

Analysis Of The Amount Of Leachate Pollution On The Environmental Health Of Settlements At Bakung Final Disposal Site Bandar Lampung City

¹Ade Lenty Hoya, ²Marlina Kamelia, ³Irma Sari

^{1,2}Program Studi Pendidikan Biologi, Universitas Islam Negeri Raden Intan Lampung, Lampung, Indonesia. ³Program Studi Biologi, Universitas Islam Negeri Raden Intan Lampung, Lampung, Indonesia.

ARTICLE INFO

Keywords:

Bakung final disposal,
Environmental Health,
Leachate

ABSTRACT

Leachate is residual waste that is exposed to water when it rains. Leachate contains physical, chemical and biological parameters that are dangerous if it enters the canals and residential areas of residents. Many problems will arise if the leachate is not treated and left alone. The purpose of this study was to determine the amount of leachate pollution on the environmental health of settlements at the Bakung final disposal site in Bandar Lampung. This type of research is qualitative research and is presented descriptively. The test sample was taken using the composite sample method (combined place) at three pool points, each of 1.7 liters with a total of 5 liters and homogenized. Samples were analyzed using SNI 8995:2021 and the water quality was assessed using the Pollution Index (IP) method. To find out the health of the environment using interviews with the community around the final disposal site. The results of the analysis showed that the physical and chemical parameters of leachate at Bakung landfill that exceeded the leachate quality standards were TSS (538.33 mg/L), BOD (5382 mg/L), COD (8220 mg/L), Total Nitrogen (91 mg/L). If the leachate is only collected without further treatment, it will result in the leachate entering residential canals and contaminating the well water in the surrounding area and possibly causing health problems such as skin irritation. Toxic environment, water unfit for consumption even blue baby syndrome in infants and an increased risk of colon cancer.

Email :

hoyaadelenty@gmail.com

Copyright © 2023 Journal Eduhealth. All rights reserved is

Licensed under a Creative Commons Attribution- Non Commercial
4.0 International License (CC BY-NC 4.0)

1. INTRODUCTION

Bakung final disposal site is located in Bakung Village, Teluk Betung Barat District, the total area of this final disposal site is 18 hectares which every day the Bakung final disposal site is able to accommodate various types of waste up to 750 - 800 tons per day (292,000 tons per year) with the highest population density in 2015 reached 20,709 people per km² [1]. Lampung province in 2022 will generate 1.64 million tons of waste, 4,515 tons of waste per day, in Bandar Lampung it self has 283,602 tons per year [2]. Garbage that accumulates when exposed to rain water will produce leachate. Leachate is a liquid that appears during the process of decomposing waste, leachate has a very pungent odor, leachate can spread through seepage into the ground and some of it follows the flowrun off so that it has an impact on groundwater, soil and river water pollution besides that air pollution can occur due to the decomposition of waste [3].

Leachate has a dangerous impact because it contains organic and inorganic compounds, as well as heavy metals. Leachate contains a toxic substance that requires management before being discharged into surface waters, without specific management leachate can contaminate well water, soil and rivers [4]. Leachate can seep into the wells of residents around the final disposal site, 100 meters from the source of the pollution [5]. Leachate contains hazardous metals from landfills so it tends to become hazardous in the future. Around the final disposal site is a residential area so the effect on occupants can contribute to the danger of metal contamination [6]. Based on these problems, it is important to know the amount of leachate pollution on the environmental health of settlements in the final disposal site Dawud Bandar Lampung so that they can overcome these problems

Analysis Of The Amount Of Leachate Pollution On The Environmental Health Of Settlements At Bakung Final Disposal Site Bandar Lampung City. Ade Lenty Hoya, et.al

2. METHOD

The research was carried out for 1 month in December-January 2023. The place of this research was carried out at the Laboratory of the Center for Standards and Industrial Services (BSPJI) Bandar Lampung. This type of research is qualitative research and is presented descriptively. The test sample was taken using the composite sample method (combined place) where the test sample was taken at different test sampling points, at the same time and volume, there were 3 different pool location points which were taken as much as 5 liters of jerry can size then homogenized into one. The population in this study was leachate in the Bakung final disposal site (Final Disposal Site) in Bandar Lampung City. Samples were taken using SNI 8995:2021 reference. Parameters analyzed consisted of 10 parameters including physical parameters (color, odor, turbidity and TSS) and chemical parameters (pH, BOD, COD, N-Total, mercury and cadmium). Data analysis was carried out by comparing the test results for each parameter with the quality standards of the Minister of Environment and Forestry of the Republic of Indonesia No. 59/Menlhk/Setjen/Kum.1/7/2016, to see the overall water quality using the Pollution Index (IP) method. Meanwhile, to find out environmental health in residential areas, interviews were conducted with the community around the Final Disposal Site.

3. RESULTS AND DISCUSSION

Result

Condition of Well Water Around Settlements

Leachate at the Bakung final disposal site is still not ideal, because the observations show that there is no management and continuous monitoring so that whether the management of this final disposal site is ideal or not, there are 3 ponds that have the same length, width and depth, the amount of waste piled up at the Bakung final disposal site and the management methods that are still characteristic open dumping/ open excavation land where the processing method is just thrown away without carrying out continuous management, causing negative impacts resulting in environmental pollution such as air pollution, soil pollution, water pollution, and causing landslides and fires [1]. Lack of open dumping method cause an unpleasant odor due to the presence of ammonia (NH₃) caused by microbial activity, and the scattering of garbage can contaminate groundwater and river water [7]. The use of this method usually still has leachate seepage which can seep into the soil which contains a lot of heavy metals. The content of heavy metals that are often found are Zinc (Zn), Cuprum (Cu), Iron (Fe), Cobalt (Co), Manganese (Mn), Nickel (Ni). If residents around the final disposal site use groundwater as a necessity for clean water, then this will become a serious problem because the residents' well water will be contaminated with the leachate.

In this open dumping method, the leachate is still collected in 3 ponds without any treatment so that when the rainfall is high the leachate is not controlled and has an impact on pollution such as contaminating the residents' wells around the landfill. leachate, the leachate that is accommodated in the pool is 3 pools with the same size with a length of 8 meters, an area of 6 meters and a depth of 5 meters for the 1st holding pond as the initial pond through which the leachate will then pass, to the 2nd pool and ending in the 3rd pond, while the leachate that flows from pond 1 to pond 3 according to the RT around the final disposal site that 3 leachate storage ponds with a system of flowing through a paralon pipe installed from inside the first pool to the last pool after that the leachate is just left with the evaporation method so that it is at risk environmental pollution, the first pollution is clean water pollution because leachate will infiltrate into the soil, then percolation occurs into groundwater.

The results of the interviews that the researchers conducted with residents around the Bakung final disposal site felt disturbed by the pungent smell of garbage, especially when there were garbage collectors passing in front of the house, then the garbage fell due to being overloaded. Apart from these problems, leachate produced from the final disposal site caused various environmental problems such as it could seep into residents' wells, according to residents, which are 20 meters from the leachate pond, many residents' wells have been exposed to a leachate mixture, especially for residents' well water, which has been analyzed by previous research related to the content of well water, saying it has been polluted and contains mercury so that the well water is unfit for use in the well water of residents around the final disposal site, which is 20 meters to 60 meters away, the well water changes color to become cloudy and has an unpleasant odor, even though it has only been drilled to a depth of 43 meters a week and after a year the well water will change when left overnight in the bath so that it becomes black, so many residents around the final disposal site buy drinking water to meet their daily needs because the well water is already polluted and unfit for use or consumption, according to the RT (Neighbourhood) around the final disposal site that leachate flows when there is high rainfall, passing 9 RT (Neighbourhood). The results of the study reported

that 89.9% of children aged 1-12 years who lived in the Bakung final disposal site were positively infected with worms [8]. Other research states that 70.0% of respondents' clean water did not meet the requirements so that it could trigger diarrheal disease in toddlers around the Bakung final disposal site [9].

Physics Parameter Analysis

Table 1. Laboratory test results for leachate content at the Bakung final disposal site

| No | Parameter | Unit | Quality standards | Test results |
|----|-----------|------|-------------------|-----------------------------|
| 1. | Color | PtCo | - | 498,66 |
| 2. | Smell | - | - | Distinctive smell of sewage |
| 3. | Turbidity | NTU | - | 322 |

Based on the research results from the table above, the color parameter shows a deep black color with a value of 498.66 PtCo (Platinum Cobalt), has an odor parameter with a characteristic smell of waste, and a turbidity parameter with a value of 322 NTU (Nephelometric Turbidity Unit).

Chemical Parameter Analysis

The results of chemical parameters include TSS (Total Suspended Solid), pH, BOD (Biological Oxygen Demand), COD (Chemical Oxygen Demand), total nitrogen, mercury and cadmium. Results as follows:

Table 2 Laboratory test results for leachate content at the Bakung final disposal site

| No. | Parameter | Unit | Quality standards | Test results |
|-----|----------------|------|-------------------|--------------|
| 1. | TSS | mg/L | 100 | 538,33 |
| 2. | pH | - | 6-9 | 8,71 |
| 3. | BOD | mg/L | 150 | 5382 |
| 4. | COD | mg/L | 300 | 8220 |
| 5. | Nitrogen total | mg/L | 60 | 91 |
| 6. | Mercury | mg/L | 0,005 | <0,001 |
| 7. | Cadmium | mg/L | 0,1 | <0,007 |

Based on the research results from the table above, the TSS parameter showed a test result of 538.33 mg/L exceeding the quality standard, the pH parameter showed a test result of 8.71, the BOD parameter showed a test result of 5382 mg/L exceeding the quality standard, the COD parameter showed a test result 8220 mg/L exceeds the quality standard, the total nitrogen parameter shows a test result of 91 mg/L exceeds the quality standard, the mercury parameter shows the test result < 0.001 mg/L below the quality standard and the cadmium parameter shows the test result < 0.007 mg/L below the quality standard.

Pollution Index (IP)

The results of the calculation of the Pollution Index have been calculated as follows: Using the Pollution Index (IP) because want to research water quality at the same time and only need single data [10]. The method of comparing the results of pollution with quality standards. The Pollution Index uses a single data showing current results only [11].

Information:

- There = Concentration of water quality parameters survey results
- That = Concentration of water quality parameters in water quality standard (j)
- Drink = Pollution index for allocation (j)
- M = Max Value
- R = Average value

The range for the PI value is:

- $0 \leq PI_j \leq 1,0$ = Meet quality standard (good condition)
- $1,0 < PI_j \leq 5,0$ = Light pollution
- $5,0 < PI_j \leq 10$ = Medium pollution
- $PI_j > 10$ = Heavy pollution

The results of the calculation of the Pollution Index have been calculated as follows:

Table 3 Baku Mutu Air Lindi

| No | Indesk Pencemaran (IP) | IP Quality Standard Value | Criteria |
|----|------------------------|---------------------------|------------------|
| 1 | Leachate | 6,84 | Medium pollution |

Based on table 3 above, the Pollution Index for leachate at the IP quality standard value shows 6.84 with moderately polluted criteria.

DISCUSSION

The physical and chemical parameters that exceed the leachate quality standards are the parameters of color, odor, turbidity, TSS, BOD, COD, and total nitrogen as explained below.

Colour, Odor, Turbidity

The results of research conducted at the Bakung Landfill showed a dark black color with a value of 498.66 PtCo (Platinum Cobalt), due to the oxidation of manganese resulting in a solid black leachate which is visible to the naked eye, the color value of the leachate is high and has a dark black color so the color is not ideal. In waters where there is a color value of less than 10 PtCo, it usually does not show a clear color, while in leachate it shows a clear, dark black color, so it can be said that it is not ideal for color parameters [12]. The leachate at the Bakung final disposal site has a characteristic odor of waste, during field observations when sampling leachate it gives off an odor due to the decomposition process of organic matter which produces a foul odor in the form of ammonia compounds so that the odor of the leachate does not match the physical criteria of water, namely the temperature normal, odorless, not cloudy (clear), does not contain solids, and is colorless.

The turbidity content in leachate at Bakung final disposal site is 322 NTU (Nephelometric Turbidity Unit) that is not included in the criteria for waters because they have high turbidity whereas ideally waters, namely the temperature is normal, odorless, not cloudy (clear), does not contain solids, and is colorless. Turbidity is related to color because if the darker the color of the water, the turbidity will be high which makes the water smelly, the turbidity factor is high due to organic and inorganic materials, for this organic matter becomes food for bacteria so that the amount will add to turbidity [13].

TSS

TSS (538.33 mg/L) Exceeds the leachate quality standard based on the Regulation of the Minister of Environment and Forestry of the Republic of Indonesia No. P59/Menlhk/Setjen/kum.1/7/2016 says 100 mg/L maximum limit for TSS. TSS experiences a high concentration of suspended solids consisting of organic matter (mud, sand and clay) and inorganic in the form of ions (calcium, sodium, magnesium, sulfate, carbonate, iron, nitrate and silica) [14]. Leachate for high TSS is not allowed to be discharged directly into water bodies (such as rivers) because it will have an impact on reducing photosynthetic activity in the water so that the oxygen released by these plants reduces and causes living things in the waters to die thereby disrupting the ecosystem in the waters [15]. The presence of TSS is physically responsible for turbidity in the waters [14]. High TSS will disrupt the process of photosynthesis causing a decrease in dissolved oxygen [13]. Penetration of sunlight to the surface and in the deeper parts is not effective due to the obstruction of the TSS [16].

BOD

BOD (Biological Oxygen Demand) is the amount of dissolved oxygen needed by aerobic microorganisms to decompose dissolved organic compounds and some suspended organic matter in waters [17]. The results of the BOD content in leachate at the Bakung final disposal site with a test result of 5382 mg/L, this value exceeds the standard. The mechanism of BOD can be high due to the relatively slow decomposition of organic matter, microbes use organic matter as a source of food [12]. High BOD content is not allowed to be discharged directly into water bodies because it will have an impact on health if it enters the digestive tract (causing diarrhea) in large quantities due to the presence of microorganisms contained in BOD, namely microorganisms. *Escherichia coli* as well as another skin irritation [12].

COD

COD is the amount of oxygen needed to chemically oxidize organic matter in waters which is an indicator of pollution [18]. The results of the COD content in leachate at the Bakung landfill with a test result of 8220 mg/L. The high COD mechanism is caused by the difficulty of decomposing organic matter by microbes [18]. The high COD is influenced by the characteristics of organic waste from the community which tend to be homogeneous, relatively long temperatures throughout the year and rainfall [19]. High COD levels in untreated wastewater can create toxic environment for aquatic flora and fauna [20]. COD

Analysis Of The Amount Of Leachate Pollution On The Environmental Health Of Settlements At Bakung Final Disposal Site Bandar Lampung City. Ade Lenty Hoya, et al

enters the river and the rate is high, it can make water unfit for consumption and pose a significant risk to human health [21].

Nitrogen

The results of the total nitrogen content in leachate at the Bakung final disposal site with a test result of 91 mg/L, this value exceeds the quality standard. The results of the study found that there was ammonia with such a pungent odor that it affected the value of the total nitrogen content. Nitrogen consists of inorganic nitrogen (in the form of ammonia, nitrites, and nitrates which are soluble) and organic nitrogen which is particulate (insoluble in water) [22]. High nitrate concentrations in drinking water can also cause potential health problems, including methemoglobinemia (blue baby syndrome) in infants and an increased risk of colon cancer [23]. Whereas in groundwater, the hazard index of nitrogen compounds is between 0.037 and 2.856 for men, between 0.054 and 3.427 for women and between 0.080 and 6.145 for children [24].

1. CONCLUSION

Physical and chemical parameters of leachate at Bakung final disposal site in Bandar Lampung City that exceeded the leachate quality standard were TSS (538.33 mg/L), BOD (5382 mg/L), COD (8220 mg/L), Total Nitrogen (91 mg/L), while the other parameters are below the leachate quality standard. If the leachate is only collected without further treatment, it will result in the leachate entering residential canals and contaminating the well water in the surrounding area and possibly causing health problems such as skin irritation, toxic environment, water unfit for consumption even blue baby syndrome in infants and an increased risk of colon cancer.

REFERENCES

- [1] O. Anggara, "Penentuan Alternatif Lokasi Tempat Pembuangan Akhir (TPA) Di Kota Bandar Lampung Menggunakan Sistem Informasi Geografis," *Geodika J. Kaji. Ilmu Dan Pendidik. Geogr.*, Vol. 5, No. 1, Pp. 112–122, 2021, Doi: 10.29408/Geodika.V5i1.3364.
- [2] Dlh, "Provinsi Lampung." 2022.
- [3] Y. Darnas, A. A. Anas, And M. A. A. Hasibuan, "Pengendalian Air Lindi Pada Proses Penutupan TPA Gampong Jawa Terhadap Kualitas Air Sumur," *J. Serambi Eng.*, Vol. 5, No. 3, Pp. 1165–1176, 2020, Doi: 10.32672/Jse.V5i3.2080.
- [4] Y. Darnas And D. Ambia, "Efektifitas Fly Ash Batubara Sebagai Adsorben Dalam Menurunkan Parameter Bod , Cod Dan Kadar Fe , Mn , Dan Zn Pada Air Lindi TPABlang Bintang , Aceh Besar (Effectiveness Of Coal Fly Ash As Adsorbent In Reducing Parameters Of Bod , Cod And Levels Of Fe ,)" Pp. 39–49.
- [5] A. Walid, R. G. T. Kusumah, E. P. Putra, W. Herlina, And P. Suciarti, "Pengaruh Keberadaan TPA Terhadap Kualitas Air Bersih Diwilayah Pemukiman Warga Sekitar: Studi Literatur," *J. Ilm. Univ. Batanghari Jambi*, Vol. 20, No. 3, P. 1075, 2020, Doi: 10.33087/Jiubj.V20i3.1025.
- [6] Nursetiawan, N. F. M. K. Amani, N. M. Z. Shaylinda, M. S. Shahar, And S. N. A. Mohd-Salleh, "Metals Contamination On Soil And Surface Water (Earth Drainage) Due To Leachate Migration From Piyungan Land," *Iop Conf. Ser. Mater. Sci. Eng.*, Vol. 1144, No. 1, P. 012063, 2021, Doi: 10.1088/1757-899x/1144/1/012063.
- [7] H. Khaira And A. Afdal, "Identifikasi Pencemaran Air Di Sekitar Tempat Pembuangan Akhir Sampah Tungkal Selatan Kota Pariaman," *J. Fis. Unand*, Vol. 11, No. 2, Pp. 214–220, 2022, Doi: 10.25077/Jfu.11.2.214-220.2022.
- [8] L. (2021) Sinaga, "Pengetahuan , Perilaku Dan Lingkungan Yang Berhubungan Bakung," Vol. 13, Pp. 10–17, 2019.
- [9] L. A. Wandira, "Determinan Kejadian Diare Pada Balita Di Wilayah Kerja Puskesmas Bakung Tahun 2017," *Ruwa Jurai J. Kesehat. Lingkung.*, Vol. 13, No. 1, P. 1, 2021, Doi: 10.26630/Rj.V13i1.2767.
- [10] A. Lentu Hoya, N. Yulastuti, S. Sudarno,) Penulis, And U. Korespondensi, "Prosiding Seminar Nasional Lahan Suboptimal Ke-8 Tahun 2020," *Pros. Semin. Nas. Lahan Suboptimal*, Pp. 47–53, 2020.
- [11] A. L. Hoya, Y. Nany, S. Utomo, And A. R. Maharlika, "Water Quality Assessment And Control Efforts Use The Pollution Index Method In The Sikendil River," *E3s Web Conf. Icenis 2020*, Vol. 06039, 2020.
- [12] H. Effendi, *Telaah Kualitas Air : Bagi Pengelolaan Sumber Daya Dan Lingkungan Perairan*.

- Yogyakarta: Kanisius, 2003.
- [13] D. Pramesta And S. Puspikawati, “Analisis Uji Kekeruhan Air Minum Dalam Kemasan,” Vol. 11, Pp. 75–85, 2020.
- [14] N. L. Angrianto, J. Manusawai, And A. S. Sinery, “Analisis Kualitas Air Lindi Dan Permukaan Pada Areal TPA Sowi Gunung Dan Sekitarnya Di Kabupaten Manokwari Papua Barat,” *Cassowary*, Vol. 4, No. 2, Pp. 221–233, 2021, Doi: 10.30862/Cassowary.Cs.V4.I2.79.
- [15] Jiyah, B. Sudarsono, And A. Sukmono, “Studi Distribusi Total Suspended Solid (Tss) Di Perairan Pantai Kabupaten Demak Menggunakan Citra Landsat,” *J. Geod. Undip*, Vol. 6, No. 1, Pp. 41–47, 2017, [Online]. Available: <https://Ejournal3.Undip.Ac.Id/Index.Php/Geodesi/Article/View/15033>.
- [16] N. Apriyani And R. Y. Lesmana, “Pengaruh Air Lindi Pada Terhadap Ph Dan Zat Organik Pada Air Tanah Di Tempat Penampungan Sementara Kelurahan Pahandut Kota Palangkaraya (Effect Of Leachate To Ph And Organic Substances Of Ground Water In The Waste Transfer Station In Kelurahan Pahandut Ko,” *J. Mns. Dan Lingkung.*, Vol. 25, No. 2, P. 60, 2020, Doi: 10.22146/Jml.39489.
- [17] J. Ramadhani, R. R. D. Asrifah, And ..., “Pengolahan Air Lindi Menggunakan Metode Constructed Wetland Di TPA Sampah Tanjungrejo, Desa Tanjungrejo, Kecamatan Jekulo, Kabupaten Kudus,” *J. Ilm. Lingkung.*, Vol. 1, Pp. 1–8, 2020, [Online]. Available: [Http://Jurnal.Upnyk.Ac.Id/Index.Php/Kebumian/Article/View/3280](http://Jurnal.Upnyk.Ac.Id/Index.Php/Kebumian/Article/View/3280).
- [18] S. Royani, A. S. Fitriana, A. B. P. Enarga, And H. Z. Bagaskara, “Kajian Cod Dan Bod Dalam Air Di Lingkungan Tempat Pemrosesan Akhir (TPA) Sampah Kaliiori Kabupaten Banyumas,” *J. Sains & Teknologi Lingkung.*, Vol. 13, No. 1, Pp. 40–49, 2021, Doi: 10.20885/Jstl.Vol13.Iss1.Art4.
- [19] A. Rahmayanti *Et Al.*, “Pengolahan Lindi Menggunakan Advanced Oxidation Process (Aops) Berbasis Ozon,” *J. Res. Technol.*, Vol. 8, No. 1, Pp. 141–148, 2022.
- [20] R. M. Mohsin, B. H. Khudair, And A. H. Mohammed, “Effective Quality Control Of A Municipal Wastewater Treatment Plant Using Geographic Information Systems: A Review,” *J. Eng.*, Vol. 27, No. 7, Pp. 66–72, 2021, Doi: 10.31026/J.Eng.2021.07.06.
- [21] K. Adak, S. Ghosal, B. Rajbansi, And D. Sarkar, “Elimination Of Anionic Dye From Wastewater Through Coagulation / Flocculation Process,” 2022.
- [22] H. Effendi, *Telaah Kualitas Air*. 2003.
- [23] H. J. Van Grinsven, A. Rabl, And T. M. De Kok, “Estimation Of Incidence And Social Cost Of Colon Cancer Due To Nitrate In Drinking Water In The Eu: A Tentative Cost-Benefit Assessment,” *Environ. Heal. A Glob. Access Sci. Source*, Vol. 9, No. 1, Pp. 1–12, 2010, Doi: 10.1186/1476-069x-9-58.
- [24] N. Vasilache *Et Al.*, “Article Groundwater Chemistry, Pollution And Health Risk Assessment For Nitrogen Compounds. A Case Study In A Suburban Region Of Romania Nic,” *Rom. J. Ecol. Environ. Chem.*, Vol. 4, No. 2, Pp. 7–22, 2022.