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Environmental Health Risk Analysis of Exposure To Cadmium in Local Water Company Tirta Anoa Water Communities in The Mandonga District Area, Kendari City

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ABSTRACT

Introduction: Local Water Company in Kendari city has 4 sources, namely the Konaweha (Pohara) river, Wanggu river, Anggoeya river, Matabondu spring. The Konaweha River is one of the rivers that has a high potential for being polluted by nickel mining activities.The Konaweha river is in the lightly polluted category. The presence of heavy metals in the environment causes accumulation in aquatic biota.

Method: This research uses quantitative research in the form of a descriptive survey with a cross sectional research design. Analytically, data from variable measurements is analyzed using the Environmental Health Risk Analysis formula to determine health risks due to exposure to lead in community drinking water and risk management from cadmium pollution to public health.

Result: Description of cadmium concentration in Local Water CompanyTirtaAnoa water, Mandonga subdistrict, Kendari city after sampling and laboratory testing at 3 points, namely the first point in Mandonga sub-district with a cadmium concentration of 0.002 mg/L, the second point in Korumba sub-district with a cadmium concentration of 0.001 mg/L , and at the third point in Anggilowu sub-district with a cadmium concentration of 0.002 mg/L.

Conclusion: The conclusion in this journal The respondent's risk level based on the RQ calculation value is still < 1, which means that people who receive water from Local Water Company Tirta Anoa, Kendari City in the Mandonga sub-district area have no risk of health problems now and in the next 30 years.

Introduction

Water is a very important need for the needs of humans, animals and plants, and is one of the natural resources that is really needed for the continuity of human life.[1] The need for clean water continues to increase considering that the population growth rate continues to increase. The quality of waters and fisheries can always change

both in terms of quality and quantity, this can be influenced by the activities of living creatures.[2]

The World Health Organization (WHO) estimates that 844 million people do not have a basic drinking water source and that 230 million people spend more than 30 minutes/day collecting water from improved water sources. This shows that there are still many people in the world whose needs for clean water are not being met quickly and many even have difficulty getting clean water to meet their daily needs.[3]

One of the most dangerous chemicals is heavy metals. Heavy metals are found in many raw materials and media used in various types of industry, the entry of this waste into waters can reduce the quality of waters and can cause pollution to these waters.[4] Heavy metals are elements that cannot be decomposed (persistent) and can accumulate through the food chain (bioaccumulation), with long-term effects that can be detrimental if exposed to living things.

Heavy metals will be more dangerous if they are contaminated with the environment. One type of heavy metal that can pollute water is cadmium (Cd). Cadmium (Cd) is contaminated in water as a result of mining processes, industrial waste and metal welding. As a result of these activities, river water becomes unfit for consumption because it is contaminated with the heavy metal cadmium. If water contaminated with heavy metals is consumed, it will have fatal consequences for the body and can cause high blood pressure, damage to testibular kidney tissue, and damage to red blood cells.

Chemical contamination that enters the ecosystem in a body of water can become a very big problem in the environment. Contamination of cadmium metal exposed in aquatic ecosystems can be related to domestic, industrial or factory waste and can be caused by other human activities. Contamination of cadmium metal that has been exposed will cause effects that can cause death if exposed in very large quantities and can cause an ecological imbalance and the diversity of aquatic organisms.

Local Water Company in Kendari city has 4 sources, namely the Konaweha (Pohara) river, Wangguriver, Anggoeya river, Matabondu spring. The Konaweha River is one of the rivers that has a high potential for being polluted by nickel mining activities. Indicators of polluted water are changes or signs that can be observed, including: temperature; pH; color, smell and taste; the emergence of precipitates, colloids and solvents; presence of microorganisms; and increased radioactivity of environmental water. In water there are heavy metals which can have morphological, physiological and even death effects on organisms.[5]

Based on the results of research conducted by [6], the Konawe hariver is in the lightly polluted category. The presence of heavy metals in the environment causes accumulation in aquatic biota. Exposure to heavy metals in animals and humans can have acute, sub-acute and chronic toxic effects. Chronic toxic effects occur if the chemical accumulates in the biological system (absorption exceeds excretion biotransformation) or if it produces toxic effects that are not reversible or if there is not enough of the biological system to recover from damage over the frequency interval of exposure, or exposure occurs repeatedly.[7]

The purpose of this study is to analyze the environmental health risk of exposure to cadmium in Tirta Anoa Water Supply in the Community in the Mandonga District, Kendari City.

Method

This research uses quantitative research in the form of a descriptive survey with a cross sectional research design. Analytically, data from variable measurements is analyzed using the Environmental Health Risk Analysis formula to determine health risks due to exposure to lead in community drinking water and risk management from cadmium pollution to public health.

Result

Measuring the concentration of the heavy metal cadmium in the water of Local Water Company Tirta Anoa, Mandonga district, Kendari city, which is commonly consumed by the people in the research area, is necessary in order to determine the level of risk that exists. Complete measurement results can be seen in the table below.

Table 1.
Concentration of the Heavy Metal Cadmium in Local Water CompanyTirtaAnoa Water, Mandonga District Kendari city, Southeast Sulawesi in 2023

Location	Cadmium
MandongaSubdistrict	0,002 mg/L
KorumbaSubdistrict	0,001 mg/L
AnggilowuSubdistrict	0,002 mg/L
Average	0,0016

Based on table above, the results show that the average concentration value of the heavy metal cadmium in the water of Local Water CompanyTirtaAnoa, Mandongadistrict, Kendari city is 0.0016 mg/L. The analytical method used to measure the metal content is by using Atomic Absorption Spectrophotometry (AAS).

Risk Characteristics

To determine the risk level of exposure to the heavy metal cadmium for each respondent or sample of people who consume Local water CompanyTirtaAnoa water in the Mandongadistrict, Kendari city, it is calculated by calculating the intake divided by the RfD value of each metal. The content of the heavy metal cadmium in the water of Local Water CompanyTirtaAnoa city Kendari. To determine the risk level (RQ) of individuals (respondents), it is calculated based on the current duration of exposure (real time) and predictions for the next 30 years. Assuming that data on variables related to intake, namely cadmium concentration, intake rate, frequency of exposure, and body weight, have not changed for 30 years.

Based on the results of calculating the intake and risk level (RQ) of exposure to the heavy metal cadmium in 98 respondents who consumed Local Water Company Tirta Anoa water, Mandonga district, it shows that respondents or people who consumed Local Water Company Tirta Anoa water in the Mandonga district, Kendari city, have no health risks for the next 30 years. because the RQ value for the heavy metal Cadmium for each respondent is still below 1 or < 1. Assuming that the heavy metal content of Cadmium only focuses on Local Water Company water consumed by the community around Mandonga district and the concentration value and other variable values will not change for the next 30 years.

Risk management

In Environmental Health Risk Analysis, the principle of risk management is carried out if the risk level (RQ) is > 1. From the calculation results, it is found that the risk level for individual people who consume Local Water Company Tirta Anoa water in the Mandonga district, Kendari City, Southeast Sulawesi, which is contaminated with the heavy metal Cadmium, is < 1. This means that people in the Mandonga district, Kendari city, are still safe and have no risk in consuming Local Water Company Tirta Anoa water, so there is no need for risk management.

Discussion

Concentration of the heavy metal Cadmium in Local Water Company Tirta Anoa water

Kendari City Local Water Company has 5 raw water units, namely the Pohara (Pohara River) raw water unit with a capacity of 400 liters/second, the Matabondu (water springs) raw water unit with a capacity of 100 liters/second, the Wanggu (Wanggu River) raw water unit with a capacity of 20 liters/second, the Anggoeya raw water unit (Anggoeya River) with a capacity of 40 liters/second, and the Anduonohu (water Springs) raw water unit with a capacity of 5 liters/second.

Raw water sources in Kendari City are used to provide drinking water. The provision of drinking water is one of the basic needs and socio-economic rights of the community that must be fulfilled by the Government, both Regional Government and Central Government. The availability of drinking water is one of the determinants of increasing community welfare, where it is hoped that the availability of drinking water can improve the level of community health and can encourage increased community productivity, so that there can be an increase in community economic growth.[8]

Description of cadmium concentration in Local Water Company Tirta Anoa water, Mandonga district, Kendari city after sampling and laboratory testing at 3 points, namely the first point in Mandonga district with a cadmium concentration of 0.002 mg/L, the second point in Korumba sub-district with a cadmium concentration of 0.001 mg/L L, and at the third point in Anggilowu sub-district with a cadmium concentration of 0.002 mg/L.

Intake of the heavy metal Cadmium

Cadmium is a type of heavy metal that is dangerous if it enters the body, because cadmium can cause health problems, both chronic and acute. Some of the effects caused by exposure to Cd are damage to the kidneys, liver, testicles, immune system, nervous system and blood. This element is dangerous if humans consume (whether inhaled or eaten) in large enough quantities, because cadmium does not easily leave the body. This metal will accumulate in the body.[9]

Level of Risk of Public Health Disorders

RQ (Risk Quotient) or Risk Quotient in health risk analysis studies is the ratio between the estimated exposure to a dangerous substance and the acceptable risk threshold. RQ is used as a tool to compare exposure levels to risk thresholds that have been determined in environmental health risk analysis.[10]

The RQ is calculated by dividing the estimated exposure dose by the established risk threshold. The risk thresholds used may vary depending on the hazardous substances analyzed and the guidelines applied. If the RQ is more than 1, it indicates that the exposure level exceeds the acceptable risk threshold and may pose a potential health risk. Conversely, if the RQ is less than 1, the exposure level is considered to be below the acceptable risk threshold. In this research, RQ is used in the environmental health risk analysis aspect to evaluate the risk of cadmium exposure in Local Water Company Tirta Anoa water, Kendari city in the Mandonga district area which is consumed by the community.

By using RQ, researchers can evaluate the extent to which health risks may occur as a result of exposure to hazardous substances and take appropriate risk management steps. In accordance with the results of risk level calculations (RQ), the results show that people who consume water from Local Water Company Tirta Anoa, Kendari city in the Mandonga district area are < 1 for the next 30 years. This is caused by the concentration of cadmium in Local Water Company water which is still considered very safe and has not passed the established quality standards. This means that people who consume Local Water Company Tirta Anoa water are still in the safe category for the next 30 years provided that the concentration of the heavy metal cadmium, intake rate and frequency of exposure do not change for the next 30 years.

Conclusion

The cadmium concentration value in Local Water Company Tirta Anoa water, Kendari city at 3 points respectively is 0.002 mg/L, 0.001 mg/L, and 0.002 mg/L. The respondent's risk level based on the RQ calculation value is still < 1, which means that people who receive water from Local Water Company Tirta Anoa, Kendari City in the Mandonga sub-district area have no risk of health problems now and in the next 30 years. Risk management to prevent the possibility of risks

arising is by maintaining the rate of intake and frequency of exposure.

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