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Ammoniacal Nitrogen Contaminant in Water of Kaliori Landfill Area in Banyumas

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Abstract

Kaliori Landfill is one of the inactive landfills in Banyumas Regency. The presence of garbage and a full leachate pond in the area is feared to pollute the waters around the landfill. One of the water quality parameters is ammoniacal nitrogen (NH3-N) based on Government Regulation of the Republic of Indonesia Number 82 in 2001. The aim of this research was to find the quality of water in landfill area based on ammoniacal nitrogen parameter. The water studied was one sample of leachate, two samples of river water and five samples of ground water in the landfill area with a radius less than 1 kilometers. Spectrophotometry method was used to find NH3-N concentration. Based on the test results, leachate and ground water have reach ammoniacal nitrogen quality standard, there were <2.0 mg/L and <0.5 mg/L respectively. Meanwhile, the ammoniacal nitrogen in river water was >2.5 mg/L, they have exceeded the established quality standards.

Keywords: *Ammoniacal Nitrogen, Water, Landfill*

1. INTRODUCTION

Garbage is a global problem in various countries, including in Indonesia. Landfill is often used as the final place for the waste disposal process, both rural and urban, so it is a problem in various regions in Indonesia. It is hoped that the Landfill will not cause problems to water quality in the landfill area. One of the water quality parameters is ammoniacal nitrogen (NH3-N) based on Government Regulation of the Republic of Indonesia Number 82 in 2001).

Ammoniacal nitrogen is usually contained in leachate, wastewater and other industrial wastewater. At relatively high concentrations, ammoniacal nitrogen is often used as a standard for determining environmental quality, even drinking water. Under certain conditions, ammoniacal nitrogen is also a relatively mobile contaminant. For this reason, ammonia is used as one of the key contaminant parameters in estimating the risk of leachate and other contaminated areas (Buss et al., 2004).

Kaliori Landfill in Banyumas is one of the inactive landfills in Banyumas Regency. The presence of garbage and a full leachate pond in the area is feared to pollute the waters around the landfill. Improper landfill such as landfilling without using a linear system is one of the main sources of NH3-N contaminants contained in groundwater. NH3-N in groundwater can react through complex physical, chemical and biological processes to form other nitrogen compounds such as NO2, NO3 which can endanger the ecosystem (Atta et al., 2014). Evidently, one of the countries in Asia, namely Malaysia, has designated NH3-N as one of the main pollutants in various rivers in Malaysia (Ministry of Health Malaysia, 2004).

Characterization of ammoniacal nitrogen parameters in the Kaliori Landfill is to determine the newest water quality which is needed to achieve equilibrium in water sources in Banyumas. Therefore this article will discuss the ammonia content on water in the Kaliori Landfill area.

2. METHODS

In this article, the samples studied include leachate, ground water and river water in the Kaliori Landfill,

Banyumas, with a radius of less than 1 kilometer. Sampling was carried out in May 2020. As many as 1 leachate, 5 ground water and 2 river water that had been collected. The location for sampling the ground water and river water is based on its distance to the leachate in the landfill. The sample identity used can be seen in Table 1, while the sampling location can be seen in Figure 1.

The ammoniacal nitrogen content in the sample was determined using the SNI 06-6989-30-2005 method (SNI, 2005). The levels obtained are then compared with existing quality standards.

Table 1. Code of Sample and Identity of Sample

Number	Code of Sample	Identity of Sample
1	LIN	Leachate
2	AS 1	River water 1
3	AS 2	River water 2
4	SUM 1	Ground water 1
5	SUM 2	Ground water 2
6	SUM 3	Ground water 3
7	SUM 4	Ground water 4
8	SUM 5	Ground water 5

Figure 1. Location of Sampling, Kaliori Landfill Banyumas

Table 2. Ammoniacal nitrogen in leachate

Parameter	Concentration (mg/L)	MOH (mg/L*)
Amonia nitrogen	1.955	10

*) quality standard

Tabel 3. Ammoniacal nitrogen in river water

Code of Sample	Concentration (mg/L)	Regulation (mg/L) *)	
		Class of 1	Activity of fishery
AS1	2.59	0.5	0.02
AS2	2.615		

*) PP RI No. 82 Th.2001

2. RESULT AND DISCUSSION

3.1. Ammoniacal nitrogen in leachate

Ammonia nitrogen is a contaminant that can be found in leachate as a result of the biological degradation of amino acids and other nitrogenous organic substances (Yusoff et al., 2013). Ammoniacal nitrogen levels in leachate are presented in Table 2.

Based on Table 2, the ammoniacal nitrogen content in leachate is 1.955 mg/L. In Indonesia, there is no quality standard for ammoniacal nitrogen in leachate. Meanwhile in Malaysia, the quality standard for ammoniacal nitrogen in leachate is 10 mg/L (Ministry of Malaysia, 2004). When compared with the quality standards in that country, the NH3-N levels obtained were still below the established quality standards.

Even though the ammonia content in leachate is still low, its presence should still be a concern. This is because the ammonia content in leachate can migrate to the surrounding waters. Yussof et al., (2013) in their research stated that leachate contaminants can move to the surrounding area which might contaminate soil and groundwater.

Contaminants in leachate can interfere with agricultural activities and good water quality. Some researchers claim that leachate from active and inactive landfills can be a source of contaminants for groundwater and surface water. Groundwater contaminants can last for decades in aquatic systems without treatment (Samsudin et al., 2006).

3.2. Ammoniacal nitrogen in river water

The NH3-N levels for AS1 and AS2 were 2.59 mg/L and 2.615 mg/L, respectively (Table 3.). There is no government regulation that clearly states the NH3-N quality standards for river water in Indonesia. However, in PP RI No. 82 of 2001 states that water is divided into several classes according to its designation. When compared with these regulations, the NH3-N levels in river water obtained have exceeded the class 1 water quality standard, which is 0.5 mg / L based on PP RI No.82 Th.2001. This means that river water is dangerous if it is used as raw material for drinking water.

Until now, there is no quality standard for ammoniacal nitrogen parameters for water in class of 2,3 and 4. However, for fisheries activities, the ammoniacal nitrogen content must not exceed the level of 0.02 mg/L. When compared with the levels obtained in this study, the ammonia parameter in river water has exceeded the quality standard for the fishery process, so it is dangerous for the growth of water's animal.

The NH3-N contaminant can increase the risk of toxicity, when it contaminated water flows into rivers and pollutes drinking water and other groundwater sources. In addition, NH3-N can also be exposed to animals which can lead to decreased bone mass, calcium content and pH in the blood (WHO, 2003).

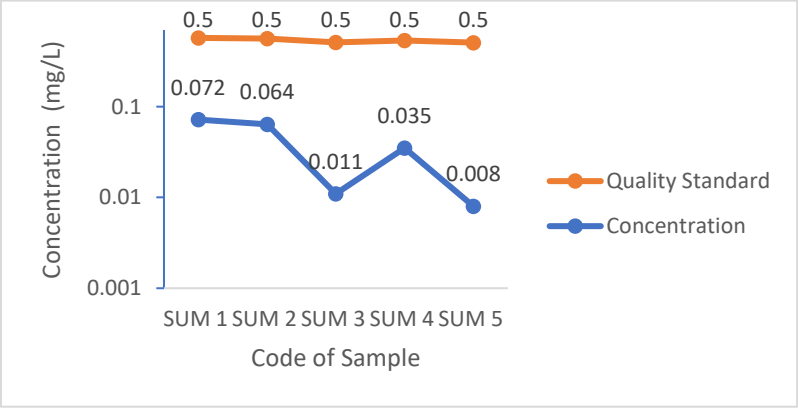
Relatively high NH3-N concentrations were identified in river water compared to leachate water. This can be caused by seepage through the soil from leachate water. The environmental agency said that NH3-N contaminants can move reactively (Environment Agency, 2003). A similar statement was made by Yusoff et al. (2003) stated that ammoniacal nitrogen can move from leachate to river water systems and penetrate rainwater, thus becoming a long-term source of contamination for the ecosystem. Atta et al. (2015) stated that hydrogeological conditions and biological activity affect the presence and transfer of nitrogen components.

Spread of contaminated water into rivers and landfill areas can be prevented in a responsible manner because conditions such as alkaline pH and warm water temperatures are the preferred conditions for NH3-N toxicity in leachate water. Fish that contaminated by ammonia in water are also at high risk for food (Atta et al., 2014).

An additional effect of ammoniacal nitrogen is decreasing oxygen and pH concentrations, which will increase BOD and COD levels in the water which can make wastewater treatment difficult. Decreasing oxygen levels are disturbing the life of aquatic ecosystem. In addition, high levels of NH3-N in the environment also prevent the decrease in manganese levels (Atta et al., 2013).

3.3. Ammonia nitrogen in ground water

Ammonium nitrogen levels in ground water are presented in Figure 2. Based on the graph in Figure 2, the highest NH3-N levels are generated from SUM1, which has the closest distance to the landfill, which is 0.072 mg/L, and the lowest is SUM 5, which is 0.008 mg/L, which has the farthest distance from the landfill. The ammoniacal nitrogen levels in the samples are fluctuate. This can be caused by the geological conditions of water in the soil. Atta et al. (2014) states that there is a fact that the biological process of NH3-N oxidation (nitrification) can be related to the presence of NO3 in groundwater (Atta et al., 2014). In addition, the temperature factor also affects NH3-N activity.



*) quality standard: PP RI No.82 Tahun 2001

Figure 2. Ammoniacal nitrogen in ground water

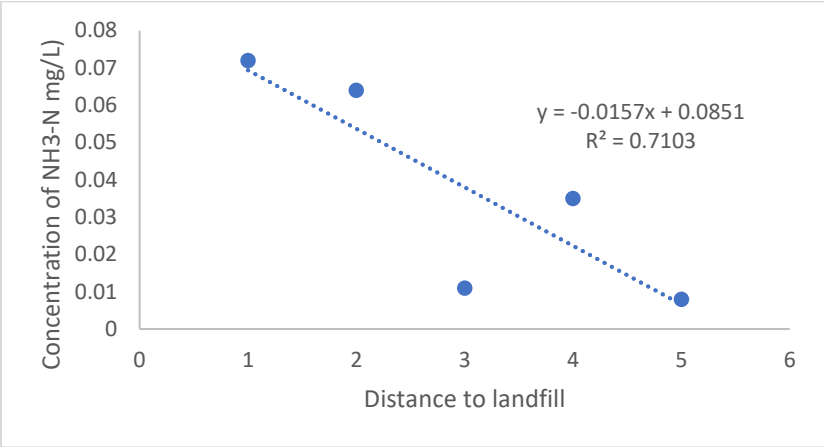


Figure 3. Correlation between distance of sampling with NH3-N concentration

4. CONCLUSION

Based on the research results, leachate and ground water had met the ammonia nitrogen quality standard. On the other hand, in river water, the ammoniacal nitrogen content has exceeded the quality standard value. In addition, there is a positive correlation between ammonia levels and the distance from the sampling location to the landfill.

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