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Research

Identification of Lead and Cadmium Contaminants in Borehole Water in Tamangapa Village

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ABSTRACT

The process of gradually stockpiling waste in landfill areas can produce problems in the form of leachate that can seep into the soil and rivers, which can cause a decrease in groundwater quality. The type of research used in quantitative research with observational descriptive method. The three borehole water samples taken from the research site contained cadmium and lead. The results of cadmium levels obtained (0.00001 mg/L) meet the requirements for clean water quality according to PERMENKES No. 416 of 1990 (0.005 mg/L), while lead levels in the first and second samples meet the requirements for clean water quality (<0.05 mg/L), while in the third sample, the lead level obtained was 0.0527 mg/L, which exceeds the amount required for clean water quality (0.05 mg/L).

1. Introduction

The process of gradually stockpiling waste in landfill areas can produce problems in the form of leachate, which can seep into the soil and rivers can causing a decrease in groundwater quality. Water pollution is the contamination of water bodies (such as oceans, seas, lakes, rivers, groundwater, and others) caused by human activities. Changes in the physical, chemical, or biological properties of water will have adverse consequences for living organisms.

Water pollution results in a freshwater crisis, threatening drinking water sources and other important needs for humans and other living things. The decline in groundwater quality can also be identified by identifying heavy metal pollutants such as chromium (Cr), lead (Pb), and other metals. Landfill has very potential to seep into groundwater (Sugianti et al., 2016).

Non-essential heavy metals are classified as toxic metals. The presence of non-essential metals in the body is still unknown and can cause adverse effects on human health. Metals classified as non-

essential metals include mercury (Hg), cadmium (Cd), lead (Pb), Zinc (Zn), chromium (Cr), and arsenic (As) (Ministry of Environment, 2021).

Regulation of the Minister of Health of the Republic of Indonesia Number 416 of 1990 concerning Water Quality Requirements, the maximum levels allowed in clean water are Cadmium (Cd) at 0.005 mg/l, and Lead (Pb) at 0.05 mg/l. Minister of Health Regulation No. 492 of 2010 on Drinking Water Quality Requirements stipulates that the allowed cadmium level in drinking water is 0.003 mg/l while the allowed lead level is 0.01 mg/l. If metal levels exceed the threshold value, it will cause health problems.

Makassar Mayor Regulation No. 70/2019 is considered not to have touched the root of the problem of high consumption of single-use plastics because this regulation only describes some types of waste that will be managed by landfills. In the 2019-2020 period, the amount of plastic waste production increased from 258 tons/day to 294 tons/day (Iman et al., 2021). Other data shows that household waste in Makassar City reaches 700-800 tons/day and increases to 1200-1500 tons/day on certain days (Harun & Sokku, 2022). This picture shows that, in reality, waste management in Makassar City has not touched the root of the problem, namely the missing link between regulations issued by the government and the consumptive behavior of the community.

Based on data from UPT Tamangapa (2021), the amount of waste generated every day in Makassar City reaches 800-900 tons/ day. The sources of waste generation consist of household waste, office waste, market waste, shopping center waste, waste originating from commercial areas, industrial areas, special areas, social facilities, public facilities, and so on. The types of waste in the Antang landfill are organic waste, plastic waste, cloth waste, paper waste, wood waste, glass waste, cans, metal, and rubber waste (UPTD Tamangapa Raya, 2021). (Waste Generation Data 2021).

This research is in line with research conducted by Rino (2022). The results of the examination of pH, canal water temperature, and examination of heavy metals lead (Pb) in Hertasning canal water do not meet the quality standards according to Legislation Number 82 of 2001.

The purpose of this study was to determine the concentration of Lead in borehole water in Tamangapa Antang village and to determine the concentration of cadmium in borehole water in Tamangapa Antang village.

2. Method

The type of research used in this study is quantitative research with the descriptive observational method. The population in this study is borehole water in Tamangapa Antang Village, Makassar and samples as many as 3 points in 3 residents' houses with different depths. Measurement using atomic absorption spectrophotometry in the form of lead and cadmium absorption data from the sample solution, and then the concentration is determined using a linear regression equation. Sample preparation was carried out by taking 50 mL of sample water and putting it into a 100 mL Erlenmeyer, adding 2.5 mL of concentrated HNO3, and diluting until 10-15 mL remained, and then cooled to room temperature. The results of the deconstruction are filtered in a 50 mL volumetric flask, and mineral-free water and the sample is ready for testing using an atomic absorption spectrophotometer (SSA).

3. Results & Discussion

The data collected in this study were collected through the distribution of questionnaires to residents who live in the Tamangapa Makassar urban landfill area. Water sampling was obtained from residents' homes within 100-150 meters of the landfill site. Questionnaires obtained from respondents are important to determine the characteristics of respondents who are sampled in this study.

Based on the analysis of cadmium and lead levels using the Atomic Absorption Spectrophotometry (AAS) method, the following results were obtained:

Table 1. Measurement results of lead and cadmium levels

Sample Code	Parameter (mg/L)		Requirements	
	Cadmium (Cd)	Lead (Pb)	Cadmium (Cd)	Lead (Pb)
Sample I	<0.00003	<0.0001	0.005 mg/L	**0.05 mg/L**
Sample II	<0.00003	<0.0001		
Sample III	**0.001**	**0.0527**		

Sampling of borehole water in the area around the Antang landfill was carried out precisely in residential areas at a distance of ±100-200 meters from the landfill site. The first sampling is ±150 meters to the west of the landfill site, the second sample is ±100 meters to the north of the first sample location, and the third sampling is ±200 meters to the south of the first sample location. Of the three sampling locations, the first sampling location is closer to the landfill than the other locations, but in terms of elevation, the third sampling location is lower in elevation than the other locations.

The results showed that borehole water at point 1 and point 2, with a distance of ± 100-150 meters from the landfill, site showed Pb and Cd levels that were smaller than the requirements for clean water quality according to PERMENKES No. 416 of 1990 (Pb < 0.0001 mg/L and Cd < 0.00003 mg/L). However, it is different from the third point location, where, from the analysis results, the Pb metal in the borehole water exceeds the maximum level (0.0527 mg/L). So it can be said that the well water at that location has been polluted and is not suitable for consumption or for washing food ingredients. This is because the third sampling location is lower in elevation than the landfill compared to sampling locations 1 and 2.

Research conducted by (Ningsih, 2020) shows that the water quality in the six sampling locations is not suitable for use as a clean water source because the level of value in each location obtained based on the calculation of the NSF - WQI (National Sanitation Foundation - Water Quality Index) calculator is still low, which is less than 50%, which means poor water quality. This is due to the proximity of the well to the landfill

4. Conclusion

The results of research conducted on the contamination of Lead and Cadmium in borehole water in Tamangapa village obtained the following conclusions: 1. Borehole water with a distance of ± 100-150 meters from the Tamangapa landfill area contains metals Lead (Pb) and Cadmium (Cd)

2. Of the three samples analyzed, in the third sample Lead (Pb) levels exceeded the maximum limit of clean water quality requirements according to PERMENKES No. 416 of 1990 (0.0527>0.05). 3. Of the three samples analyzed, the cadmium (Cd) level does not exceed the maximum limit of clean water quality requirements according to PERMENKES No. 416 of 1990 (0.00001 <0.05).

Based on the results and conclusions obtained, it is necessary to conduct further research related to microbial contamination of borehole water around the landfill site. There is also socialization from the Tamangapa village government about the dangers and impacts of water contamination.

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