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Analysis of Ground Water Quality in the Waste Disposal Landfill Area of Kulo, Tondano, North Sulawesi

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Abstract : Abstract: One of the land usages is waste disposal landfill activities, but its presence often results in problem. This facility is needed, and at the same time it is unwanted. The problem is the landfill site occurs in the area that hydrogeologically susceptible to environmental pollution potential. Beside the effluent is very potential to cause water pollution, both groundwater or surface water, the distance between the water spring and the drainage channels of the waste landfill is less than 100 m. This study was carried out in Kulo village, Tondano, Minahasa Regency, North Sulawesi Province. The waste landfill has been running since 2008 with an area of 3 Ha, and the landfill area used is still 1.3 Ha. This study was aimed at analyzing the groundwater quality and the groundwater microbiology around the waste landfill of Kulo, Tondano, using the water quality standard based on the regulation of Indonesian Republic Health Minister numbered 416/ 1990. It applied survey method, field pobservation, and laboratory analysis. Groundwater quality and microbiological parameters measured were pH, BOD, COD, TDS, TSS, NH3-N, NO3-N, N-NO2, Fe, Mn, Zn, Al, total *coliform,* and *colitinja.* Results showed that 8 of 12 tested parameters met the allowable quality standard, pH (7.2), TSS (7.6 mg/L), TDS (328.4 mg/L), nitrate (5.074 mg/L), nitrite (0.610 mg/L), Mn (tt*), Zn (0.021 mg/L), and Al (tt*). Nevertheless, some of these parameters were still below the quality standard, so that this condition should be considered. In contrast, 4 parameters, Ammonia-N-NH3 (1.899 mg/L), Fe (0.349 mg/L), *Total coliform*, (21 MPN/100 ml) and colitinja (7 MPN/100 ml), did not meet the quality standard of Health Minister's Regulation numbered 416/1990 concerning clean water quality requirements. The groundwater parameters exceeding the quality standard need further water treatment before consumption. This study also found that distance between the water spring and the drainage channels of the waste landfill was only 65 m. This situation needs to be considered in site selection due to its potentiality to high risk. Therefore, efforts to improve the waste landfill site management are needed in order to avoid more severe groundwater contamination.
Keywords : landfill**,** groundwater, effluent, groundwater chemicals.

Introduction

Increased population growth rate of perkotaan will raise various sectors of development activities, such as residence, industry, and trade that will, of course, add the middens volume [1]. Cities with high population growth rate can result in increased waste volume and more diverse types of wastes [2.]

This condition can occur due to more and more consumptive people's life style that causes increased number of middens**,** so that it increases the burden of the waste landfills which eventually yield the incapability of the waste landfill to hold the increasing number of middens. This problem will more and more difficult with the limitation of the available waste landfills.

The waste landfills condition in various cities in Indonesia is generally not good. Based on Monitoring Team of Adipura Program (2007), it is apparent that mean score for various major components range between 46 and 60, categorized as poor condition.

Water pollution, in general, comes from industrial wastes, domestic wastes, waste landfills, and etc. If water has been polluted, human life can be disturbed, since the use of contaminated water can result in various diseases, such as polio, cholera, typhus, dysentry amoeba, and intestinal worms. In addition, impact of water pollution can result in poison coming from the landfill effluent. Environmental pollution affects not only the natural environment, but plants, animals, and human life as well.

One of the land usages is for waste disposal landfill activity, but its presence often results in problem. This facility is needed, and at the same time it is unwanted. However, the land use planning is often only based upon economic considerations in normally shor term, whereas land is one of the environmental carrying capacity components.

The development of waste disposal landfills cannot be separated from the availability of land. Therefore, to judge a land used for waspe disposal landfill activities cannot directly make an areal border for the development of the waste landfill, but physical factors, such as geology, geomorphology, soil type, land form, hydrology, climate, and land use, and non-physical factors, such as surrounding communities, livelihood of surrounding communities, and government's policy, should be considered[3.]

Preliminary observations on the waste disposal landfill management in Kulo, Tondano, recommended that the land was piled and obliged to be done once a week at the operational end after garvage disposals using controlled landfill method, but it has not been conducted, so that it could yield several negative impact on the envirionment. Such a waste disposal process method will produce effluents in the pile layer and then penetrate into the soil layer underneath. The effluent is very **damaging** and could give unpleasant smell. It is highly potential to pollute the groundwater and surface water so that it should be well managed. Therefore, the important aspects necessarily considered are **rock** types and soil characteristics that play important role in naturally preventing or reducing groundwater and surface water pollution from leachate[4.] According to[5] ,immersion level is highly dependent upon the attenuation capacity of the rocks and the soil characteristics. The attenuation capacity covers permeability, filtration ability, ion exchange, absorption, and others[6.] Fine-particled rock materials, such as clays and marls**,** fine-textured soil materials, have higher attenuation capacity than coarse-particled materials[7.] In addition, the position of groundwater level is important parameter as well; the shallower the groundwater level is, the easier the water pollution occurs[8.]

The waste disposal landfill of Kulo, Tondano, has recently been operated under controlled landfill disposal system that holds a much as 40.13 m^3 of waste per day, even though the landfill management operation has not been done under the standard requirement criterion of the controlled landfill system. Tondano is the capital of Minahasa Regency located at the margin of Tondano Lake and Tondano river headwaters flowing to Manado city. According to [9.], the administrative area of the city is 114.55 km^2 with population of 63,537 people in urban areas. In the meantime, according to Statistic Center of Minahasa Regency (2011), population growth rate of Minahasa Regency from 2000 to 2010 seemed to rise, and the significant increment occurred between 2008 to 2010, 1.88%. Increased number of people makes the living needs increase, and thus, the waste disposals also rise. Assume that each Tondanoness produces 0.8 kg of waste, the waste pile yielded in Tondano city is about 50 tons per day.

In fact, the preliminary observation demonstrated that the landfill location in Kulo was located in the area with wavy topography and slightly steep to steep slopes, and existed in the area prone to hydrogeology. It could result from the presence of several watersprings around the waste landfills, such as Kinembengan spring (< 100 m), Sumaroingsong spring (200 m from the landfill), and hot water spring of Ranopasu Sumarongsong (500 m from the landfill). Its river flow will hwad to Kembuan village with a population of about 1,000 people, and meet the river "Dua-Dua" (1,500 m from the landfill) in Uluan village, Kembes district, with about 1,500 people. The land use along the river is dry land plantation, fish ponds, rice field, and other agriculture. Besides, people in both villages use the river water for bathing and washing, as drinking water, and for cattles.

The initial observation also shows that NSPM has noe been implemented. For instance, the present composting facility equipment has never been operated and its infrastructure is not enough yet. Even, although the landfill effluent processing ponds present in the landfill site, such as sedimentation and maturation pond, the effluent is not managed to flow into the effluent treatment ponds, but only goes to the drainage channel and sink into surrounding land. It is potential to result in pollution in water and soil.

According to [10], effluent is a liquid waste coming from the the landfill as a result of external water ingress into the middens, dissolves and rinses the organic matters of biologically decomposed organic matters. Thus, it is necessary to be important consideration to manage the present waste landfill using the selected system, controlled landfill. Problems mentioned above wanted to be solved by responding the following questions: (i) does the waste landfill operations in Kulo, Tondano, give negative impacts on water and soil pollution around the landfill area? and (ii) how is the waste landfill management process in Kulo, Tondano, in relation with the Indonesian National Standard (SNI) implementation and the management of water and soil pollution?.

According to[11], groundwater consists of (i) shallow groundwater, water availability due to water sink from the soil surface. Mud, bacteria, and certain chemical components will stay at soil layers. Contamination continuously occurs, particularly in the water level near the soil. This groundwater is usually used as drinking water source through shallow water spring; (ii) deep groundwater is the groundwater occurring after the first water concentration layer. This deep groundwater collection is not as easy as shallow groundwater collection, since it occurs at the depth range of 200-300 M. Deep groundwater quality is better than the shallow one because its filtering is properer and free of bacteria. The chemical component structure depends on the passed soil layers. If it goes through lime soil, the water will contain Ca (HCO3)2 and Mg(HCO3)2; and (iii) water spring is the groundwater coming out by itsef to the ground surface. Spring originating from deep ground is nearly not influenced by season and its quality is the same as deep groundwater.

Water pollution can become regional or global environmental problem and be highly related with air pollution and land usage. Even though water is a renewable natural resource, but it will be able to be easily contaminated by human activities for various purposes[12].

According to the Governent Regulation numbered 82/2001, water pollution is the inclusion of living things, substance, energy and matter, or other components into the water through human activities, so that the quality of the water drops to a certain level that causes water cannot function in compliance with the allocation.

Based on conditions mentioned above, this study focused on groundwater chemical characteristics and microbiology around the landfill area in Kulo, Tondano, in meeting the Health Minister's Regulation numbered 416/MENKES/PER/IX/1990 concerning clean water requirements. Hence, the objective of the study is to analyze the groundwater quality (chemical and microbiological parameters) around the waste landfill in Kulo, Tondano.

Materials and Method

This study was conducted in Kulo village, North Tondano district, Minahasa Regency, North Sulawesi Province as waste landfill of Tondano town. Study site selection was based on the considersation of waste landfill management operations that have started since 2008 and the landfill age was 9 years with the landfill area used of about 1.3 Ha, so that the landfill capacity is estimated only up to 2018. The study site was in the sub-watershed of Kuala Rurukan, and based on the geographic position, the landfill of Kulo, Tondano, was located at: 01^{o} 19.999' N and 124^{o} 53.94' E.

Materials and equipment used in this study were those related with the objective, i.e landfill environment identification and groundwater chemical measurements and microbiology around the landfill site. For biophysical environment identification, the field survey used a topographical map of Indonesia of Tanawangko sheet at 1 : 50,000 scale (1991), Garmin 76-typed Global Positioning System (GPS), Coolpix Nikon digital camera with a resolution of 12,0 Megapixels and optical zoom of 3.6x, Altimeter, Clinometer, compass, and other laborstory tools.

To know the physical condition of the landfill environment and the water condition, the groundwater springs around the landfill were sampled. Roughly, two components of data were collected, physical component and social economic of the communities.

Data collection used survey method through field observation, laboratory analysis, and direct interviews. Field observation was conducted to study the biophysical aspects of the landfill footprint as a physical means of waste treatment management, while the laboratory analysis to study the water quality around the landfill area. All variables were observed and analyzed descriptively. Map of thr study site is presented in Fig. 1.

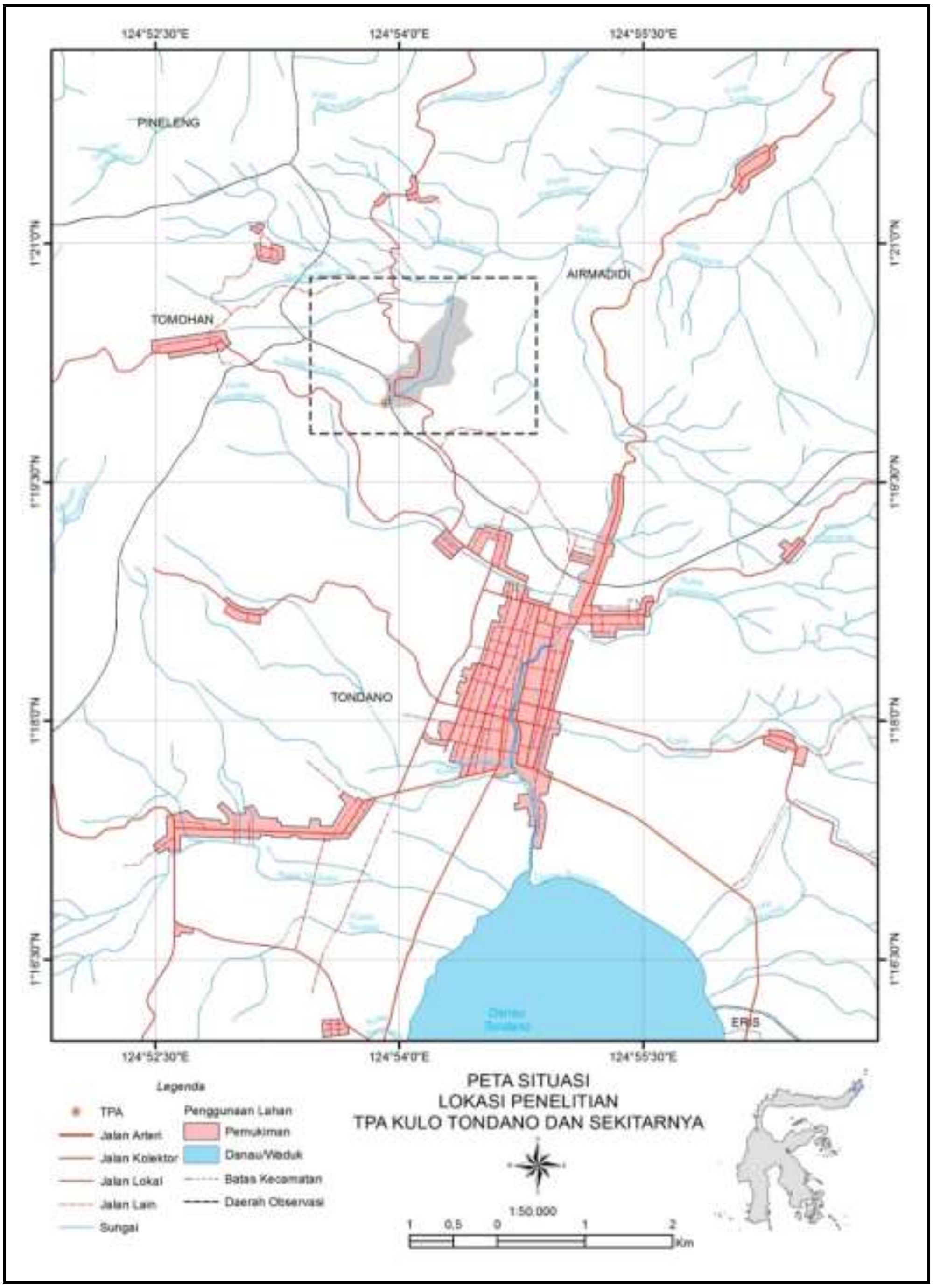

Figure 1. Map of study site condition

In short, the equipment used for water quality analysis and microbiological analysis method in Kulo landfill, Tondano, is given in Table 1.

Table 1. Measured water quality parameter, analytical method, and equipment

No	Parameters	Unit	Method	Equipment
1	pH	-	QI/LKA/08 (Electrometry)	500-1000 ml-polyethylene flask, pH meter
2	BOD	mg/L	APHA. 5210 B-1998	1000 ml-polyethylene flask, **buret**
3	COD	mg/L	QI/LKA/19 (Spectrophotometry)	100 ml-polyethylene flask, **buret**
4	TSS	mg/L	APHA. 2540 D-2005	1000 ml-polyethylene flask, analytical balance
5	TDS	mg/L	APHA. 2540 C-2005	1000 ml-polyethylene flask, analytical balance
6	Nitrate (NO3_N)	mg/L	QI/LKA/65	250 ml-polyethylene flask, spectrophotometer
7	Nitrite (NO2_N)	mg/L	APHA. 4500-NO2 B-2005	250 ml-polyethylene flask, spectrophotometer
8	Ammonia (NH3_N)	mg/L	APHA. 4500-NH3 F-2005	250 ml-polyethylene flask, spectrophotometer
9	Fe	mg/L	APHA. 3111 B-2005	500-1000 ml-polyethylene flask, spectrophotometer
10	Mn	mg/L	APHA. 3111 B-2005	500-1000 ml-polyethylene flask, spectrophotometer
11	Zinc	mg/L	APHA. 3111 B-2005	500-1000 ml polyethylene flask -, spectrophotometer
12	Aluminium	mg/L	APHA. 3111 B-2005	500-1000 ml- polyethylene flask, spectrophotometer
13	Total Coliform	MPN/100 ml	QI/LKA/18 (Tabung Ganda)	50 ml-polyethylene flask, MPN Table
14	Coli tinja	MPN/100 ml	QI/LKA/53 (Tabung Ganda)	50 ml- polyethylene flask. MPN Table

Groundwater quality data collection around the waste landfill was done using survey method covering water pH, COD, BOD, TDS, TSS, NO_3, NH_3, NO_2, Fe, Mn, Zn, Al, and *total coliform* and *coli tinja*. Water samples were taken in and around the waste landfill site of Kulo Tondano and the analysis was conducted in the laboratory.

Water samples were taken at two observation points, Kinembengan spring, in < 50 m distant ($20^0$04.3'N – 124^0 54.01'E), below the drainage channel of the waste landfill effluent and Sumaroinsong spring in < 300 m distant ($01^0$20.137'N – 124^0 54.147'E) below the drainage channel of the waste landfill effluent.

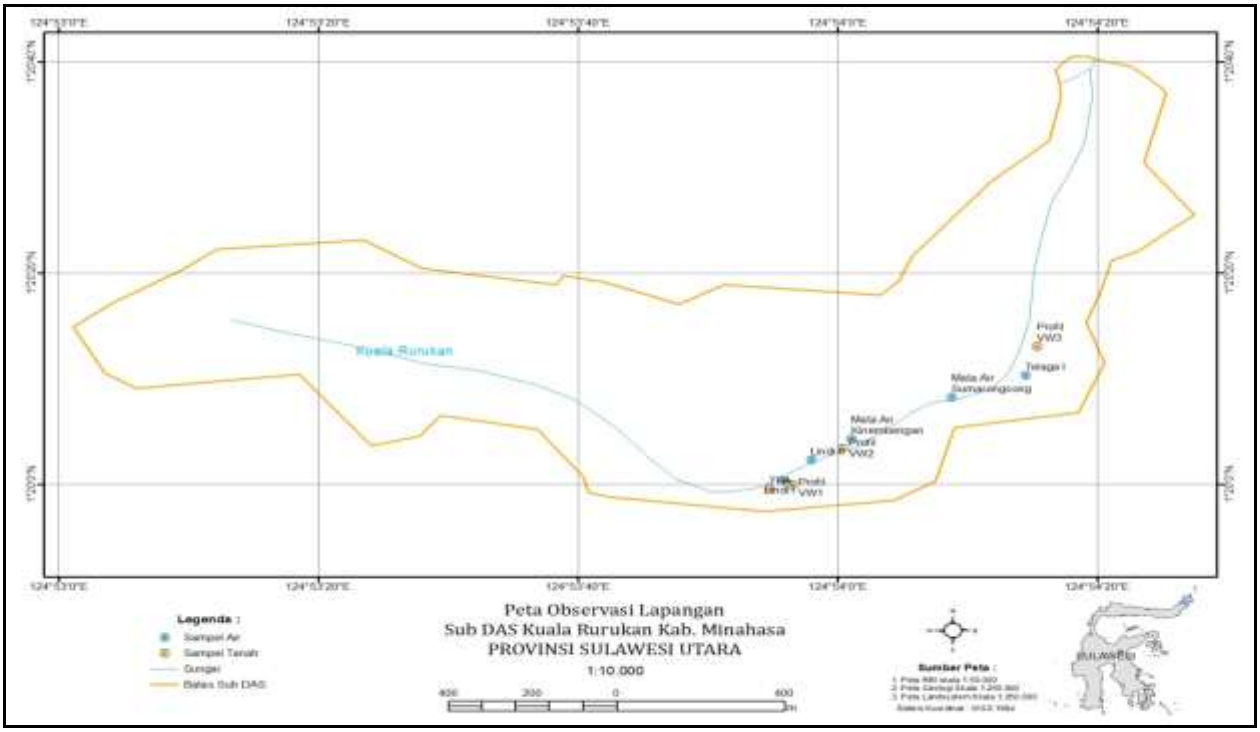

Figure 2. Map of sampling site

For chemical analysis in the laboratory, at least 1,500 ml of water sample are required, and do not contain bubbles. The water samples were put in the bottle, tightly closed, sealed, and covered with alumunium foil to avoid the sunlight. For microbiological examination, at least 200 ml of water samples were needed. The samples were stored at 4^0C and examined in 24 hours. The sample bottle for mcrobiological examination should have tight cap to prevent contamination and be resistant to sterilization. The analysis was done quickly when the organisms are still alive. If it cannot be done immediately, the samples were preserved in 3% phosphate buffered glutaraldehyde, 2% formalin or lugol solution (100g Kl, 1000 ml aquadest, 50 g of crystal iodine, and 100 ml of acetate glacial acid).

Well water and spring water examination followed the Health Minister Regulation of Indonesian Republic numbered 416/MENKES/PER/IX/1990 on clean water quality requirements and management. According to this regulation, clean water is defined as water used for daily need that its quality meets the health requirement and can be drunk after cook, while the drinking water examination folloed the Health Minister's Regulation of Indonesian Republic numbered 492/Menkes/Per/IV/2010 concerning drinking water quality requirements. According the Indonesian Health Minister's Decree numbered 907/2002 concerning drinking water quality requirement and management, drinking water is the water, etiher through treatment process or not, meets the health criterion and can directly be drunk.

Results and Discussion

Study site is geographically located in sub-watershed of Rurukan stream between 124^o 53' 20'' and 124^o 54' 20'' E and between 1^o 20' 0'' dan 1^o 20' 20'' N referring to the topographical map of Indonesia, sheet of 2417-23 Manado (skala 1 : 50.000 BAKOSURTANAL, 1991), about 808 m above sea level. Rurukan sub-watershed is part of Rurukan watershed. Sub-watershed is watershed part accepting rainfalls and fllow it through the stream to the main river.

This area administratively belongs to Minahasa Regency located in the north of Tondano town (± 3 km). The study site is surrounded by steep slopes from the east to the west, the south is bordered with Tondano district, and the west is bordered with Tombulu (Suluan village), and the north with Airmadidi district and the east border of the study site.

The groundwater quality parameter data of both springs were compared with the quality standard according to its purposes using the Regulation of Indonesian Republic Health Minister numbered 416/MENKES/PER/IX/1990 concerning clean water quality requirements.

To know the condition of groundwater quality, the water parameters of groundwater springs in Kinembengan and Sumaroinsong were measured covering pH, BOD, COD, TSS, TDS, nitrate ($N-NO_3$), nitrite ($N-NO_2$), and free ammonia bebas ($N-NH_3$), and microbiological parameters, total coliform and colitinja. The laboratory analysis of water samples from Kinembengan and Sumaroinsong springs is presented in Table 2 and Table 3.

Table 2. Laboratory analysis on water sample in Kinembengan water spring

No	Parameter	Unit	Output	Allowable maximum concentration
1	pH	-	7.2	6.5 – 8.5
2	BOD	mg/L	11.78	-
3	COD	mg/L	32.93	-
4	TSS	mg/L	7.6	50
5	TDS	mg/L	328.4	500
6	Nitrate ($N-NO_3$)	mg/L	5.074	50
7	Nitrite ($N-NO_2$)	mg/L	0.610	3
8	Ammonia ($N-NH_3$)	mg/L	1.899	1.5
9	Fe	mg/L	0.349	0.3
10	Manganese (Mn)	mg/L	tt*)	0.4
11	Zinc	mg/L	0.021	3
12	Aluminium	mg/L	tt*)	0.2
13	Total Coliform	MPN/100 ml	21	0
14	Coli tinja	MPN/100 ml	7	0

Note: *) undetected
Source: Quality standard requirement based on Health Minister's Regulation Numbered 416/1990

Table 2 demonstrates that 8 of 22 measured parameters measured, pH (7.2), TSS (7.6 mg/L), TDS (328.4 mg/L), nitrate (5.074 mg/L), nitrite (0.610 mg/L), Mn (tt*), Zn (0.021 mg/L), and Al (tt*) meet the allowable quality standard, but 4 other parameters, Ammonia-N-NH3 (1.899 mg/L), Fe (0.349 mg/L), *Total coliform*, (21 MPN/100 ml) and colitinja (7 MPN/100 ml) do noy meet the quality standard based on the Health Minister's Regulation numbered 416/1990 concerning the clean water quality requirements. Although some measured parameters are still lower than the quality standard, these need to be considered. On the other hand, the groundwater parameters above the threshold of the quality standard need further water treatment before consumption because of being very high risk. The present study also found that the distance between the water spring and the drainage channel of the waste effluent was only 65 m, indicating that the landfill site selection should be highly considered. Efforts to minimize the groundwater pollution from the wastelandfill effluent are done through linear system, effluent collection and treatment, and need regulations on the waste landfill management [13].

Groundwater is a very valuable water resource often used for industry, trade, agriculture, and the most important is for drinking water. However, the spring water used for domestic needs is susceptible to contamination from human activities.

Groundwater pollution of the waste landfill often occurs in the cities of the United States, The city waste composition, the landfill effluent, and the effluent, in fact, vary among one and the other. The groundwater pollution levels also vary with the waste landfill locations, and some of them have cause serious groundwater contamination.

Table 3. Laboratory analysis on ground water sample in Sumaroinsong water spring.

No	Parameter	Unit	Output	Allowable maximum content
1	pH	-	6.80	6.5 – 8.5
2	BOD	mg/L	8.78	-
3	COD	mg/L	22.60	-
4	TSS	mg/L	43.90	50
5	TDS	mg/L	22.60	500
6	Nitrate (N-NO_3)	mg/L	1.773	50
7	Nitrite (N-NO_2)	mg/L	0.015	3
8	Ammonia (N-NH_3)	mg/L	0.185	1.5
9	Fe	mg/L	0.585	0.3
10	Manganese (Mn)	mg/L	tt*)	0.4
11	Zinc	mg/L	0.023	3
12	Aluminium	mg/L	tt*)	0.2
13	Total coliform	MPN/100 ml	20	0
14	Colitinja	MPN/100 ml	7	0

Note: *) Undetected

Source: Quality standard requirement based on Health Minister's Regulation Numbered 416/1990

Table 3 shows that 9 of 12 parameters measured, pH (6.80), TSS (43.90 mg/L), TDS (22.60 mg/L), nitrate (1.773 mg/L), nitrite (0.015 mg/L), ammonia (0.185 mg/L), Mn (tt* mg/L), Zn (0.023 mg/L), and Al (tt* mg/L) meet the allowable quality standard. Although some parameters are still below the quality standard, these are still necessary to consider. In contrast, 3 parameters, Fe (0.585 mg/L), total coliform (20 MPN/100 ml) and coli tinja (7 MPN/100 ml) do not meed the quality standard based on the Health Minister's Regulation numbered 416/1990 on clean water quality requiements. High Fe, total coliform and colitinja reveal that the groundwater is affected by the waste landfill effluent. This study found that all groundwater samples of Kinembengan spring and Sumaroinsong spring were not heavily polluted yet, but need water treatment before consumption. The impact of waste landfill effluent on the soil quality and the groundwater resource has got high attention, because the environmental impact could be very serious. The effluent flow of the landfill site and the pollutant removals from the sediment (in certain condition) will result in high risk to the groundwater resource if they are not well managed[14]. Other study on the effect of the waste landfill effluent on the groundwater quality was also done by[15] in Athena, Greek**.** They found that several water parameters, pH, conductivity, hardness, CO2, dissolved solid, and suspended matter, chloride, phosphate, sulphate, ammonium, nitrate, and Ca, Mg, Na, K, Fe, Cu, Mn, Zn, Pb, Cd, Cr, Ni, were monitored at the points of 3 km from the landfill for one-year. This finding indicated that all measured parameters exceeded the allowable threshold, so that it was not proper for drinking water, and the contamination decreased with the distance from the landfill location.

Groundwater is a valuable natural water resource and considered as available and safe water source for domestic, agricultural, and industrial consumptions. In Sri Lanka, inappropriate waste treatment is one of the major sources of environmental pollution and groundwater quality decline around the waste landfill [16]. These studies reveal that all groundwater parameter concentrations, but pH, have exceeded the threshold for drinking water.

City waste landfill is a unique environment due to continuously accepting organic and inorganic wastes. Therefore, there are continuous bacteriological risks for surface water and groundwater around and in the effluent.[17], who studied the impact of the city waste landfill and its effluent on the surrounding groundwater microbiological quality. The bacteriological contamination was analyzed on number of mesophilic bacteria, psychrophilic bacteria, coliform bacteria, fecal streptococcus, and *Clostridium perfringens*. The results indicated very high bacteriological contamination in the groundwater samples collected from all Piezometer.

It could result from groundwater pollution of the waste landfill effluent. Physical, chemical, and bacteriological analyses were done on water samples collected from 3 drilled holes near the waste landfill, surrounding soil sample in Akure, Nigeria, to ensure the effect of the waste landfill on the soil quality [18]. The water samples were taken from the drilled holes at the radial distance of 50, 80, dan 100 m from the waste landfill, and 12 soil samples were collected at the distance of 0 m (the landfill site), 10, 20, and 30 m from the landfill. The water quality parameters covered turbidity, temperature, pH, dissolved oxygen (DO), TDS, total hardness (TH), total iron (Fe), nitrate, nitrite, chloride, calcium, and heavy metals (Cu, Zn, and Pb). Most of these parameters showed pollution level, despite below the WHO threshold for consumption water. Water pH range from 5.7 to 6.8, reflecting toxic pollution, turbidity ranged from 1.6 to 6.6 NTU, and water temperature ranged from 26.5 to 27.5°C. Fe, nitrate, nitrite and calcium concentrations ranged from 0.9 to 1.4 mg/L, 30 to 61 mg/L, 0.7 to 0.9 mg/L, and 17-122 mg/L, respectively. Zn concentration ranged from 3.3 to 5.4 mg/L, and Pb ranged from 1.1 from 1.2 mg/L. The groundwater porosity, soil porosity, pH, soil organic matter, organic C, and organic N ranged from 38 to 54, 44 to 48, 6.9 to 7.5, 2.44 to 4.27, 1.42 to 2.48, and 0.12 to 0.21%, respectively (Akinbile, 2012). The present study reflects that all water samples of drilled holes are not heavily polluted, in spite of requiring water treatment before consumption, while the soil is really unsuitable for food plants. The landfill redesign to prevent the effluent reaching the groundwater, it is recommended to adopt the environmental friendly technology to recycle the green house gas and to conduct the sustainable land management program for land reclammation.

[19] analyzed the physico-chemical parameters and the microbiology of effluent sample and groundwater collected from locations around the waste landfills of the city to assess the impact of waste effluents on the groundwater quality. Total dissolved solid (TDS), electrical conductivity (EC), and Na+ concentration exceeded the upper threshold of WHO for drinking water in 62.5% of samples, **100% of samples**, and 37.5% of groundwater samples, and pH and Fe concentration also exceeded the upper threshold of WHO in 75% of groundwater samples. There is significant negative relationship between Na+, TDS, and EC with the waste landfill site. High population of Enterobacteriaceae started from 4.0×10^{3} ± 0.0 to 1.0575×10^{6} ± 162.705 CFU/ml was also detected in the groundwater samples reflecting presence of contamination. The impact of wte disposal landfill effluent on the groundwater quality is, in fact, not too serious (minimu impact). This could be related with the soil texture of clay in the landfill site; it has ability to bind the contaminants in the waste effluent so that the contaminant entering the groundwater is not much.

Conclusion

The groundwater quality of Kinembengan and Sumaroinsong springs was hevily polluted, but needed water treatment before consumption. There were 8 of 12 parameters, pH (7,2), TSS (7.6 mg/L), TDS (328.4 mg/L), nitrate (5.074 mg/L), nitrite (0.610 mg/L), Mn (tt*), Zn (0.021 mg/L), and Al (tt*), met the allowable quality standard. Even though some of these parameters were still below the quality standard, these should be considered. Nevertheless, there were 4 parameters, Ammonia-N-NH3 (1.899 mg/L), Fe (0.349 mg/L), *Total coliform*, (21 MPN/100 ml) and coli tinja (7 MPN/100 ml) that did not meet the quality standard based upon the Health Minister's Regulation numbered 416/1990 concerning clean water quality requirements. The groundwater parameters above the quality standard need further effort of water treatment since the pollutant content will highly hazards the human health if water treatment before consumption is not done. This study also found that distance between the water spring and the drainage channel of the waste landfill was very closed, 65 ,m indicating that site determination needs more attention, since it has very high risk. In addition, efforts to improve the landfill site management need to be done in order to avoid more severe groundwater contamination.

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