Analysis of The Heavy Metal Content of Pb, Cu and Hg in Leachate at Final Waste Disposal Batu Bola Padangsidimpuan City

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Abstract. Safe and proper disposal of waste is an important component in integrated waste management. The method of accumulating garbage in landfills (TPA) can result in a decrease in environmental quality due to air pollution due to solid waste burning, groundwater pollution due to leaching, and an increasing number of disease vectors that can endanger the health of waste collectors and residents around the landfill. The purpose of this study was to determine the metal content of Lead (Pb), Mercury (Hg) and Copper (Cu) in the leachate of TPA BatuBola. This research method uses descriptive exploratory method by conducting a survey first. Atomic Absorption Spectrophotometer is a tool used in this study. Data analysis was carried out by comparing the test result data with the quality standards by Permen LHK P.59 / 2016 and Permen LHK No.5 / 2014. The data shows that the concentration of Hg metal is <0.0004 mg / L. Meanwhile, the threshold set by the government is 0.005 mg / L. The concentration of lead metal (Pb) also shows a value that is below the quality standard threshold, namely <0.003 mg / L, while the set limit is 0.1 mg / L. As well, the measurement of copper metal (Cu) is still below the quality standard threshold, namely <0.006 mg / L, while the limit set by the government is 2.0 mg / L. However, caution must be exercised because if it is accumulated in large quantities it can still be dangerous.

1. Introduction
Leachate (leachate) is a liquid that seeps through a pile of waste carrying dissolved or suspended material, especially the result of the decomposition of waste matter[1]. Leachate is a type of pollutant that has a high potential to pollute the environment around the landfill because it contains very toxic materials[2]. Leachate that seeps into the soil will cause direct groundwater pollution[3]. The composition of leachate is influenced by several factors such as the type of waste deposited, the amount of rainfall in the landfill area and the specific conditions of the dumpsite. [4]. Leachate generally contains high levels of organic and inorganic compounds heavy metals[5]. Leachate from the landfill has the potential to contain several heavy metals, including cadmium (Cd), lead (Pb),...
copper (Cu), chromium (Cr), mercury (Hg) and zinc (Zn) in landfill (Final Disposal Place). TPA is a place for storing various kinds of waste so that leachate contains various types of pollutants that have the potential to disrupt the environment and human health. Leachate can seep into the ground, or flow on the ground and empties into river water flow. Each landfill has different leachate characteristics depending on the processes that occur in the landfill, which include physical, chemical and biological processes. [6] who conducted a study on the characteristics of leachate in landfills in Riyadh City, Saudi Arabia found that leachate in these locations contained Chemical Oxygen Demand (COD), Biology Oxygen Demand (BOD), Electrical Conductivity (EC), Total Suspended Solid (TSS) with a high concentration but has a low pH value. In addition, leachate in the Riyadh City TPA contains Fe, Mn, Mo, Ni, Cr, Zn and Cu. Zub[7], found that the test results of leachate samples at TPA Maros South Sulawesi had high COD, BOD and TSS values. [8] conducted a study to determine the characteristics of leachate in TPA Air Hitam in Puchong Selangor and found that leachate had very low COD and relatively high heavy metal concentrations for Fe, Zn, Pb and Ni while Mn, Cd, Cu and Cr were found to be relatively low.

The disposal system applied to the Batu Bola landfill in Padangsidimpuan City is an open dumping system, where garbage is piled up without any geotextile layers and leachate channels. The process of continuous landfilling in the final disposal site (TPA) produces pollutants in the form of leachate (leachate) as a result of the infiltration of rainwater that enters the landfill. Research on the content of heavy metals in the leachate of TPA Batu Bola has never been carried out, therefore it is necessary to conduct research on the content of heavy metals in leachate at the Batu Bola landfill.

The purpose of this study was to determine the content of heavy metals Pb, Cu and Hg in the leachate of Batu Bola landfill. The benefit of this research is to provide initial information regarding the heavy metal content in the leachate of Batu Bola landfill so that it can be used as a reference material in controlling pollution.

2. Methods
The materials used are liquid waste media or leachate at Batu Bola landfill, Padangsidimpuan City, to be precise in Batu Bola Village, Padangsidimpuan Selatan District. The heavy metals used are Pb, Cu and Hg. The parameters tested were metal content or metal concentration. The equipment used consists of AAS, plastic sample bottles of 1.5 L size, label paper, stationery. The leachate samples were analyzed through a digestion process using AAS (Atomic Absorption Spectrophotometer) at a wavelength of 283.3 nm. The liquid was analyzed to determine the content of heavy metals in the sample with the standard procedure of SNI 6989.8-2009 which was carried out at the Testing Laboratory of the Medan Industrial Research and Standardization Center.

The levels of heavy metals Pb, Cu and Hg in leachate obtained from the test results are then compared with the individual water quality standards set by the Government, namely through Permen LHK P.59 / 2016 and Permen LHK No.5 / 2014.

3. Results and Discussion
3.1 Heavy Metal Content in TPA Leachate Water
Leachate has certain characteristics, this is because the waste disposed of at the landfill comes from various different sources with different types of waste. The composition of leachate is not only influenced by the characteristics of waste (organic and inorganic), but also the ease of decomposition (soluble / insoluble), the condition of the waste pile (temperature, pH, humidity, and age), the characteristics of the water source (quantity and quality of water supplied), influenced by climate and hydrogeology, cover soil composition, nutrient availability, and microbes and the presence of inhibitors. Climate is an important factor affecting the quantity and quality of leachate. [9]. Becomes the transport phase for washing and migration of contaminants from the garbage heap, also affects biology. Likewise, the age of the pile of garbage also affects the quality of leachate and gas formed. Changes in the quality of leachate and gas are the main parameters to determine the level of stabilization of waste piles [10].The entry of chemical substances contained in leachate into the
aquatic ecosystem can also affect the existing biota. If in the aquatic ecosystem there is pollution, it can cause the death of biota or affect physiological activities, cell formation and cell tissue function of an organ[11]. The variation in leachate composition is influenced by several factors, including: composition and age of waste, location and operation as well as landfill conditions, climate and hydrogeological conditions, humidity, temperature, pH, and level of stabilization [12].

Leachate has the characteristics of containing dissolved organic matter (CH4, voicyl fatty acid); inorganic macrocomponents (such as Ca^{2+}, Mg^{2+}, NH4^+, Cl^-, SO4^{2-}) heavy metals such as Pb, Cd, Cr, Cu, Ni, Hg, and others (San, 2001). Leachate from landfills has caused serious pollution. Organic compounds include aromatic hydrocarbons, phenols in groundwater, with very high concentrations of ammonium, heavy metals, and organic contaminants. In general, the main parameters used to describe the contaminant concentration in leachate are COD, ammonia. Nitrogen (NH4-N), Suspended Solids (SS), Dissolved Solids (DS), heavy metals, and salts [11].

The results of measuring the levels of Hg, Pb and Cu in leachate water at Batu Bola landfill show that the content of heavy metals Hg, Pb and Cu in leachate is still very low, data shows the detection of Hg, Pb and Cu metal concentrations is still below the AAS detection limit.

| Parameter | Results | Unit | Method |
|-----------|---------|------|--------|
| Mercury   | <0.0004 | mg/L | SNI 6989.8-2009 |
| Lead      | <0.003  | mg/L | SNI 6989.8-2009 |
| Copper    | <0.006  | mg/L | SNI 06-2462-1991 |

Measurement of mercury (Hg) levels in leachate using AAS is <0.0004 mg/L. The data shows that the Hg metal content in leachate is still below the threshold set by the government, which is 0.005 mg/L. The concentration of lead metal (Pb) also shows a value that is below the quality standard threshold, namely <0.003 mg/L, while the set limit is 0.1 mg/L. Likewise, the measurement of copper metal content (Cu) is still below the quality standard threshold, namely <0.006 mg/L, while the limit set by the government is 2.0 mg/L. The heavy metal content of copper probably comes from the waste of electrical equipment, pipes and wire.[13].

| Parameter | Value | Unit |
|-----------|-------|------|
| Mercury   | 0.005* | mg/L |
| Lead      | 0.1**  | mg/L |
| Copper    | 2.0**  | mg/L |

Information:
* = Permen LHK P.59/2016 about the quality standards of leachate water
** = Permen LHK No.5/2014 regarding waste quality standards that have not been determined.

Essential heavy metals are metals with certain concentrations needed by organisms, but these metals can cause toxic effects if excessive amounts such as the Cu concentration found in the leachate of Batu Bola landfill are classified as essential heavy metals. But you have to be careful because if it accumulates in large quantities it can still be dangerous. Non-essential heavy metals, metals whose benefits are not known in the body, are even toxic, such as Hg and Pb. Based on the results of the analysis, the metal concentration is still below the threshold set by the government, namely the Permen LHK P.59 / 2016 concerning the quality standard of leachate and / or final waste treatment activities. However, you also have to be careful because the heavy metals in these non-essential...
groups are toxic. Considering that in the future Indonesia is still faced with the problem of environmental pollution due to development, the efforts to restore and rehabilitate polluted land need mutual attention. At present, although phytoremediation technology has not been widely applied in restoring soil and water pollution, in the future it is hoped that it will become one of the potential environmental cleaning technologies supported by plant biodiversity in Indonesia that can be used as an accumulator boost plant, so that sustainable development programs can be achieved. [14].

4. Conclusions
Based on the measurement results of several parameters that have been carried out on the content of mercury, copper and lead in the leachate of Batu Bola landfill, it shows that the mercury, copper and lead content are still below the threshold set by the government. The data shows that the concentration of Hg metal is <0.0004 mg/L. Meanwhile, the threshold set by the government is 0.005 mg/L. The concentration of lead metal (Pb) also shows a value that is below the quality standard threshold, namely <0.003 mg/L, while the set limit is 0.1 mg/L. Likewise, the measurement of copper metal content (Cu) is still below the quality standard threshold, namely <0.006 mg/L, while the limit set by the government is 2.0 mg/L. However, caution must be exercised because if it is accumulated in large quantities it can still be dangerous.

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