	70.0	70.0	80.0
	.06	1	10.0	10.0	90.0
	.07	1	10.0	10.0	100.0
	Total	10	100.0	100.0	

B. Kadar ion logam Pb pada rambut

Statistics

Kadar ion logam Pb pada rambut

($\mu\text{g/g}$)

N	Valid	10
	Missing	0
Mean		.0470
Median		.0400
Mode		.04
Std. Deviation		.01418
Minimum		.03
Maximum		.07

Kadar ion logam Pb pada rambut ($\mu\text{g/g}$)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.03	1	10.0	10.0	10.0
	.04	6	60.0	60.0	70.0
	.06	1	10.0	10.0	80.0
	.07	2	20.0	20.0	100.0
	Total	10	100.0	100.0	

HASIL UJI ANALISIS DATA PENELITIAN STUDI PUSTAKA

A. Hasil uji *mann-whitney*

Ranks				
	Sampel	N	Mean Rank	Sum of Ranks
Kadar Ion Logam Pb	Darah	10	7.15	71.50
	Rambut	10	13.85	138.50
	Total	20		

Test Statistics^a

Kadar Ion Logam Pb	
Mann-Whitney U	16.500
Wilcoxon W	71.500
Z	-2.629
Asymp. Sig. (2-tailed)	.009
Exact Sig. [2*(1-tailed Sig.)]	.009 ^b

a. Grouping Variable: Sampel

b. Not corrected for ties.

B. Hasil uji *chi square*

Case Processing Summary

	Valid		Cases Missing		Total	
	N	Percent	N	Percent	N	Percent
Kadar ion logam Pb pada darah ($\mu\text{g/mL}$) * Kadar ion logam Pb pada rambut ($\mu\text{g/g}$)	10	100.0%	0	0.0%	10	100.0%

Kadar ion logam Pb pada darah ($\mu\text{g/mL}$) * Kadar ion logam Pb pada rambut ($\mu\text{g/g}$) Crosstabulation

Count

		Kadar ion logam Pb pada rambut ($\mu\text{g/g}$)		Total
		> 0.0470	< 0.0470	
Kadar ion logam Pb pada darah ($\mu\text{g/mL}$)	> 0.0280	2	0	2
	< 0.0280	1	7	8
Total		3	7	10

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	5.833 ^a	1	.016		
Continuity Correction ^b	2.411	1	.121		
Likelihood Ratio	6.189	1	.013		
Fisher's Exact Test				.067	.067
Linear-by-Linear Association	5.250	1	.022		
N of Valid Cases	10				

a. 3 cells (75.0%) have expected count less than 5. The minimum expected count is .60.

b. Computed only for a 2x2 table

Blood lead level among fuel station workers at Khartoum city

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Abstract

Lead is one of the oldest heavy metals; it is the most widely studied occupational and environmental toxin. The aim of this study is to determine the levels of lead in blood of 50 Sudanese males employed in fuel stations in Khartoum city with mean age (30.1±1.4yrs), and 42 non exposed healthy men as control with mean age (28.0±1.3yrs). This study was conducted between the period from November 2013 and March 2014. Flameless atomic absorption was used for blood lead measurement. The study showed that the mean blood lead the fuel station workers was (33.6±2.2µg/dl; range: 10.5–97.5µg/dl), while in the non-exposed healthy control men was (8.1±0.31µg/dl; range: 5.0–14.1µg/dl). Blood lead is significantly elevated in the fuel stations workers in Khartoum City (P value = 0.000). Fuel pump filling workers are at risk of lead exposure toxicity and its health complications. A policy action to improve working conditions and to phase out the problem of the lead in fuel stations is recommended.

{ **Citation:** Eltayeb Tayrab, Nageeb Abdelrahman, Ali Kodi Tirba. Blood lead level among fuel station workers at Khartoum city. American Journal of Research Communication, 2014, 2(6): 74-82} www.usa-journals.com, ISSN: 2325-4076.

Hubungan Kadar Timbal dalam Darah terhadap Kejadian Hipertensi pada Operator SPBU di Kota Kendari

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ABSTRACT

Hypertension is a common health problem and often asymptomatic until advanced stages of development and often leads to death. One of the factors that play a role in the occurrence of hypertension is a heavy metal, that is lead (Pb) which is used as an additional chemical mixture of gasoline. Gas station's operator is one of the jobs are high-risk exposure to lead for a long time. This study aims to determine the association of blood lead levels with incidence of hypertension among the gas station's operators in Kendari. This study used cross sectional design with observational analytic approach. The study was conducted at nine stations in Kendari and Forensic and Molecular Biology Laboratory, Faculty of Mathematics and Science, Haluoleo University, Kendari on 16 - 20 December 2016. Sample consisted of 30 operators of gas station, using proportional stratified sampling technique. The instrument used in this study were questionnaires and testing blood specimens in the laboratory by ashing method. Analysis of the data used in this study was Fisher Exact Test. The result showed respondents with normal blood lead levels are 6 respondents (20.0%) and abnormal blood lead levels are 24 respondents (80.0%). Respondents who have hypertension are 26 respondents (86.7%) and respondents who did not have hypertension are 4 respondents (13.3%). Respondents with normal lead levels who had hypertension totaled 2 respondents (6.7%) and who do not have hypertension totaled 4 respondents (13.3%). Respondents with abnormal lead levels who had hypertension totaled 24 respondents (100.0%) and who do not have hypertension numbered 0 respondents (0.0%). Based on the result of data analysis using the Fisher Exact statistical tests on the correlation of blood lead levels in the incidence of hypertension among the gas station's operators in Kendari, p value = 0.001 which means that H0 is rejected. There is correlation between blood lead level with incidence of hypertension among the gas station's operators in Kendari.

Keywords: Lead in the blood, hypertension, gas station's operator

PENDAHULUAN

Hipertensi merupakan masalah kesehatan yang umum dijumpai dan sering asimtomatik sampai perkembangan tahap lanjut. Hipertensi menjadi faktor risiko utama terjadinya penyakit jantung iskemi, gagal jantung kongestif, stroke, gangguan penglihatan, gagal ginjal dan kecacatan. Adanya kerusakan organ target, terutama pada jantung dan pembuluh darah akan memperburuk prognosis pasien hipertensi. Tingginya morbiditas dan mortalitas pasien hipertensi terutama disebabkan oleh timbulnya penyakit kardiovaskular. Sebagai dampak dari komplikasi, kualitas

hidup penderita menjadi rendah dan dapat menyebabkan depresi hingga kematian (Yogiantoro, 2009).

Data *World Health Organization* (WHO) menunjukkan pada tahun 2008 diperkirakan 40% dewasa berusia 25 tahun ke atas telah terdiagnosis menderita hipertensi. Jumlah ini merupakan peningkatan dari sebelumnya yaitu pada tahun 1980 berjumlah 600 juta menjadi 1 miliar pada tahun 2008 (WHO, 2013).

Hipertensi sering ditemukan pada pelayanan kesehatan seperti puskesmas, klinik dan rumah sakit dengan prevalensi yang cukup tinggi di Indonesia yaitu



Deteksi Frekuensi Distribusi Timbal Dalam Darah Pekerja Pengisi Bahan Bakar: Studi Kasus SPBU di Plaju, Sumatera Selatan.

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info Artikel : Diterima Desember 2018 ; Disetujui Maret 2019 ; Publikasi April 2019

ABSTRAK

Latar belakang: Timbal (Pb) sebagai logam berat pernah dijadikan sebagai bahan aditif pada bensin. Pb dalam bentuk tetraetiltimbal ($Pb_2(C_2H_5)_4$) yang membantu proses pembakaran pada mesin kendaraan menjadi lebih halus dan cepat. Pb pada bahan bakar berdampak merugikan bagi lingkungan sekitar termasuk manusia. Pada saat pembakaran, Pb dilepas ke udara bersamaan dengan asap kendaraan. Senyawa yang dilepaskan tersebut berdampak negatif bagi kesehatan. Efek pertama keracunan timbal kronis sebelum mencapai organ target adalah gangguan haemoglobin dan berakibat pada menurunnya kadar haemoglobin. Gangguan anemia akan timbul bila kandungan Pb lebih dari 70 ug/dl atau setara 0,7 ppm. Berkaitan dengan efek negatif Pb dalam bensin, maka sangatlah penting untuk mendeteksi dan memperkirakan frekuensi kadar Pb dalam darah pekerja pengisi bahan bakar (pekerja SPBU) yang melakukan kontak langsung dengan bahan bakar.

Metode: Sebanyak 11 orang pekerja pengisi bahan bakar dan 2 orang pegawai administrasi menjadi responden dan kontrol dalam penelitian ini. Kriteria inklusi adalah jenis kelamin laki-laki dan perempuan dengan usia 20-40 tahun, dan kriteria eksklusi adalah yang tidak bersedia menjadi responden. Responden mengisi kuesioner dan di wawancara untuk mengetahui riwayat kesehatan, kemudian dilakukan pengambilan darah untuk dianalisis. Penentuan titik sampling berdasarkan metode purposive sampling dengan kriteria Stasiun Pengisian Bahan Bakar (SPBU) berada di daerah padat kendaraan dan beroperasi selama 24 jam.

Hasil: Analisis darah menggunakan SSA Shimadzu 6300 menunjukkan kadar $Pb < 2.995$ ng/ml. Hal ini mengindikasikan tidak adanya Pb dalam darah responden. Tidak terdeteksinya Pb dalam darah diduga akibat responden terpapar Pb dalam jangka waktu singkat, penggunaan peralatan keselamatan (APD) saat bekerja, serta dapat mengindikasikan rendahnya kadar Pb pada bahan bakar kendaraan bermotor.

Simpulan: Tidak terdeteksinya Pb dalam darah responden tidak berarti mengabaikan keberadaan Pb di dalam bahan bakar. Sangatlah penting untuk melakukan pemeriksaan kandungan kadar Pb secara rutin pada semua pekerja SPBU akibat resiko paparan Pb bagi kesehatan.

Kata kunci: timbal; pekerja pengisi bahan bakar; bahan bakar bensin; darah; SSA Shimadzu 6300

ABSTRACT

Title: Frequency Distribution Of Leads In Blood Workers Filling Fuel: Case Study Of Fueling Station at Plaju, South Sumatra

Background: Lead (Pb) as heavy metal has been used as an additive in gasoline. Pb in the form of tetra ethyl lead ($Pb_2(C_2H_5)_4$) which helps the combustion process on the vehicle engine so that the engine sound becomes smoother and faster. Pb on fuel has a negative impact on the surrounding environment including humans. When burning in a vehicle engine, Pb is released into the air along with vehicle smoke. The compound released has a negative impact on health. The first of chronic Pb poisoning before reaching the target organ is the presence of haemoglobin synthesis disorder so that the haemoglobin level decreases. Anemic disorders will occur if the Pb content is more than 70 ug / dl or equal to 0.7 ppm. In connection with the negative effects of Pb in gasoline, it is very important to detect and estimate the frequency of Pb levels in the blood of fuel filling workers who make direct contact with fuel.

**IDENTIFIKASI KADAR TIMBAL (Pb) DALAM DARAH PADA
PETUGAS OPERATOR SPBU 34-42115 KOTA SERANG****IDENTIFICATION OF BLOOD LEAD LEVEL AMONG SPBU OPERATOR
OFFICERS 34-42115 IN SERANG CITY****Ghina Stamara, Diana Rinawati, Barlian Barlian**

Poltekkes Kemenkes Banten

Korespondensi: dianarinawati14rina@gmail.com**ABSTRACT**

Blood is a means of transporting oxygen and spreading it throughout the liquid body. In the body, the blood has a main role as a means of transporting oxygen from cells to the lungs as well as for the defense of the human body against foreign substances. Lead in the blood is bound by erythrocytes, which are divided into two namely soft tissue and hard tissue. The SPBU officer as one of the groups that have a high risk of being directly exposed to lead. Lead exposure can come from vehicle emissions coming from or steam coming from gasoline when charging. This research is a descriptive study by examining the blood sample of SPBU 34-42115 Serang City Operator Officers to determine the concentration of heavy metals (Pb). The instrument used in identifying Pb in the blood is ICP-OES (Inductively Coupled Plasma Optical Emission Spectrometry) with a wavelength of 283.3 nm. The results of the study by identifying seven samples showed that the blood samples that were tested were not detected blood lead levels with a working period of <4 years. Under National and International Regulations regarding lead Based on the Circular of the Minister of Manpower of the Republic of Indonesia No. 01 / MEN / 1997 concerning the Threshold Value of Chemicals, the threshold value of lead exposure and its inorganic compound at work is 0.05 mg / m³.

Keywords: *Blood, Metal Lead (Pb), ICP-OES***ABSTRAK**

Darah adalah alat pengangkut oksigen dan menyebarkannya keseluruh tubuh yang bersifat cair. Didalam tubuh darah berperan utama sebagai alat transportasi oksigen dari sel ke paru-paru serta untuk pertahanan tubuh manusia terhadap zat asing. Timbal (Pb) dalam darah diikat oleh eritrosit, yang dibagi menjadi dua yaitu ke jaringan lunak dan ke jaringan keras. Petugas SPBU sebagai salah satu kelompok yang mempunyai risiko tinggi untuk terpapar timbal secara langsung. Paparan timbal dapat berasal dari emisi kendaraan yang datang maupun uap yang berasal dari bensin saat pengisian. Penelitian ini merupakan penelitian deskriptif dengan melakukan pemeriksaan sampel darah petugas Petugas Operator SPBU 34-42115 Kota Serang guna mengetahui konsentrasi logam berat (Pb). Alat yang digunakan dalam mengidentifikasi Pb dalam darah adalah ICP-OES (*Inductively Coupled Plasma Optical Emission Spectrometry*) dengan panjang gelombang 283,3 nm. Hasil penelitian dengan mengidentifikasi tujuh sampel menunjukkan bahwa sampel darah yang telah diuji tidak terdeteksi kadar timbal dalam darah tersebut dengan masa kerja <4 tahun. Sesuai dengan Peraturan Nasional dan

GAMBARAN KADAR TIMBAL DALAM OPERATOR SPBU DI PASAR KLIWON KOTA SURAKARTA BERDASARKAN UMUR

*An Overview of Blood Lead Level Of Gas Station Operations
In Pasar Kliwon In Area Surakarta City*

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ABSTRAK

Latar Belakang : Operator SPBU merupakan kelompok pekerja yang beresiko terkena paparan timbal. Timbal merupakan logam berat yang dapat meracuni tubuh manusia dalam jangka panjang.

Tujuan : Penelitian ini bertujuan untuk mengetahui gambaran kadar timbal dalam darah operator SPBU di Pasar Kliwon Kota Surakarta.

Metode : Jenis penelitian diskriptif dengan pendekatan *cross sectional*, dengan 10 subjek operator SPBU di Pasar Kliwon Kota Surakarta dan menggunakan teknik pengambilan sampel yaitu *purposive sampling*. Penelitian diawali dengan melakukan pemberian *informed consent* dan kuesioner. Pemeriksaan kadar timbal dalam darah menggunakan Spektrofotometer Serapan Atom AA 7000.

Hasil : Sebanyak 10 responden operator SPBU yang mau bersedia dan memenuhi syarat kriteria sampel yang telah ditetapkan oleh peneliti, meskipun di daerah pasar Kliwon ada beberapa tempat SPBU. Sepuluh responden tersebut mempunyai kadar timbal normal menurut standar menurut CDC (*Centers for Disease Control and Prevention*) yaitu $< 10 \mu\text{g/dL}$. Data yang diperoleh disajikan dalam bentuk diskriptif dan tabel.

Simpulan : Kadar timbal dalam darah operator SPBU di Pasar Kliwon Kota Surakarta tidak melebihi batas yang ditetapkan.

Kata kunci : Operator SPBU, Timbal, darah

ABSTRACT

Background : Gas station operators are a group of workers who are at risk of exposure to lead. Lead is a heavy metal that can poison the human body in the long run.

The purpose : This research was to find out the blood lead level in the gas station attendant's on the age.

Method : This type of research is descriptive with a cross sectional approach, with 10 SPBU operators in Pasar Kliwon Surakarta City and using purposive sampling technique. The research begins with giving informed consent and a questionnaire. Examination of lead levels in the blood used Atomic Absorption Spectrophotometer AA 7000.



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RESEARCH ARTICLE

LEVEL OF LEAD IN THE BLOOD AMONG FUEL STATION EMPLOYEES AND ITS RELATIONSHIP TO IMPAIRED LIVER AND KIDNEY FUNCTIONS IN DAMASCUS; SYRIA: OCCUPATIONAL EXPOSURE TO LEAD

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ABSTRACT

Objectives: Chronic exposure to lead is known to cause adverse health effects. Workers at fuel stations are exposed to high concentrations of lead during filling cars and through Car's emissions and being in contact with contaminated hands, food, water and clothing. This study was designed to find blood lead level and their adverse effects on kidney and liver function among fuel station workers.

Methods: Forty fuel station workers (exposed group) and thirty apparently healthy subjects (non-exposed group) in Damascus were randomly selected for the study. Blood lead levels were determined using Atomic absorption spectrometry after microwave-assisted acid digestion. Serum concentration of creatinine, uric acid and urea values were recorded to assess kidney function, whereas AST and ALT serum concentrations were used to evaluate liver function.

Results: The results showed a non-significant elevation of blood lead level in the exposed group ($11.04 \pm 10.36 \mu\text{g/dl}$) compared to the non-exposed group ($8.1 \pm 2.97 \mu\text{g/dl}$). Serum concentration of creatinine and uric acid were significantly elevated in the exposed group, but there was no change in AST and ALT serum levels.

Conclusion: It is concluded that blood lead levels of fuel station workers don't exceed the threshold that may cause kidney or liver dysfunctions.

Keywords: Lead hepatotoxicity, lead nephrotoxicity, occupational lead exposure.

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INTRODUCTION

Heavy exposure to lead may cause serious adverse health issues especially among those who are exposed to it on a daily basis. Workers at fuel stations are heavily exposed to lead¹, as gasoline contains an organic form of lead (tetraethyl lead) which is used as an antiknock agent². Lead poisoning increase blood lead concentrations above the accepted concentrations of less than $10 \mu\text{g/dl}$ determined by the world health organization (WHO)³. Heavy exposure to lead has been associated with kidney and liver toxicity^{4,5}. The kidney is often targeted by heavy metals due as it reabsorbs and concentrates divalent ions and metals during excretion. The severity of kidney impairment caused by lead depends on the type, dose, and duration of

exposure⁶. Acute lead exposure causes impairment of the proximal tubular architecture and induces histological changes such as eosinophilic intra-nuclear inclusions of lead-protein complexes in tubular cells and mitochondrial swelling. On the other hand, chronic exposure to lead may damage kidneys as manifested by increased urate secretion, vasoconstriction of renal blood vessels and consequent glomerulosclerosis, hypertension and interstitial fibrosis^{7,8}. Lead exposure may also causes liver toxicity associated with changes in liver structure^{9,10}. Lead in the body is metabolized inside the liver via glutathione conjugation. Thus, lead and its metabolite are concentrated in the liver^{11,12,13} leading to depletion of glutathione and increased oxidative stress, which aggravates liver

STUDI BIOAKUMULASI ION LOGAM PB DALAM RAMBUT DAN DARAH OPERATOR STASIUN PENGISIAN BAHAN BAKAR UMUM, JALAN SENTOSA, SAMARINDA

BIOACCUMULATION STUDY OF Pb METAL ION IN HAIR AND BLOOD OF OPERATOR OF GENERAL FUEL FILLING STATION, SENTOSA ROAD, SAMARINDA

Sukma Wiratama*, Saibun Sitorus, Rudi Kartika

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ABSTRACT

A study about Bioaccumulation of Pb Metal Ion in Hair and Blood of Operator of General Fuel Filling Station, Sentosa Road Samarinda has been conducted. The aim of the study is to determine the accumulation of Pb metal ions levels and the association between the hours of work of gas station operator assumed to be positively correlated and the levels of Pb metal ions in hair as well as in blood. Hair and blood were homogenized and analyzed by Atomic Adsorption Spectrophotometer (AAS). The results displayed that the lowest and highest level of Pb metal ions contained in hair was 0.03 µg/g and 0.07 µg/g, respectively. The highest number found in blood was similar to the level contained in hair, that is 0.07 µg/mL. However, the lowest level was marginally lower with a number 0.01 µg/mL. The coefficient correlation (r) obtained were 0.822 and 0.859 for hair and blood, respectively. These numbers indicate there was a strong positive relationship between working hours of gas station operator and levels of Pb metal ion in hair and blood. This inference was also supported by the results of t test, that is, 0.564. Furthermore, % determinants analysis was also undertaken which result in 82.2% and 85.9% for hair and blood, respectively to strengthen the test result that working hours of gas station operator in Sentosa Road Samarinda was positively associated with Pb metal ion levels in hair and in blood.

Keywords: *Hair, Blood, Bioaccumulation, Correlation Coefficient, Pb Metal Ion Levels*

PENDAHULUAN

Bahan bakar adalah suatu materi apapun yang bisa diubah menjadi energi dan umumnya bahan bakar mengandung energi panas yang dapat dilepaskan dan dimanipulasi. Manusia menggunakan bahan bakar pada proses pembakaran (reaksi redoks) dimana bahan bakar tersebut akan melepaskan panas setelah direaksikan dengan oksigen di udara. Contoh lain dari proses pelepasan energi dari bahan bakar adalah melalui reaksi eksotermal dan reaksi nuklir (reaksi fisi dan fusi). Hidrokarbon (bensin dan solar) merupakan jenis bahan bakar yang paling sering digunakan oleh manusia.

Timbal merupakan logam yang berwarna abu-abu kebiruan dan memiliki kerapatan yang tinggi (11,84 g/mL pada suhu kamar), timbal mudah larut dalam HNO₃ yang konsentrasi pekatnya 8M dan membentuk nitrogen oksida [1]. Logam ini termasuk ke dalam kelompok logam-logam golongan IVA pada tabel periodik unsur kimia. Mempunyai nomor atom (NA) 82 dan bobot atau berat atom (BA) 207,2.

Timbal yang merupakan salah satu unsur logam berat yang terdapat dalam bahan bakar minyak yaitu bensin yang dapat mencemari udara. Timbal umumnya dikenal sebagai timah hitam dan biasa digunakan sebagai campuran bahan bakar bensin.

Timbal dapat masuk ke dalam tubuh manusia melalui saluran pencernaan (digesti) atau melalui saluran pernafasan (inhalasi). Proses masuknya ion logam Pb ke dalam tubuh dapat melalui berbagai cara dan akan terakumulasi dalam organ-organ tubuh. Meskipun tubuh manusia dapat mengekskresi timbal, namun hal itu tidak sebanding dengan absorpsinya sehingga dapat menimbulkan efek negatif baik akut maupun kronis. Ion logam Pb yang ada di dalam darah diikat oleh eritrosit yang dikirim ke jaringan lunak (sumsum tulang, sistem saraf, ginjal, hati) dan ke jaringan keras (tulang, kuku, rambut, gigi).

Pencemaran logam terhadap lingkungan merupakan suatu proses yang erat hubungannya dengan penggunaan logam tersebut oleh manusia, khususnya logam berat seperti timbal dapat menimbulkan bahaya pada makhluk hidup khususnya

Korelasi Konsentrasi *Particulate Matter* (PM₁₀) di Udara dan Kandungan Timbal (Pb) dalam Rambut Petugas SPBU di Kota Pekanbaru

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Abstract: *This research describes the concentration of PM₁₀ in the air and the Pb content in the Gas Station Attendants' hair in Pekanbaru. It was conducted in March – June 2014 by using Case Control Survey Method and Statistical Analysis which are ANOVA Test and Independent Sample t-Test in order to find out the difference of the Pb content in gas station attendants' hair of Pekanbaru City that is based on age, sex, location, group (case-control) and term of service and also to test the correlation between PM₁₀ concentration and lead content (Pb) with a simple regression correlation analysis. The result reveals that there is no difference in Pb content in the gas station attendants' hair in Pekanbaru City based on age, sex, term of service and the group (case-control) ($p > 0,05$). However, there are differences in the Pb content in the gas station attendants' hair based on the locations ($p < 0,05$). PM₁₀ concentration and Pb content in the gas station attendants' hair resulted an equation $Y = 0,151 + 0,001x$. While $R^2 = 0,110$ as a determinant coefficient showed a weak positive relationship between the concentration of PM₁₀ and Pb content in the gas station attendants' hair of Pekanbaru City.*

Key words: PM₁₀, Lead, Hair, Gas Station Attendant

Berdasarkan pemantauan dari pencemaran udara tertinggi di perkotaan, emisi transportasi terbukti sebagai penyumbang pencemaran udara tertinggi di Indonesia yakni sekitar 85%. Sebagian besar kendaraan bermotor itu menghasilkan emisi gas buang yang buruk, akibat perawatan yang kurang memadai ataupun dari penggunaan bahan bakar (bensin) dengan kualitas kurang baik (Gusnita, 2012). Sumber polutan merupakan unsur kimia dari gas buang kendaraan transportasi terdiri dari unsur O₃ (Ozon), CO (Carbon Monoksida), NO₂ (Natrium dioksida), SO₂ (Sulfur dioksida), PM₁₀ (*Particulate Matter* 10) dan Timbal (Pb) (Reffiane *et.al.*, 2011).

PM₁₀ merupakan partikel udara dalam wujud padat yang berdiameter kurang dari 10 µm. Partikel tersebut akan berada di udara untuk waktu yang relatif lama dalam keadaan melayang-layang dan masuk ke dalam tubuh manusia melalui saluran pernafasan sehingga dapat menyebabkan gangguan kesehatan (Eka,

2009). Unsur-unsur kimia yang teridentifikasi dari PM₁₀ adalah unsur Br, Mn, Al, I, V, Cl, Na, Pb, Hg, dan Black Carbon (BC) (Zannaria, *et.al.*, 2009).

Pb atau timah hitam merupakan salah satu zat yang dapat diukur sebagai *Total Suspended Particulate* (TSP). keberadaan Pb di udara ambient diketahui dapat menyebabkan dampak buruk bagi kesehatan manusia, diantaranya mengganggu biosistensis haemoglobin dan menyebabkan anemia, menyebabkan kenaikan tekanan darah, kerusakan ginjal, gangguan sistem saraf, merusak otak dan menurunkan IQ serta konsentrasi dan menurunkan fertilitas pria melalui perusakan sperma (Aprianti, 2011). Pb terdapat pada bensin dalam bentuk *tetraethyl lead* (C₂H₅)₄Pb yang berfungsi sebagai zat aditif untuk meningkatkan bilangan oktan mesin kendaraan (Panjaitan, 2014).

Kota Pekanbaru termasuk ke dalam lima kota besar yang tercatat memiliki pencemaran udara tertinggi di Indonesia (Reyno *dalam*

ANALISIS KADAR LOGAM TIMBAL (Pb) PADA RAMBUT KARYAWAN SPBU

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ABSTRACT

Development in the field of health is the achievement of an optimal public health degree. Among people who are often exposed to air pollution such as lead metal (Pb) is a gas station officer. One of the objectives of this research is to figure out the differences of lead level (Pb) in the hair of SPBU workers who base on Jl. Ir. Juanda based on length of service period by using experimental research to analyze Pb metal at gas station workers. The population and sample of research is hair of three gas station workers that contains metal of lead (Pb). The results of this study revealed that the longer employment period of workers, the higher the Pb level in their hair and the percentage recovery value for the wet destruction method using HNO₃ and HClO₄ has an average recovery of 96.23% which is the precision test value of 4.01%. It is recommended that the validation test then use another method of dry destruction and examine the identity of age, place of birth date and lifestyle.

Key words: Validation, Analysis Method, Metal Content Pb

PENDAHULUAN

Udara bersih adalah udara yang cukup akan kebutuhan oksigen (O₂) yang dibutuhkan makhluk hidup untuk proses fisiologis normal. Di daerah perkotaan yang ramai, gas pencemar berasal dari asap kendaraan, gas buangan pabrik, pembangkit tenaga listrik, asap rokok dan sebagainya yang erat hubungannya dengan aktivitas kehidupan manusia (Darmono, 2009).

Pembangunan di bidang teknologi dan industri berjalan sangat pesat. Pembangunan tersebut merupakan usaha untuk menyediakan sarana dan prasarana pendukung kesejahteraan manusia. Salah satu di antaranya adalah pertambahan sarana transportasi kendaraan bermotor. Pertambahan sarana transportasi memang memberikan dampak positif, namun ternyata juga memberikan dampak negatif karena dapat menurunkan kualitas lingkungan, salah satunya terjadi karena adanya emisi gas

buang dari kendaraan berbahan bakar yang mengandung Pb. Emisi gas buang merupakan hasil samping dari pembakaran yang terjadi dalam mesin-mesin kendaraan. Pb yang merupakan hasil samping dari pembakaran ini berasal dari senyawa tetrametil-Pb dan tetraetil-Pb yang selalu ditambahkan dalam bahan bakar kendaraan bermotor dan berfungsi sebagai anti ketuk (anti-knock) pada mesin-mesin kendaraan (Heryando, 1994).

Emisi gas buang yang mengandung Pb jika dihirup oleh manusia akan menyebabkan keracunan sistemik. Menurut Slamet (1994) keracunan Pb akan menimbulkan gejala: rasa logam di mulut, garis hitam pada gusi, gangguan pencernaan, anoreksia, muntah-muntah, kolik encephalitis, wrist drop, iritasi, perubahan kepribadian, kelumpuhan dan kebutaan. Basophilic stippling dari sel darah merah merupakan gejala patognomonis bagi keracunan Pb. Gejala lain dari keracunan ini

Validasi Metode Analisa Kadar Timbal (Pb) dalam Rambut Karyawan SPBU di Indarung

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ABSTRAK

Timbal (Pb) adalah logam berat yang dapat menyebabkan keracunan dan terakumulasi dalam tubuh manusia. Mekanisme masuknya timbal kedalam tubuh manusia dapat melalui system pernafasan, oral, ataupun langsung melalui permukaan kulit. Timbal yang diabsorpsi dalam tubuh sebanyak 95% diikat oleh eritrosit kemudian diangkut oleh darah keorgan-organ tubuh dan kemudian akan disimpan dalam jaringan lunak (sum-sum tulang, sistim saraf, ginjal, hati) serta jaringan keras (tulang, kuku, rambut, gigi). Berdasarkan pada profesi seseorang, maka kontaminasi logam timbal (Pb) dapat terjadi karena berhubungan langsung atau tidak langsung dengan sumber pencemaran logam timbal (Pb). Telah dilakukan uji validasi metode destruksi basah untuk penentuan kadar timbal (Pb) dalam rambut. Destruksi basah menggunakan campuran HNO_3 dan HClO_4 . Analisis kandungan timbal hasil destruksi dilakukan dengan Spektrofotometer Serapan Atom (SSA). Untuk menentukan metode destruksi yang valid dilakukan validasi metode yang meliputi uji akurasi, presisi, dan linearitas serta penentuan LoD dan LoQ. Uji presisi dilakukan dengan menghitung persen recovery, yaitu 96,24%. Hasil uji presisi adalah 3,2%. Sementara itu, linearitas kurva standar diperoleh sebesar 0,9995 dengan LoD dan LoQ berturut-turut 0,0804 mg/g dan 0,2680 mg/g. Perhitungan konsentrasi Pb dalam sampel rambut hasil dari metode destruksi berturut turut 0,0139 ppm dan 0,1648 ppm. Hasil ini lebih tinggi dari LoD namun lebih rendah dari LoQ. Berdasarkan hasil analisis dapat disimpulkan bahwa metode destruksi ini dapat dipercaya atau valid untuk analisa kadar logam timbal (Pb) dalam rambut dengan SSA.

Kata Kunci : timbal (Pb), validasi, SSA.

PENDAHULUAN

Pencemaran lingkungan dapat menyebabkan terjadinya bahaya toksik padamanusia, dapat menyebabkan perubahan biosfer atau perubahan lingkungan luar. Haruslah dibedakan antara pencemaran lingkungan secara kimia dan secara fisika. Pencemaran secara kimia terjadi jika lingkungan tercemar akibat kerja kimia dari zat berbahaya dan pencemaran fisika misalnya terjadi peningkatan suhu air permukaan akibat stasiun listrik dan peningkatan suara (Mutschler, 1991).

Istilah lingkungan mencakup semua yang mengelilingi masing-masing organisme, terutama udara, tanah dan air. Seperti kita ketahui bahwa lingkungan hidup merupakan bagian yang di dalamnya terdapat manusia dan sumber daya manusia yang tidak dapat terpisahkan, oleh karena itu adanya suatu industri yang semakin pesat perkembangannya dapat menimbulkan dampak negatif seperti terjadinya pencemaran lingkungan (air, udara dan tanah) oleh suatu zat kimia dari industri tersebut dan akibatnya akan dirasakan baik oleh pekerja industri tersebut maupun oleh masyarakat yang berada disekitar kawasan industri tersebut (Katzung, 2004).

Berdasarkan pada profesi seseorang, maka kontaminasi logam timbal (Pb) dapat terjadi karena berhubungan langsung atau tidak langsung dengan sumber pencemaran logam timbal (Pb), sehingga orang yang bekerja dalam



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**Lead Content in Hair and Health Problems at Workers in
SPBU (Gas Station) of Gorontalo City in 2017. Public
Health Departement, State University of Gorontalo,
Gorontalo, Indonesia**

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Abstract

Lead (Pb) is a poisonous heavy metal and able to pollute environment as well as endanger health. Particle of Pb which pollutes air drives from combustion residue of motor vehicle, waste of factory production of alkyl Pb and Pb-oxide, combustion of charcoal and other addictive materials. The polluted air enters human body through process of respirations. Concentrate of Pb exposure is influenced by size of particle from lead compound as well as the inhaled air volume. Research samples are workers of SPBU in Gorontalo City to investigate Pb content accumulated in workers' body and its influence towards health problems. This research aims to investigate Pb content contained in hair of SPBU workers and accumulation of Pb metal in workers' body and its influence towards health problems. This is an analytical observational research with cross sectional study approach. The research applies *Atomic Absorbtion Spechtofotometry* (AAS) to analyze specimen. Finding of hair sample test shows that based on accumulation of Pb exposure towards 48 respondents, 40 of have exceeded the Threshold Limit value namely >2,00 ppm. Then analysis of linear regression shows that value of correlation (R) coefficient between Pb content in hair towards disease complaint is 0,422 with determinant coefficient (R^2) for 0,178.

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Analisis Paparan Timbal (Pb) Pada Petugas Stasiun Pengisian Bensin Umum (SPBU) CV. Arba di Kota Palu

Analysis of lead (pb) Exposure in Gas Station Worker (SPBU) CV. Arba in Palu City

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Abstrak

Polusi logam berat termasuk timbal (Pb) merupakan masalah yang serius di negara maju maupun negara berkembang seperti Indonesia. Polusi timbal berkaitan erat dengan proses pertambangan, asap kendaraan bermotor serta Industri yang menggunakan bahan baku timbal (Pb) seperti bahan bakar minyak yang mengandung bahan kimia beracun. Bahan bakar minyak dapat menghasilkan uap atau gas diudara yang menyebabkan dampak buruk bagi kesehatan manusia. Penelitian ini bertujuan untuk mengetahui paparan timbal (Pb) pada petugas SPBU CV. Arba. Penelitian ini menggunakan desain penelitian observasional analitik dengan pendekatan *Cross sectional study*. Sampel dalam penelitian ini diambil dengan menggunakan metode pengambilan sampel *Total Sampling* yaitu sebesar 40 responden. Hasil penelitian ini adalah ada hubungan yang bermakna antara paparan timbal (Pb) dengan jam kerja responden dengan nilai $p=0,004$, ada hubungan yang bermakna antara paparan timbal (Pb) dengan masa kerja responden dengan nilai $p=0,000$, dan hubungan yang bermakna antara paparan timbal (Pb) dengan kebiasaan merokok dengan nilai $p=0,001$. Kesimpulan dari penelitian ini adalah Pb dapat terakumulasi didalam tubuh dalam kurun waktu yang lama, akumulasi timbal (Pb) didalam tubuh khususnya kepada para petugas SPBU dapat dipengaruhi oleh beberapa faktor diantaranya ialah masa kerja yang lama, jam kerja yang lebih dari jam kerja normal, dan kebiasaan merokok. Selain melalui spesimen darah dan urin, akumulasi timbal (Pb) didalam tubuh seseorang juga dapat dideteksi melalui spesimen yang lain seperti rambut karna rambut dapat menyimpan akumulasi zat kimia didalam tubuh dalam kurun waktu yang lama.

Kata Kunci : Analisis Timbal (PB); Petugas SPBU

Abstract

Heavy metal pollution including lead (Pb) is a serious problem in both developed and developing countries such as Indonesia. Lead pollution is closely related to the mining process, motor vehicle fumes and industries that use lead (Pb) as fuel oil which contains toxic chemicals. Fuel oil can produce steam or gas in the air which causes adverse effects on human health. This study aims to determine the exposure of lead (Pb) to CV. Arba gas station officers. This study uses an analytic observational study design with a cross sectional study approach. The sample in this study was taken using the Total Sampling method that is equal to 40 respondents. The results of this study is that there is a significant relationship between exposure to lead (Pb) with the working hours of respondents with a value of $p = 0.004$, there is a significant relationship between exposure to lead (Pb) with the employment period of respondents with $p = 0.000$, and a significant relationship between exposure to lead (Pb) and smoking habits with p value = 0.001. The conclusion of this study is that Pb can accumulate in the body for a long time, lead accumulation (Pb) in the body, especially to gas station officers, it can be influenced by several factors, including long working hours, working hours that are more than normal working hours, and smoking habits. In addition to blood and urine specimens, the accumulation of lead (Pb) in a person's body can also be detected through other specimens such as hair because hair can store accumulation of chemicals in the body for a long time.

Keywords: Analysis Lead (PB); workers

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Correlation between Work Duration of Gas Station Operators with Mucociliary Transport Time, Hair Pb Level, and Nasal Cytogram

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Abstract- Gas station operators are groups of workers exposed to the risk of dangerous chemical compounds, particularly lead from gasoline and vehicle gas emission that are waiting for a refuelling queue or a vehicle that will depart after completing the refuelling. The research aimed at investigating the correlation between work duration of gas station operators with mucociliary transport time, hair Pb level, and nasal cytogram. The research used the analytic observational method with the cross sectional design, was conducted to the operators of gas station in Tamalanrea and in Gunung Bawakaraeng street from August 2017 until September 2017 with 30 people as total samples. Sample divided into two groups, gas station operator with work duration < 1 year for 15 people and gas station operator with work duration $\geq$ 1 year for 15 people and each sample was underwent mucociliary transport time examination, hair Pb level examination, and nasal mucosa cytogram examination. The research result indicates that the significant correlation between work duration and mucociliary transport time with p value <0.05 and OR value=11. There is a significant correlation between work duration and Pb hair level with p value <0.05 and OR value = 9.3. There is no significant correlation between work duration and eosinophil and neutrophil count with p value > 0.05.

Keywords: work duration, mucociliary transport time, lead (Pb), nasal cytogram.

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