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THE EFFECT OF KEBON KONGOK WASTE DISPOSAL SITES ON GROUND WATER QUALITY IN SUKA MAKMUR VILLAGE, WEST LOMBOK DISTRICT

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Abstract: The Kebon Kongok waste disposal sites (WDS), Suka Makmur Village, is the final waste disposal site for Mataram City and West Lombok because Mataram City does not have a WDS. The condition of the WDS has exceeded its capacity. Suka Makmur Village is a village close to the Kebon Kongok WDS. This research was conducted in Suka Makmur Village to know groundwater quality with Smell, Taste, TDS, pH, BOD, COD, Ammonia (NH_3N), and Total Coliform. The method used to determine the quality of groundwater is by using the Pollution Index Method. In determining the sampling technique, the purposive sampling technique is used, a determination technique with certain considerations. The results showed that the results of the analysis of raw water samples with the parameters Odor, Taste, Total Dissolved Solid, pH, BOD, COD, Ammonia (NH_3N), and Total Coliform. The results obtained from the three sample points that exceeded the Water Quality Standard threshold were only the Total Coliform parameter, sample 1 was 230 mg/l, sample 2 was 91 mg/l, and sample 3 was 230 mg/l based on the Regulation of the Minister of Health of the Republic of Indonesia Number 32 2017 concerning Environmental Health Quality Standards and Water Health Requirements for Sanitation Hygiene, Swimming Pools, Solus Per Aqua, and Public Baths. Based on the results of data analysis using the Pollution Index Method (IP), sample one was 3.14, sample two was 1.68, and sample three was 3.13. These results indicate that the condition of the water is included in the Light Polluted category based on the Decree of the State Minister for the Environment Number 115 of 2003 concerning Water Quality Status, the Pollution Index value with an IP score of 1.1 - 5.0 is intended for class I water.

Keywords: *Kebun Kongok Landfill, Groundwater Quality, Pollution Index*

INTRODUCTION

The quality and quantity of groundwater can decrease; one of the causes is there is waste management carried out at the Final Waste Management Site (WDS). In part, In most low to middle-income countries, nearly all of the waste generated goes to landfill. Even in many developed countries, landfill is the most popular disposal method [1]. Water Leachate and gas emissions in WDS originate from waste that undergoes complex biochemical and physical processes. Rainfall and the character of the waste stockpiled in the WDS will affect the leachate discharge and its quality. Water sources around the WDS can be polluted due to the influence of this leachat [2].

Kebon Kongok WDS is one of the final disposal sites in West Nusa Tenggara Province, particularly in West Lombok Regency. The Kebon Kongok WDS produces 300-400 tons of waste daily and still uses the Control Landfill system to minimize disturbances that cause delays in waste transportation. Suka Makmur Village is a village close to the Kebon Kongok WDS. Suka Makmur Village has nine hamlets, namely Mengkok Hamlet, Egok Hamlet, Egok Tengan Hamlet, Egok Selatan Hamlet, Ketejer Hamlet, Makmur Hamlet, Kedatuk Hamlet, Kebon Kongok Hamlet, and East Kebon Kongok Hamlet. Of the nine hamlets, the hamlet that is farthest from the Kebon Kongok WDS is Mengkok Hamlet, with a distance of 2400 meters, and the hamlet closest to the Kebon Kongok WDS is Kebon Kongok Timur Hamlet, with a distance of <100 meters. 19/PRT/M/2012 concerning the spatial planning of the area around the final waste processing site, the safe distance for settlements from the WDS is 500 meters, and as long as the place that holds leachate in the WDS is damaged.

Phenomena in people's lives What often arises is pollution. Wrong, very dangerous pollution, that is water pollution. The level of water pollution height can cause a lot of damage to humans and the Environment. Water is known as a source of life used by society to meet the needs of daily life, therefore necessary for more attention from various parties [3].

Indications of pollution in the research location use quality standards that refer to the Regulation of the Minister of Health of the Republic of Indonesia Number 32 of 2017 [4]. Then, the quality status of water quality will be assessed using the pollution index method. The pollution index method was chosen because it has the advantage of being able to determine the quality status of monitored water quality using one data series, so it requires low cost and a relatively short time [5].

According to the chemical parameters, the water contains neither toxic chemicals nor heavy metal that passes through clean water quality standards. If water contains excess heavy metals threshold, it will cause pollution and harm society [6]. Heavy metals are often found in liquids leachates,

including iron, arsenic, chromium, cadmium, zinc, mercury, copper, nickel, and lead. Factors natural and human activities influence metal weight in the waters—biological factors in the form of erosion of mineral stones around water. At the same time, human activity can be in the form of industrial and domestic waste disposal [7].

RESEARCH METHODS

Research Design

This research is analytic descriptive research aimed at finding relationships between variables.

Research sites

This research was conducted in Suka Makmur Village, West Lombok Regency. Suka Makmur Village was chosen as the research location because this village is the closest to the Kebon Kongok WDS, and the closest hamlet is <200 meters from the WDS.

Sampling Technique

The sampling technique used in this research is purposive because it uses certain considerations [5]. The method of taking subjects is not only based on strata, randomness, or blood but is based on a certain purpose. Using certain points divided by distance, with the distance from the Kebon Kongok Final Disposal Site (WDS);

Sample point 1: >2000 meters
Sample Point 2: 501-1999 meters
Sample Point 3 : <500 meters

Groundwater Quality Sampling

Groundwater sampling around the Kebon Kongok landfill was carried out in residential areas at a certain distance. The distance taken is the distance closest to the WDS, farthest from the WDS, and the distance between the two follows SNI WDS 03-3241-1994 Procedures for selecting the location of the WDS sampling point [5]. The raw water sampling method is carried out concerning SNI 06-2412-1991 concerning the Water Quality Sampling Method [5].

Table 1. Coordinates of sampling points

Sample point	Coordinate (S)	
	Latitude	Longitude
Sampel 1	08º39’44.27”S	116º05’54.20”E
Sampel 2	08º39’10.58”S	116º05’49.13”E
Sampel 3	08º38’49.38”S	116º05’35.31”E

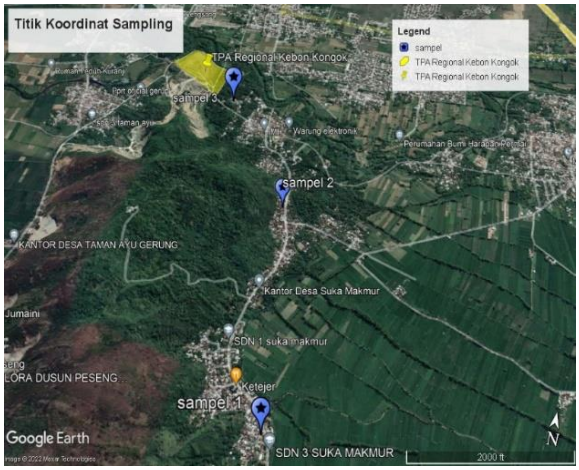

Figure 1 Map of Locations for Sampling Points

Water Quality Analysis

It is an analysis to determine the quality of groundwater by testing water pollution parameters which include physical parameters (smell, taste, suspended solids), chemical parameters (pH, COD, BOD, ammonia (NH_3N), and microbiological parameters (Total Coliform) The water quality analysis method uses the method shown in Table 6. Water quality analysis is carried out by calculating using the Pollution Index method; measured parameter values in river reservoirs are compared with water quality standards for designation, namely environmental quality standards in waters according to regulations government of the Republic of Indonesia Number 82 of 2001 concerning Water Quality Management and Water Pollution Control, the classification of water quality is determined into four (4) classes, namely;

1. Class I (one) is water whose designation can be used as raw water for drinking water and or other uses that require the same quality of water as that use.
2. Class II (two), water that can be used for water recreation facilities/infrastructure, freshwater fish cultivation, animal husbandry, water for irrigating plantations, and/or other uses that require the same quality of water as said use.
3. Class III (three), water that can be used for freshwater fish cultivation, animal husbandry, water for irrigating crops, and or other uses that require the same quality of water as said use.
4. Class IV (four), water whose designation can be used to irrigate plantations and or other uses that require the same quality of water as said use

In chapter two, the Decree of the Minister of State for the Environment No. 115 of 2003 concerning Guidelines for Determining Water Quality Status, it is explained that determining water quality status can be carried out using the Pollution Index

Method [7]. The statistical analysis used is the Pollution Index (IP) method to determine river water quality. The formula used is as follows:

$$IPj = \frac{\sqrt{(Ci/Lij)^2M + ((Ci/Lij)^2R}}{2}$$

Information:

Lij = Concentration of water quality parameters stated in the quality standard for water use (j)

Ci = Concentration of water quality parameters survey results

Ipj = Pollution Index for designation (j)

(Ci/Lij)M = Maximum Ci/Lij value

(ci/Lij)R = Average Ci/Lij values

Evaluation of the pollution index value with water quality is shown in Table 2:

Table 2. Relationship between Pollution Index Values and Water Quality

IP Mark	Water Quality
$0 \leq Ip \leq 1.0$	Good Condition
$1.0 < Ip \leq 5.0$	Lightly Polluted
$5.0 < Ip \leq 10.0$	Moderately Polluted
$Ip > 10.0$	Heavily Polluted

Table 3. Water Quality Parameter Analysis Method

Parameter	Unit	Analytical Method
Physics		
Flavor	-	WI-M.K/7.2.26/LKPKPM
Smell	-	WI-M.K/7.2.27/LKPKPM
Total Disolved Solid	mg/L	SNI-06.6989.3-2004
Chemistry		
Ph		SNI-06.6989.11-2004
BOD	mg/L	SNI-6989.72-2009
COD	mg/L	SNI-6989.2-2009
Amonia (NH_3N)	mg/L	SNI-06.6989.30-2005
Biology		
Total Coliform	mg/L	SNI 01-2332.1-2006

RESULTS AND DISCUSSION

Water quality

Water quality is expressed in several parameters, namely physical parameters (odor, taste, Suspended Solids), chemical parameters (pH, COD, BOD, ammonia (NH_3N), and microbiological parameters (Total Coliform). Water quality parameters are compared with water quality standards based on Minister of Health Regulation No. 32 of 2017 concerning Environmental Health Quality Standards and Water Health Requirements for Sanitation Hygiene, Swimming Pools, Solus per Aqua, and Public Baths [5]. The results of observations and measurements of water quality follow Table 4.

Table 4. Results of Observation and Measurement of Water Quality

Parameter	Results			Quality Standards	Method
	Sample 1 (mg/l)	Sample 2 (mg/l)	Sample 3 (mg/l)		
Physics					
Flavor	Tasteless	Tasteless	Tasteless	Tasteless	Sense of taste
Smell	No Smell	No Smell	No Smell	No Smell	Sense of Smell
Total Dissolved Solid	0.86	0.68	0.6	1000	SNI 06-6989.27-2004
Chemistry					
pH	6.8	6.65	6.50	6.5-8.5	SNI 06-6989.11-2004

COD	22	8	30	NA/ml	SNI 6.6989.2:2009
BOD	5	4.5	3.8	NA/ml	SNI 6989.72:2009
Amoniak (NH_3N)	7.25	2.25	4.27	NA/ml	SNI 06-6989.30-2005
Biology					
Total Coliform	230	91	230	50	SNI 01-2332.1-2006

From the analysis results, the three well water samples in Suka Makmur Village around the Kebon Kongok WDS indicated that the biological parameters were above the water quality standard, namely ≥ 50 MPN/100 ml. The results of the total coliform test on water quality at the three sample points obtained results, namely sample one of 230 mg/l, sample two of 91 mg/l, and sample three of 230 mg/l, and these were all contaminated with coliform bacteria originating from the WDS [8].

pH

pH is one of the important parameters in analyzing river water quality, and the results obtained are the degree of acidity, or the pH of river water is close to neutral [9]. Based on the results of pH measurements, in sample 1, the results were obtained 6.8; in sample 2, the results were obtained .65, and in sample 3, the results were obtained 6.50.

COD (Chemical Oxygen Demand)

COD is the amount of oxygen in ppm or mg/L needed under special conditions to decompose organic matter [10] chemically. Based on the results of COD measurements, in sample one, the results were obtained at 22; in sample two, the results were obtained at 8, and in sample three, the results were obtained at 30.

BOD (Biological Oxygen Demand)

BOD is the oxygen needed to decompose the organic material biologically or by bacteria[11]. The results obtained in this study were the highest BOD at point 1, One of the factors affecting the high BOD value at point 1 is due to the location of the sampling close to the WDS and resulting in the possibility of a large amount of organic matter contained from leachate runoff flowing into the river body. Based on the results of BOD measurements, in sample one, the results were obtained 5; in sample two, the results were obtained 4.5, and in sample 3, the results were obtained at 3.8.

Amoniak (NH_3N)

Based on the results of Amoniak (NH_3N) measurements, in sample one, the results were obtained 7,5; in sample two, the results were obtained 4,5, and in sample three, the results were obtained 7,27

Total Coliform

The results of the water quality analysis showed that the coliform concentration at all sampling points exceeded the quality standard [12]. Based on the results of Total Coliform measurements in sample one, the results were obtained at 230; in sample two, the results were obtained at 91, and in sample three, the results were obtained at 230. It shows that the water quality in Suka Makmur Village has been contaminated

Pollution Index

Determining water status using the Pollution Index Method based on the Decree of the State Minister for the Environment Number: 115 of 2003 concerning Guidelines for Determining Water Quality Status. Water quality can be determined by measuring and calculating physical, chemical, and biological parameters [13]. Determine the water quality status; parameter values must be interrelated and cannot be separated. Thus, all values resulting from parameter calculations must be transformed into a single representative value [14]. The single value of the water pollution index is used to evaluate the pollution level in the aquatic Environment [15]. The results of calculating the pollution index at each sampling point are presented in Table 5 as follows.

Based on the IP calculation results in the table above, sample one gets a result of 3.14, sample two of 1.68, and sample three of 3.13. These results indicate that the condition of the water is lightly polluted based on the Decree of the State Minister for the Environment Number 115 of 2003 concerning the Status of Water Quality, the Pollution Index value with an IP score of 1.1 – 5.0. In the classification of water quality, it is included in class I according to the designation used, namely drinking water as raw water [16].

The selection of the Pollution Index (IP) method to assess water quality status, because it can determine the quality status of monitored water quality using one data series requires low cost and a relatively short time [17]. However, the pollution index method also needs to improve; namely, the results of the IP score assessment obtained are less sensitive because it depends on the number of parameters tested [18].

The quality of water can be determined by measuring the intensity of physical, chemical, or biological parameters. In determining water quality status, these parameter values cannot be separated from each other. Therefore all those parameter values must be transformed into a single representative value[19].

Table 8. Pollution Index Calculation Results

No	Parameter	Sample 1				Sample 2				Sample 3			
		Ci	Lij	Ci/Lij	Ci/Lij (after)	Ci	Lij	Ci/Lij	Ci/Lij (after)	Ci	Lij	Ci/Lij	Ci/Lij baru
1	TDS	0.86	1000	0.00	0.00	0.68	1000	0.00	0.00	0.6	1000	0.00	0.00
2	Total Coliform	230	50	4.60	4.31	91	50	1.2	2.30	2.30	50	4.60	4.31
3	Ammoniak (NH_3N)	7.57	10	0.75	0.75	2.25	10	0.23	0.23	4.27	10	0.43	0.43
4	BOD	5	30	0.17	0.17	4.5	30	0.15	0.15	3. 8	30	0.13	0.13
5	COD	22	100	0.22	0.22	8	100	0.08	0.08	30	100	0.30	0.30
6	pH	6. 82	6-9	0.91	0.91	6.65	6-9	0. 89	0. 89	6.5	6-9	0. 87	0. 87
(Ci/Lix)R : 1.06 (Ci/Lix)M : 4.31 (lp)x : 3.14						Ci/Lix)R : 0,61 (Ci/Lix)M : 2.30 (lp)x : 1.6				Ci/Lix)R : 1.01 (Ci/Lix)M : 4.31 (lp)x : 3.13			

The research that has been done by Vini Natalia results obtained showed that the levels of organic matter in drilled well water which is approximately 100 meters from the landfill site, has exceeded the maximum levels [20].

According to Wahyuni et al. research, the quality of well water excavation can be affected by the location of the pollutant source, the physical condition of wells, and community behavior using dug wells[22].

Analysis of the effect of landfill distance on water quality then calculated determination value (r_2) determines the relationship between landfill distance to water quality. The relationship is estimated by regression analysis and correlation between the garbage heap and leachate and groundwater quality. Results The quality of well water in the Alak sub-district is in the appropriate category according to the meaning of Permenkes No. 492 / Menkes / Per / IV / 2010 April 19, 2010. The variable distance of the final disposal site's existence affects the well water quality. Water quality parameters taken from residential areas in Alak village at a distance of 800 m and 1,200 m are still within the safe limits for consumption [23].

CONCLUSION

The conclusions obtained from the research results are as follows The quality of groundwater in Suka Makmur Village in terms of physical, chemical, and biological parameters. Physical parameters include Odor, Taste, and Total Dissolved Solid (TDS). Chemical parameters include pH, COD, BOD, and Ammonia (NH_3N). The biological parameter is Total Coliform. Of the three sample points and all parameters, only biological parameters exceeded the quality standard, namely the Total Coliform parameter. Sample 1 was 230 mg/l, sample 2 was 91 mg/l, and sample 3 was 230 mg/l based on the Regulation of the Minister of Health of the Republic of Indonesia Number 32 of 2017. Based on the results of the Pollution Index (IP) score assessment, it can be concluded that the water quality status of the three sample points is categorized as Light Polluted based on the Decree of the State Minister for the Environment Number 115 of 2003 concerning Water Quality Status, Pollution Index value with IP score 1.1 – 5.0.

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