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Analysis of soil water biophysicochemical content from temporary waste disposal places

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ABSTRACT

Population growth is in line with the increasing volume of waste generated, so that it has an impact on the increase in the location of landfills in temporary disposal sites (TPS) and landfills (TPA). Piles of runny rubbish often cause degradation of ground water quality. This study aims to determine the biological, physical, and chemical properties of groundwater originating from one of the TPS with different depths and distances. The research method used is an experiment which is further described qualitatively. This research was conducted at the Laboratory of Botany, Department of Biology, Universitas Siliwangi for four months. The material used in this study is ground water taken from one of the polling stations in the City of Tasikmalaya with different distances and depths. The instrument used was the observation guide analysed at PT Sucofindo. Based on the results of the study it can be concluded that all parameters observed are biological content, physical content and chemical content in groundwater as a whole polluted by alkali.

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Introduction

Increased population growth resulted in an increase in waste production. Increasing the volume of waste, if not managed properly, will cause environmental damage. Because more waste is generated that will have an aimpact on environmental pollution (Agnes & Rajmund, 2016). This can be seen in the absorption of water pollution from the rain into groundwater flow. Water pollution consists of contamination of microorganisms in the water, water pollution of inorganic nutrients, pollution of inorganic chemicals, and pollution of organic chemical (Schwab, 1996). Because of the large number of landfills in open land close to residential areas.

Waste into solid waste consisting of organic and non organic substances which are considered no longer useful and must be managed so as no to endanger the environment (SNI 19-2454-1991). Several strategic aspects in waste management such as waste storage, collection, transfer, transportation, processing and final disposal (Salvato, 2003). All of these strategies are of course to maintain environmental quality so that water remains clean. Because in general, clean water supply from ground water. Clean water must meet several requirements both quantitatively and qualitatively. Thus, the development and checking of samples is needed to determine the source of contaminated water (Aguayo, 1999). Because ground water is very important to humans and that almost 97% of clean water comes from ground water, 3% from rivers and lakes (National Research Council, 2008).

Usually the quality of ground water and springs is better than shallow ground water. Because shallow ground water is more contaminated from the outside and functions less filters. Water that comes from the surface when it seeps into the soil, the water will immediately interact physically, chemically, and biologically, thus changing the quality of the water. Unpolluted ground water has clean water quality, is colorless and is free of impurities. That is because when the precipitation process occurs, the impurities that are carried by the water are filtered by granules of particles in the soil layer (Lehr & Keeley, 2005).

Several studies showed the important of a clean groundwater quality for human and animal consumption with further treatment near the landfill area (Ishaku, 2011). In Akinbile's study (2012) on the environmental impact of the landfills on groundwater quality and agricultural area in Nigeria indicated that the landfill site indeed polluted the groundwater and soil in the crop. It showed that the groundwater polluted were the source of the health problems like typhoid fever or worm infestation.

The example of water pollution can be seen from the formation of alkali. Alkali is water contaminated by landfill waste. Alkali contains dissolved waste, is not retained by the soil, and is not degraded chemically or biochemically (Sawyer, 2003). The clay has a significant influence on the natural attenuation of leachate on ground water resources (Longe & Balogun, 2010). The scale of this threat depends on the composition, the amount of alkali and the distance of landfill from the water source (Slomczynska & Slomczynski, 2004). Moreover, there are puddies and deposits that can reduce the ability to filter (Loganathan, 1998; Ree, 1949; Wilson, 1967).

Most alkali contains many dissolved organic materials and inorganic compounds such as ammonium, calcium, magnecium, sodium, potassium, iron, sulphate, chloride, and heavy metals such as cadmium, chromium, copper, lead, nickel, zinc, and xenobiotic organic substances (Lee & Jones-Lee, 1993; Longe & Enekwechi, 2007). The source of water that triggers alkali comes from rain water seepage into a pile of garbage or high ground water in addition to the liquid contained in the garbage. The difference in the number of landfills consists of natural factors and human factors (Tchobanoglous, 1993). When water enters the landfill, chemical and biological reactions will occur with the waste. Therefore, relevancy for research to determine the extent of a groundwater quality groundwater. So it can be uncertained whether it has been contaminated with waste or not. So it does not endanger the health of humans around it.

Commented [A1]: Tell me various studies related to groundwater quality in various environmental conditions in the last 15 years?

Method

The data collection method used was an experiment followed by a qualitative descriptive approach. The sample of the research was collected by taking the groundwater from the resident house or store around the landfills in Cikurubuk traditional market in Tasikmalaya, West Java, Indonesia, this was determined by the distances of 7, 15, 25 m, respectively and depth of 5, 8, 10 m away from the landfill. The basis determination in taking the sample because the groundwater in that area is near the landfills of Cikurubuk which contaminated the groundwater quality. In this qualitative research process, analysed specific data to the variable observed in this study was analysis of groundwater quality based on different points of distance and depth from the focal point of landfills in the Cikurubuk market and groundwater contaminated with alkali originating from PT Sucofindo, Bandung.

Commented [A2]: write more specifically the method used.
1. How to take samples?
3. Which locations are sampled? What is the basis for determining the location?
2. What parameters are measured from each parameter (biological, physical, and chemical)?

Results and Discussion

a. For difference sample distance

Table 1. Analysis Result for Disticinc Sampling Samples

Sample Distance	Parameter Type		
	physiscall	chemicall	biologicall
7 m	13 mg/L	16.33 mg/L	6.50 mg/L
15 m	5 mg/L	6.53 mg/L	2.80 mg/L
25 m	5 mg/L	6.53 mg/L	2.50 mg/L

1) Biological Content (BOD)

In table 1 shows that the biological content or BOD decreases in line with the increasing distance of sampling from temporary landfills. This shows that the biological contained in well water around landfills is quite high and decrases with increasing distance of the well from the landfill.

2) Physics content or Total Suspended Solid (TSS)

As shown in table 1, the physical content decreases with increasing sampling distance from temporary landfills, but for 15 and 25 m the physical content is the same. This shows that the physical content contained in the well water around the landfill is quite high and decreases with increasing distance of the well from the landfill.

3) Chemical Content (COD)

As shown in table 1, the chemical content decreases with increasing sampling distance from temporary landfills, but for a distance of 15 m and 25 m the chemical content is the same. This shows that the chemical content contained in well water around landfills is quite high and decreases with increasing distance of the well from the landfill.

b. For difference depth

Tabel 2. Analysis Result for Different Depths of Sampling

Depth	Parameter Type		
	physyscal	chemical	biological
5 m	17 mg/L	17.00 mg/L	6.80 mg/L
8 m	14 mg/L	13.07 mg/L	5.50 mg/L
10 m	10 mg/L	9.80 mg/L	4.0 g/L

1) Biological Content (BOD)

As shown in table 2, the biological content or BOD decreases in line with the increasing depth of sampling from temporary landfills. This shows that the biological contained in well water around landfills is quite high and decrases with increasing distance of the well from the landfill.

2) Physics content or Total Suspended Solid (TSS)

As shown in table 2, the physical content decreases with increasing sampling depths of sampling from temporary landfills. This shows that the physical content contained in the well water around the landfill is quite high and decreases with increasing depths of the well from the landfill.

3) Chemical Content (COD)

As shown in table 2, the chemical content decreases with increasing depths of sampling from temporary landfills, but for a distance of 15 m and 25 m the chemical content is the same. This shows that the chemical content contained in well water around landfills is quite high and decreases with increasing depths of the well from the landfill.

Quality of soil-water requires the integration of biological, physical, and chemical properties (Lupardus et al., 2021). The chemical parameters consist of total organic carbon, total ni-trogen, C/N ratio, pH, and heavy metals. And the physical parameters consist of bulk density, lutum content/soil type, and ground water level (Breure et al., 2005). Biological oxygen Demand (BOD) is one of the parameters of soil-water quality, therefore the quality of soil water also shown by biological indicators such as invertebrate community abundance (Lupardus et al., 2021).

Total Suspended Solids (TSS) provide essential information for the assessment of water environmental quality (Dorji and Fearns, 2016; Masocha et al., 2017). In our research, we found that distances and dephts is in line with the TSS content. TSS contents also closely related to the presence of detrital matter and microorganisms (Chen et al., 2014; Gonzalez-Hidalgo et al., 2013). In fact, TSS adversely affects the aquatic ecosystems by blocking sunlight and subsequently reduce the photosynstheis (Patel et al., 2020). The suspended solids are also responsible as carrier of pollutants like phosphorous, mercury, heavy metals, hydrophobic organic compounds etc. (Patel et al., 2020; Billota & Brazier, 2008).

The chemical oxygen demand (COD) is an important parameter for the determination of the organic load in water (Kolb et al., 2017). Detection of COD in water and wastewater is crucial parameter for water quality control and environmental monitoring (Bogdanowicz et al., 2012). In our research, we found the opposite between distances and depths of the sample with content of COD. Test standards samples, a wide range of 20-9000 mg/l COD to detection limit at 7.5 mg/l (Bogdanowicz et al., 2012). Our research shown that the results is the standards range.

Commented [A3]: How impact this result to environment in around?
how bad is the groundwater quality in the area?

Based on the data shown above, the contamination of groundwater in the landfills of Cikurubuk market is categorized as a low contamination, so in other words the groundwater quality in that area is not that strongly polluted. However, this result should also become the basis information for the residents and the government of how the groundwater quality around landfills, besides the government nee to know how to manage and treat it well, so the groundwater can be maximized use by the resident near the landfill.

Conclusion

According to the results of the study, it can be concluded that all parameters observed, in terms of biological content, physical content, and chemical content in ground water as a whole are polluted by alkali water. Although this research was conducted in the dry season,, groundwater is still contaminated with several substances that make water unfit for consumption.

Acknowledgment

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