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Comparative Study of Lead (Pb) Levels on the Goats Liver at Industrial and Non-Industrial Areas Using Atomic Absorption Spectrophotometry Method

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Abstract. The comparison of Lead in goat liver in an industrial and non-industrial area. The goat liver was drily digested, and then the ash of the goat liver dissolved with $HNO_{3(p)}$. Qualitative test using Inductively Coupled Plasma – Optical Emission (ICP – OES) where the sample results obtained I (Industrial area) = 0.088 ppm, sample II (Industrial area) = 0.080 ppm, sample III (Industrial area) = 0.086 ppm and sample IV (Non-Industrial area) = 0.022 ppm and Quantitative test determination of Pb content using Atomic Absorption Spectrophotometry (AAS) at a wavelength for Pb 217.0 nm. The result of the determination showed that the content in Lead of sample A (Non-Industrial Area) = 0.4585 mg/Kg, sample B (Non-Industrial Area) = 0.4490 mg/Kg, sample C (Industrial area) = 0.8761 mg/Kg and sample D (Industrial area) = 0.8622 mg/Kg. However, Pb of metal content fulfilled SNI 7387:2009 that 1.0 mg/Kg.

Keywords: Lead, Atomic Absorption Spectrophotometry, Goat Liver

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1 Introduction

Lead, known as Pb metal in the elemental composition, is a heavy metal that occurs naturally in the earth's crust and is spread to nature in small quantities through natural processes, including volcanic eruptions and geochemical processes. Pb is a soft bluish or grey metal with a melting point of 327.5°C and a boiling point of 1,740°C at atmospheric pressure. Lead has the dispersed atomic number of all the stable elements, 82. Group IV A with an atomic weight of 207.2. But this metal is very toxic.

Environmental pollution is not something new because ecological pollution has occurred since ancient times until now. Dumping certain chemical compounds from industrial and transportation activities causes the highest pollution. One of the most significant pollutants produced is Pb. Many industries use Pb in their production processes, such as the battery, paint, pesticides, pipe,

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and ceramics industries. As an anti-knocking agent, Pb is also used as an additive in fuel, especially gasoline. Pb is one of the dangerous chemicals that can harm health when it enters the human body. Health problems caused by Pb poisoning include anaemia, fetal disorders in pregnant women, increased blood vessel permeability, damage to the cerebrum, epilepsy, hallucinations, delirium, and diabetes (Palar. H, 2004).

The lead (Pb) contamination factor in goat livers can be caused by several things, including food factors and drinks consumed by these ruminants, where food such as grass, reeds and other leaves are contaminated with Pb metals as drinks that are often taken from running water. Snake River has been infected by industrial waste, either from exhaust gases or solid and liquid waste from industrial processes such as fertilizers, pesticides, and exhaust gases from vehicles produced from contaminated gasoline fuel in goat food and drink, which then enters the body. The blood absorbs animals, binds to blood proteins and is distributed throughout the body's tissues. The highest metal accumulation is usually in the liver detoxification organs and renal excretion. In these two networks, metals usually also bind to various types of proteins, both enzymes and other proteins called metallothionein (Darmono, 2001).

The heavy metal Pb can enter the body of living things through the digestive and respiratory tracts and accumulate in the body's metabolic organ systems. Research on animal innards has been carried out before. Pb was analyzed in the beef liver in the Deli Serdang area with Pb levels of 0.2 ppm (Merry Irasanti, 2012), and Cirebon beef liver analysis was 0.2931 mg/Kg (Evi, 2006). So that researchers are interested in analyzing the heavy metal Pb in the liver of slaughtered goats in the industrial area of Perbaungan area with the liver of non-industrial goats in the Sei Rampah area so that it can be used as a comparison to compare Pb levels in the livers of slaughtered goats in industrial areas and the non-industrial regions using the ICP method. (Inductively Coupled Plasma-Optical Emission Spectrometry) as a qualitative test and the SSA (Atomic Absorption Spectrophotometry) method with a wavelength of 217.0 nm as a quantitative analysis.

2 Materials and Methods

2.1 Preparation of Standard Pb^{2+} Solution

2.1.1 Pb^{2+} Standard Solution 1000 mg/L

A total of 1.5990 g of $Pb(NO_3)_2$ was put into an Erlenmeyer flask containing distilled water, stirred until all the crystals were completely dissolved, put into a 1000 mL volumetric flask, added distilled water up to the marked line and homogenized.

2.1.2 Pb^{2+} Standard Solution 100 mg/L

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A total of 10 mL of 1000 mg/L Pb standard solution was put into a 100 mL measuring flask and then diluted with distilled water up to the marked line and homogenized.

2.1.3 Pb 2+ Standard Solution 10 mg/L

A total of 10 mL of 100 mg/L Pb standard solution was put into a 100 ml measuring flask and then diluted with distilled water up to the marked line and homogenized.

2.1.4 Pb 2+ Standard Solution .3; 0.5; 0.7; 0.9 and 1.1 mg/L

Pipette 1.5 each; 2.5; 3.5; 4.5, and 5.5 mL of standard Pb^{2+} 10 mg/L solution was put into a 50 mL volumetric flask, added distilled water up to the marked line and homogenized.

2.2 Preparation of Standard Pb^{2+} Solution Calibration Curve

A total of 50 ml of a solution of the Pb^{2+} 0.3 mg/L standard series was measured for its absorbance by Atomic Absorption Spectrophotometry (AAS) at $\lambda = 217.0$ nm, and the same was done for the Pb^{2+} 0.5 standard series; 0.7; 0.9 and 1.1 mg/L.

2.3 Sample Ashing

Samples of goat liver cut into small pieces were put in a reusable cup and then in the oven to a constant weight, incinerated at 550°C for 7 hours in an electric furnace and then cooled in a desiccator.

2.4 Provision of Sample Solutions

As much as 10 g of sample ash obtained in dry digestion was put into a 250 ml beaker glass. Then, 10 ml of concentrated HNO_3 was mixed evenly to obtain a sample solution, heated for 30 minutes, and cooled. The sample solution was added 5 ml of concentrated HNO_3 was then heated on a hot plate to half the initial volume, filtered with Whatman No.42 filter paper, washed with hot distilled water, then the filtrate was put into a 10 ml volumetric flask and adjusted to pH = 3 and added with distilled water until marking line then homogenized.

2.5 Determination of Pb^{2+} in Samples

The digested sample solution was tested qualitatively with ICP-OES and then analyzed quantitatively with an Atomic Absorption Spectrophotometer (AAS) with a wavelength for Pb metal $\lambda = 217.0$ nm.

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3 RESULT AND DISCUSSION

Lead is a heavy metal with a high commodity value. Where Lead can be found in the Liver of Slaughtered Goats originating from Industrial and Non-industrial areas. The Perbaungan area is an industrial area with the potential for Goat Liver which contains heavy metals such as Lead.

Determination of Lead (Pb) content in Goat Liver found in industrial and non-industrial areas was done by destroying samples using the wet destruction method. The solvent selection was based on a qualitative separation analysis of the cation grouping where Pb is a group 1 cation and separation of this cation using HNO_3 (Vogel, 1985). Setting pH = 3 is done because a pH below 2 can cause equipment damage and corrosion; above pH 4, it causes metal deposition in the sample. Then the absorbance and concentration values of the samples were determined using an Atomic Absorption Spectrophotometer at a wavelength of 217.0 nm.

The standard series curve for Lead (Pb) metal was prepared by varying the concentration of the standard series solution using the Least Square Method so that a linear line equation for Lead metal Y = 0.0455X + 0.0003 was obtained. This study obtained the correlation coefficient for Lead (Pb) = 0.9945. It indicates a positive relationship or correlation between concentration and absorbance. Analytical research shows an excellent standard curve graph with a smaller price equal to 0.99.

In previous research, analysis of Pb metal on local and imported beef liver obtained the average metal content in Jakarta beef liver in wet weight is 0.1667 µg/g. Meanwhile, the Pb metal in Bogor beef liver is 0.3578 µg/ g. As for the metal Pb in Cirebon, beef liver is 0.2931 µg/g. The average content of Pb metal in New Zealand beef liver is 0.2915 µg/g. At the same time, the average range of Pb metal in Australian beef liver is 0.2280 µg/g. The Pb metal content in Bogor beef's liver is more significant than that of Jakarta, Cirebon, New Zealand and Australian cattle. (Evi, 2006)

From the research conducted, the levels of Lead (Pb) metal in sample A (non-industrial area) = 0.4585 mg/Kg, sample B (non-industrial area) = 0.4490 mg/Kg, sample C (industrial area) = 0 .8761 mg/Kg, and sample D (Industrial Area) = 0.8622 mg/Kg. The level of Lead metal in the sample of Goat Liver obtained when compared with the data in the attachment to the decree of SNI 7387:2009, shows that the content of Pb metal in Goat Liver got is still below the threshold permitted by SNI 7387:2009, namely 1. 0mg/Kg. The SNI data attachment shows the point for Pb in the goat liver. It can be observed by looking at the data from the analysis of lead levels, where the mean difference in lead levels in the livers of industrial and non-industrial slaughter goats is significant.

The presence of Lead (Pb) metal in the liver of the slaughtered goat comes from several factors, including food, beverages, polluted air from industrial waste, and exhaust gases from vehicles, such as food, namely grass or reeds consumed by ruminants. For example, goats have been

polluted by the heavy metal Pb as well as from the drinks consumed by these Rumansia animals, which then allows the metal to accumulate in the liver of the slaughtered goat and bind to enzymes in the liver of the slaughtered goat, both in the form of organic complexes and inorganic complexes in the liver cut goat.

4 Conclusion

Lead (Pb) metal content in sample A (non-industrial area) = 0.4585 mg/Kg, sample B (non-industrial area) = 0.4490 mg/Kg, sample C (Industrial area) = 0.8761 mg/Kg, and sample D (Industrial area) = 0.8622 mg/Kg. Next, the level of Lead (Pb) metal in the liver of beef goats in both industrial and non-industrial areas still meets the standards set by SNI 7387:2009, namely 1.0 mg /Kg.

References

Anderson, R., (1987). Sample Pretreatment and Separation. Chichester: John Wiley and Sons.

Central Bureau of Statistics for Deli Serdang Regency, (2012), 2011 PSPK Tabulation for Deli Serdang Regency.

Diapari, D., (2009), The Impact of Lead (Pb) Pollution Due to Acid Rain on Local Male Livestock Production, Accompanied, Graduate School of IPB.

Ebynthalina, Sembiring., (2006), Accumulation of Pb and Its Effect on the Condition of Swietenia Macropyhlla King Leaves, ITB, Bandung (Accessed February 26, 2014.

Fardiaz, S., (1992), Water and Air Pollution , Kanisius, Yogyakarta.

Irianto, K., (2008). Structure and Functions of the Paramedic Human Body. Publisher Yrama Widia, Bandung.

Kozlowski, TT, PJ Kramer, and SG Pallardy., (1991), The Physiological Ecology of Woody Plants, Academic Press Inc., London. (http://www.Amazon.com/The- Physiological-Ecology-Woody-Plants/dp/012424263). Accessed September 25, 2013.

Mukono, HJ, (2002), Environmental Epidemiology , Airlangga University Press, Surabaya.

Nasution, FA, (2004), Lead Hazards and Problems, Department of Environmental Engineering, ITB, Bandung.

Nugroho., (2005), Development Methods of Analysis Using ICP Tool - AES P Lasma 40 For Determination of AS and Sb Elements. Accessed November 8, 2013.

Palar, H., (2008), Pollution and Toxicology of Heavy Metals, Rineka Cipta, Jakarta.

Siregar, EBM, (2005), Air Pollution, Plant Responses and Their Effects on Humans, University of North Sumatra

Santi, N. (2001), Air Pollution by Lead (Pb) and its Control, University of North Sumatra (http://repository.usu.ac.id/handle/123456789/3542) Accessed October 9, 2013.

Velsunder., (2008), Leanerhelp Liver (http://http.learnerhelp.com.images/liver). Accessed October 16, 2013.

Widowati, Wahyu A., Raymond J., (2008), Toxic Metal Effects, Andi Offset, Yogyakarta.