THE 1ST JESICA
International Conference
and Call For Papers

Proceedings of The 1st Jakarta Economic Sustainable International Conference Agenda (JESICA)

ANALYSIS OF LEAD (PB) IN REFILL DRINKING WATER AT SUMBERSARI VILLAGE, MALANG CITY

Vika Septiana[1], Lukky Jayadi[1]

[1]Poltekkes Kemenkes Malang, Indonesia

vikaseptiana754@gmail.com

ABSTRACT

Drinking water is water whose quality meets health requirements and can be drunk directly, the health requirements in question are microbiology, chemistry, physics, and radioactivity. Therefore, before drinking water is consumed, it must meet these requirements to be safe in the body. One of the requirements in drinking water is chemical requirements in the form of lead metal (Pb). Lead (Pb)is a heavy metal that is a neurotoxin that can enter and accumulate in the human body so that the harmful effects on the body are increasing. This study aims to determine the levels of Pb in refill drinking water at the Refill Drinking Water Depot, Sumbersari Village, Malang City according to the Regulation of the Minister of Health Number 492 of 2010. The research method used is atomic absorption spectrophotometry. The procedure carried out was sample preparation in the form of refill drinking water using the wet digestion method using HNO3 and making 100 ppm Pb mains, 1.5, 10, 15, and 20 ppm working solutions. The determination of Pb levels was carried out using an atomic absorption spectrophotometer with a wavelength of 283.3 nm. The results showed that the levels of Pb in the three samples were 0.0000 ppm, which means that the refill drinking water sample did not contain Pb.

Keywords: *Refill drinking water, Pb, Atomic Absorption Spectrophotometry.*

INTRODUCTION

Water is the source of life for all living things, including humans. The function of water for life cannot be replaced by other compounds, because almost all human activities require water. Therefore, water resources must be protected so that they can be used properly by humans and other living things. The use of water for various purposes must be done wisely by taking into account the interests of present and future generations. Aspects of saving and preserving water resources must be instilled in all water users (Khaira, 2014).

According to the 2010 Basic Health Research data on the proportion of household drinking water sources in Indonesia, refilled drinking water is the most widely used drinking water source by the Indonesian people (14%) after dug wells are protected. Meanwhile, based on data from the Central Bureau of Statistics of the City of Malng in 2020, the percentage of main drinking water sources that are most widely used by households for drinking is branded bottled water or refilled water (48.92%), piped (27.06%), wells. protected (6.61%), and drilled/pump wells (17.24%). Increasing the attractiveness of the community, the quality in drinking water must be good. The requirements for drinking water quality must comply with the Regulation of the Minister of Health of the Republic of Indonesia No. 492/MENKES/PER/IV/2010 where there are two parameters, namely mandatory parameters and additional parameters which include chemical, microbiological, physical and radioactivity parameters. Chemical requirements, namely drinking water must not contain toxic chemical compounds and every substance dissolved in water has a certain allowable limit. One of the chemical requirements is lead (Pb). The presence of heavy metals in waters is harmful both directly to the life of organisms, and their effects indirectly to human health. This is related to the properties of heavy metals, which are difficult to decompose, so they are easy to accumulate in the aquatic environment and their natural presence is difficult to decompose (Ika et al, 2012).

This is corroborated by (Siaka, 2008) who in his research revealed that the decline in water quality was caused by the presence of pollutants, both in the form of organic and inorganic components. Inorganic components, including heavy metals are dangerous. Heavy metals are still a metal group with the same criteria as other metals. The difference lies in the effect that is caused when this metal is given or enters the body of a living organism. Although all heavy metals can cause poisoning in living things, some of these heavy metals are still needed in very small amounts. If the very few needs are not met, it can be fatal for the survival of the organism (Rusman, 2010).

Lead (Pb) is a heavy metal which is a neurotoxin that can enter and accumulate in the human body so that the harmful effects on the body are increasing. According to the Regulation of the Minister of Health Number 492 of 2010 concerning Requirements for Drinking Water Quality, it is stated that the permissible level of lead (Pb) in drinking water is 0.01 mg/L. The impact of lead (Pb) accumulation in the human body, namely in children, can cause disturbances in the early stages of physical and mental growth which then results in the function of intelligence and academic ability. When lead (Pb) is distributed to soft tissues, it is deposited

in bones and teeth. Deposits in bone will increase the risk of osteoporosis. If the concentration of lead (Pb) increases, there will be anemia and damage to brain function and kidney function failure, while lead poisoning (Pb) in adults is characterized by symptoms such as paleness, pain, and paralysis (Moelyaningrum, 2017).

MATERIALS AND METHODS

This research uses a descriptive type of research to determine the level of lead (Pb) contained in refill drinking water using an atomic absorption spectrophotometer. The research was conducted in March-April 2021, with the research location, namely the Chemistry Laboratory, Faculty of Mathematics and Natural Sciences, State University of Malang for the analysis of Pb in refilled drinking water using the Atomic Absorption Spectrophotometer instrument. The independent variable used was lead (Pb), the dependent variable used was refilled drinking water.

Tools and materials

Tool

The tools used are beaker, stir bar, spatula, analytical balance, watch glass, Atomic Absorption Spectrophotometer (SSA), pH meter, micropipette, 50 ml volumetric flask, 100 ml erlenmeyer, 100 ml volumetric flask, 1000 ml volumetric flask , 10 ml volume pipette, 20 ml test tube, 100 ml beaker, 500 ml beaker, and hotplate.

Ingredients

The materials used are refillable drinking water, Whatman paper no. 41 aquades, nitric acid (HNO3) solution, 100 ppm Pb mother liquor, Pb 1 solution; 5; 10; 15; and 20 ppm

How it Works

Sample Preparation

a) Pipette a 50 ml refilled drinking water sample and put it into a 100 ml Erlenmeyer

b) Added 5 ml of concentrated HNO3 and covered with a funnel

c) Heated on a hot plate until the solution is clear and the volume is approximately 15 mL-20 mL

d) Cooled and filtered using whatman paper no. 41

e) Transferred to a 50 mL volumetric flask

f) Cool and add aquades to the mark

Preparation of 100 ppm Pb Master Solution

a) Weighed 0.16 grams of Pb(NO3)2

b) Put in a 1000 ml beaker

c) Add a small amount of 1:1. HNO3 solution

d) Added 10 ml of concentrated HNO3

e) Limited by aquades

Preparation of Pb Work Standard Solution

a) Prepared a solution with a concentration of 1; 5; 10; 15; and 20 ppm

b) Pipette the standard solution of Pb(NO3)2 100 ppm as much as 0.1; 0.5; 1; 1.5; and 2 mL

c) Put into each 10 mL volumetric flask and dilute with distilled water to the mark

Lead standard calibration curve measurement

a) Add each standard solution 1; 5; 10; 15; and 20 ppm which had been prepared by being injected into AAS and then the absorption was measured at a wavelength of 283.3 nm.

b) The measurement results are recorded and then a calibration curve is made.

Measurement of lead (Pb) levels in the sample

a) Added a refilled drinking water test sample which had been prepared by being injected into AAS and then its absorption was measured at a wavelength of 283.3 nm.

b) Record the measurement results obtained

RESULTS AND DISCUSSION

In the analysis of Pb levels, refill drinking water samples were used. The refill drinking water analyzed is refill drinking water sold in Sumbersari Village, Malang City with 3 different Refill Drinking Water Depots. Sampling was done using a glass bottle, because if a plastic bottle is used, the water sample being tested will react with the chemicals contained in the plastic. In this research, the analysis of Pb in refilled drinking water used the Atomic Absorption Spectrophotometry method. Atomic Absorption Spectrophotometry is an analytical tool that is mainly used for the analysis of very small amounts of metal because it is very sensitive. The working principle of this tool is based on the evaporation of the sample solution then the metal contained in it is converted into free atoms. The atom absorbs radiation from a light source to be emitted from a cathode lamp containing the element to be determined. The amount of radiation absorption is then measured at a certain wavelength (Artati, 2018). The Atomic Absorption Spectrophotometry method is based on the interaction between the analyte in the sample at the atomic scale and the energy coming from the radiation source. Atomic Absorption Spectrophotometry method is used because it has good sensitivity and accuracy, so

it is suitable when used for analysis of dissolved metals in water samples. When compared with other spectrophotometer methods, Atomic Absorption Spectrophotometry has advantages because the analysis process can be carried out more quickly, selectively and the sample preparation is relatively easy to do (Sumantri, 2013).

The absorbance measurement of the sample solution was carried out using an Atomic Absorption Spectrophotometer with a wavelength of 283.3 nm by turning on the instrument and computer then checking the readiness of the equipment (cathode lamp, gas, detector pressure, heater, etc.), and removing excess gas. The next step is the compressor pump is turned on, then the test solution is aspirated (Ade, 2012). Furthermore, the following results will be obtained:

Table 1. Data Analysis of Pb Levels in Refill Drinking Water

No	Sample code	Pb Level (ppm)
1.	Sample A	0,0000
2.	Sample B	0,0000
3.	Sample C	0,0000

Based on the research results obtained, the 3 samples of refill drinking water tested had levels of 0.000 ppm each. This illustrates that the refill drinking water tested was free from the danger of Pb metal, because the Refill Drinking Water Depot tested was located far from the gas station so that it was free from environmental pollution and there were no factories with Pb waste in the surrounding environment so that there were no substances that pollute the depot. refill drinking water. Thus the Refill Drinking Water Depot can produce good quality drinking water. This is in accordance with the Regulation of the Minister of Health of the Republic of Indonesia Number 43 of 2014 concerning Sanitation Hygiene for Drinking Water Depots. In addition, the Refill Drinking Water Depot is also likely to be regularly monitored by the Malang City Health Service so as to produce good water quality. Another factor that affects the results is the type of pipe used. The pipe that is widely used by the public is PVC pipe because it has a cheap price and is durable (40-50 years of use). Pb compounds in PVC are used as heat stabilizers. The longer the use of the PVC pipe, the extraction of the Pb also decreases because the Pb content in the pipe has decreased with use (Hasanuddin, 2008). In addition, it is possible that the Refill Drinking Water Depot will be tested using a reverse osmosis method of disinfection. Reversed is a process of purifying water through a semipermeable membrane at high pressure (50-60 pounds per square inch (psi)). A semipermeable membrane is a molecular-scale filter membrane that can be penetrated by water molecules easily, but cannot or is difficult for other molecules larger than water molecules to pass. Reversed osmosis membranes produce 99.99% pure water. Its diameter is 0.0001 microns (500,000 times smaller than a hair). Its function is to filter microorganisms such as bacteria, viruses and heavy metals. This Reversed osmosis filtering technique prevents the presence of Pb in drinking water (Fitri Wahyu, 2017).

CONCLUSION

Based on the research of Pb analysis from three refill drinking water depots, Sumbersari Village, Malang City which was tested, the results obtained were that it did not contain Pb. So these results indicate that the tested refill drinking water has met the requirements for drinking water quality chemical parameters of lead content <0.01 mg/L based on the Regulation of the Minister of Health Number 492 of 2010 concerning drinking water quality. It is recommended that the concentration of the standard solution made is below 0.01 ppm and for further researchers it is possible to analyze other metal elements in refilled drinking water.

REFERENCES

Ade Firmansyah. 2012. Analysis of Lead Heavy Metal Levels in Guci Mountain Springs Using Atomic Absorption Spectrophotometry Method. Faculty of Pharmacy, University of Muhammadiyah Purwokerto.

Artati. 2018. Analysis of Lead (Pb) Levels in Water Through Distribution Pipelines for Regional Drinking Water Companies (PDAMs) Makassar. Department of Health Analyst Poltekkes Kemenkes Makassar

Fitri Wahyu Febriwani, Aisyah Elliyanti, Mohamad Reza. 2017. Analysis of Lead Levels (Pb) of Refillable Drinking Water at Drinking Water Depots (DAM) in Padang Timur District, Padang City in 2017. Faculty of Medicine; Andalas University. West Sumatra.

Hasanudin MI. 2008. Study of the impact of using PVC plastic on the environment and its alternatives in Indonesia. Depok: University of Indonesia

Ika. 2012. Analysis of ferrous metal (Fe) in seawater in the coastal area of the Taipa ferry port, North Palu sub-district. Palu: Tadulako University.

Khaira, Kuntum. 2014. Analysis of Copper (Cu) and Zinc (Zn) Levels in Gallon Bottled Drinking Water in Lima Kaum District, Tanah Datar Regency. Journal of Science and Technology Vol. VI No. 2: 116-123, December 2014.

Moelyaningrum, A. D. 2017. Correlation between blood lead level (BLL) and osteoporosis in postmenopausal women in Surabaya Indonesia. Proceeding of the 1st International Symposium of Public Health. Emerging and Re-emerging Disease. S3 Health Sciences, Faculty of Public Health, Airlangga University, p:190-197.

Rusman. 2010. Analysis of metal content of chromium (Cr) and lead (Pb) in Palu river estuary water. Untad Press, Palu.

Siaka. 2008. Correlation between sediment depth at Benoa harbor and heavy metal concentrations of Pb and Cu. Journal of Chemistry, 2(2), 61-70.

Sumantri. 2013. Environmental Health. Jakarta: Kencana Prenada Media Group.