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Water Quality Mapping in the Mojorejo Sukoharjo TPA Residential Area in 2024

Irham Dhafin Maulana[1], Mifbakhuddin[2], Estri Irawati[3]

[1,2,3]Prodi Kesehatan Masyarakat, Fakultas Kesehatan Masyarakat, Universitas Muhammadiyah Semarang

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ABSTRACT

Introduction: Mojorejo Sukoharjo TPA is located close to residential areas, namely less than 500 meters. The condition of the landfill is stated to be overloaded by 2025. The condition around the landfill is already polluted, which can be seen in the physical characteristics of the river water nearby. Researchers are interested in examining the condition of water pollution used by residents living around the landfill. **Method**: This research is quantitative descriptive. The population of this study were seven water samples that were close to the Mojorejo TPA. Sample testing was carried out at the Sukoharjo Regency LABKESDA with physical and chemical measurement parameters. **Results**: The results of the research showed a picture, of a total of 7 samples that smelled or did not meet the requirements, there were 5 samples with TDS in this research area of around 193.0 mg/l - 298 .0 mg/l. This TDS meets the requirements for clean water quality standards. Meanwhile, the water temperature in this area is 27 – 300 C which is in the qualifying category. The color of the water sample is clear and colorless so it meets the requirements. The lowest pH level is 1.25 and the highest pH is 13.69. Fe levels also meet the requirements, namely 0.000 mg/l to 0.37 mg/l. **Conclusion**: Of all the samples tested, the results showed that the odor parameters and pH levels did not meet the requirements. Meanwhile, TDS, temperature, color and iron/Fe parameters meet the requirements.

Corresponding Authors:
Prodi Kesehatan Masyarakat, Fakultas Kesehatan Masyarakat, Universitas Muhammadiyah Semarang, Jl. Kedungmundu Raya No 18 Semarang, Indonesia
Email: mifbakhuddin@yahoo.com

INTRODUCTION

Waste management is needed to produce waste that does not pollute the environment and affect the level of waste accumulation in the Final Waste Disposal Site (TPAS) area. In general, waste is anything that is thrown away and collected at a location called a Dump Station or TPA (Purnami, 2021). The Ministry of Environment 2022 reported that Indonesian people produce 64,134.90 tons of waste every day, or 23,409,238.99 tons of

waste a year. Household waste consists of two types, namely organic waste and inorganic waste (Siregar, 2022).

Waste management is needed to produce more durable waste that does not pollute the environment and does not affect the level of waste accumulation in the Final Waste Disposal Site (TPAS) area (Yuliesti et al., 2020). Waste handling is a way to prevent pollution (Azwari et al., 2023). Sukoharjo Regency only has one TPA, namely TPA Mojorejo, which is located in Mojorejo Village, Bendosari District. The landfill area is 2.8 ha, with 60% for wasteland and 40% for leachate pond infrastructure, green belts, and cover of land (Triafriyani Putri et al., 2017). he shift of leachate into the soil, which is no longer accommodated/overloaded in leachate water storage tanks, causes pollution of shallow groundwater, irrigation water, surface water, groundwater, rice fields and river water (Arsyadi, 2017). The Mojorejo landfill releases leachate every day. Leachate or waste is liquid waste made from dissolved and suspended materials. The increase in the amount of waste has an impact on the environment, especially on waste production. Leachate consists of dissolved elements that are harmful to health and can pollute surface water, groundwater and other water bodies near final waste disposal sites if not adequately monitored (Rahmi et al., 2018).

The water below the earth's surface is groundwater. Groundwater can be collected through wells, tunnels, drainage systems or pumping systems. Research on the aquifer distribution system and the chemical properties of groundwater can be carried out to determine the potential and quality of groundwater in an area which is associated with the use of groundwater as a source of clean water. The availability of groundwater for human needs, industry, agriculture, recreation and other uses is greatly influenced by the quality of groundwater, which includes physical, chemical and biological components. Based on the Regulation of the Minister of Health of the Republic of Indonesia No. 32 of 2017 concerning environmental health quality standards and water health requirements for sanitation and hygiene purposes, it is necessary to monitor water quality intensively and continuously (Menteri Kesehatan Republik Indonesia, 2017).

The results of previous research in 2018 at the Putri Cempo Surakarta TPAS showed that the water characteristics evaluated were physical, chemical and heavy metal concentrations in pure water. Tests were carried out at varying horizontal distances from the dump site. Examination of the homeowner's well water samples showed that the smell (12.5%), taste (12.5%), pH (91.7%), nitrates (70.83%), as well as organic compounds and TDS (4.16%) on samples does not exceed quality standards (H. A. Arifin, 2018)

The results of the 2020 Ministry of Health survey show that only 12% of Indonesian households have access to safe drinking water (Kesehatan, 2020). The Sustainable Development Goals (SDGs) (Puja Pangestu et al., 2021) also demand that the entire global population have access to safe drinking water by 2030 (Hiola et al., 2022). Pumped well water is still the main source of clean water for household needs in Central Java, namely 19.23% (BPS Provinsi Jawa Tengah, 2022). Meanwhile, 31.03% of Sukoharjo Regency residents also use well water as their main source of clean water.

The Mojorejo Final Waste Disposal Site is only less than 500 meters from the housing of residents. This condition means that the residents of Mojorejo Village, especially around the Mojorejo TPA, mostly use clean water from pumped wells for their daily needs. Residents use clean surface or shallow water through pumped wells that have a depth of less than 40 meters. Research on the quality of healthy water in residential areas around the Mojorejo TPA has never been carried out before. This result is what underlies the researchers' desire to research mapping the water quality of residents' wells in the

Mojorejo TPA residential area, Sukoharjo, with the aim of being able to describe the quality of water in the Mojorejo TPA area using physical and chemical parameters to see whether the water used is clean for residents' daily activities. -days it is suitable for use or has not met the threshold value.

LITERATURE REVIEW

Waste is defined as items that cannot be used anymore and are thrown away from industrial and household production (KARTINI, 2019). Even though it cannot be eliminated instantly, the waste problem can be reduced by building a landfill. TPA is defined as a location where waste is processed and returned to environmental media. A final waste disposal site is a physical location where waste is safely quarantined (Arifin, 2021). Landfills usually cause significant damage, including water, air and soil pollution due to the landfilled waste. Then, people who rely on groundwater for their daily needs are at risk of being affected by the leachate processing process in the bottom layer of the landfill.

According to Law No. 23 of 1997 concerning Environmental Management and PP RI No. 82 of 2001, "Water Quality Management occurs when humans put living creatures, substances, energy or other objects into the water, causing the water quality to be polluted so that it cannot be used". According to PP 82 of 2001, water pollution occurs when human activities introduce living creatures, substances, energy or other components into the water, causing the quality of the water to decrease so that the water can no longer function as it should. Although there are several forms of water pollution, water pollution is usually classified into two sources, namely sources of pollution originating from direct sources, also known as "point sources", mainly originating from industrial waste disposal pipes that do not process their waste and the results of waste processing at WWTPs, which enters the receiving water body. The next source of pollution is pollution from indirect sources, also known as non-point sources, originating from the use of consumer goods by small and medium businesses, agriculture and livestock. One of the health impacts of using unclean water is that you can get schistosomiasis. This disease will cause sufferers to itch and develop rashes, fever, headaches, muscle and joint pain, and shortness of breath. In the chronic stage, this disease will cause severe and life-threatening organ damage. This disease is caused by parasitic worms, which are transmitted through exposure to the water where these organisms live.

The quality standards used in this research are based on the Environmental Health Quality Standards for Water Media for Sanitation and Hygiene Purposes. The basis for quality standards is the Regulation of the Minister of Health of the Republic of Indonesia, Number 32 of 2017 (Asadiya & Karnaningroem, 2018).

Table 2. Physical Parameters in Environmental Health Quality Standards for Water Media for Sanitation Hygiene Purposes

Mandatory Parameters	Unit	Quality Standard Unit
TDS	NTU	25
Colors	TCU	50
Dissolved solids (Total Dissolved Solids)	ppm	1000
Temperature	^{o}C	air temperature ± 3
Taste	-	tasteless
Odor	-	odorless

METHOD

This research is a type of quantitative descriptive research, and researchers focus on the water used by residents around the Mojorejo TPA. Researchers carry out measurements and collect instantaneous data according to the conditions or circumstances at the research location without any further procedures. The population studied in this research used all wells at a distance of 0 – 500 meters from the Mojorejo TPA, with a total of 15 wells. Sampling used a purposive sampling technique, where the samples taken from this study initially consisted of 15 samples to 7 samples because the water source used came from the same place; the difference was the distance and location of sampling. This research focuses on all pump water sources that draw groundwater within a distance of 0-500 meters. There are seven wells in the Mojorejo TPA area with a distance of 500 meters from the TPA with details of 2 wells in the Mojorejo TPA area, 2 PAMSIMAS, one agricultural well, one well at SDN Mojorejo 1, and 1 well in the community.

1. **Physics parameters**
   a. **Smell and colour**
      Colour and odour measurements can be carried out directly with the help of organoleptics. The researcher did this condition, and 1 witness followed the research flow to smell and see the water samples. The nose organ is used to sniff the smell of the water to determine the quality of the water content. The water is checked using the eye organ with the water test flow, which flows for a few minutes to clean the sediment from the water that is stuck in the tap. The water is held in a clear glass under light and looked at for approximately 2 minutes to see if there is a change in colour. Then, the water sample is asked whether it smells or not and is colored.
   b. **Total Dissolved Solids (TDS)**
      Before inserting the TDS meter electrode into the previously prepared water sample, make sure it is completely submerged in water and does not touch the walls or bottom of the container. Wait a few moments for the tool to provide accurate and stable results. On the device screen, the TDS value will be displayed in ppm (parts per million) form, and these figures will be recorded on the observation sheet.
      The steps for using this TDS meter are as follows: first, open the bottom cover of the TDS meter to find out that the safe limit for dipping it is just beyond the lid line. Then, turn on the TDS meter by pressing the ON/OFF button until the number 0000 appears on the monitor. Finally, dip the TDS meter into the water where you want to check the TDS level, but don't forget to dip it only to the safe limit mentioned at the beginning. After that, read the instruction value written on the TDS Meter and press the hold button on the TDS meter so that the measured value does not disappear or change to 0000.
   c. **Temperature**
      To measure water temperature, use a traditional water thermometer, namely a mercury thermometer, which works based on the principle of body expansion, where if the water temperature rises, the thermometer will expand and show an increase in temperature, then record the results displayed on the thermometer on the observation sheet.
2. **Chemical parameters**
   a. **Iron (Fe)**
      Measuring the iron content in water using the Atomic Absorption Spectrophotometry (SSA)—flame lab test in accordance with SNI 6989:4:2009, which

was carried out at LABKESDA Kab. Sukoharjo. The atomic absorption spectrophotometry method relies on how atoms absorb light. The advantages of the SSA method are high sensitivity, high selectivity and relatively high accuracy (SNI 6989.4:2009, 2009).

b. Degree of Acidity (pH)

The pH measurements are carried out by placing the water sample to be tested in a container. Then, after pressing the on button on the pH meter, put the water sample to be tested into the container. When the pH meter is inserted into the water, the number scale will move randomly. Then, wait until the numbers don't move anymore and don't change any more, and record the results.

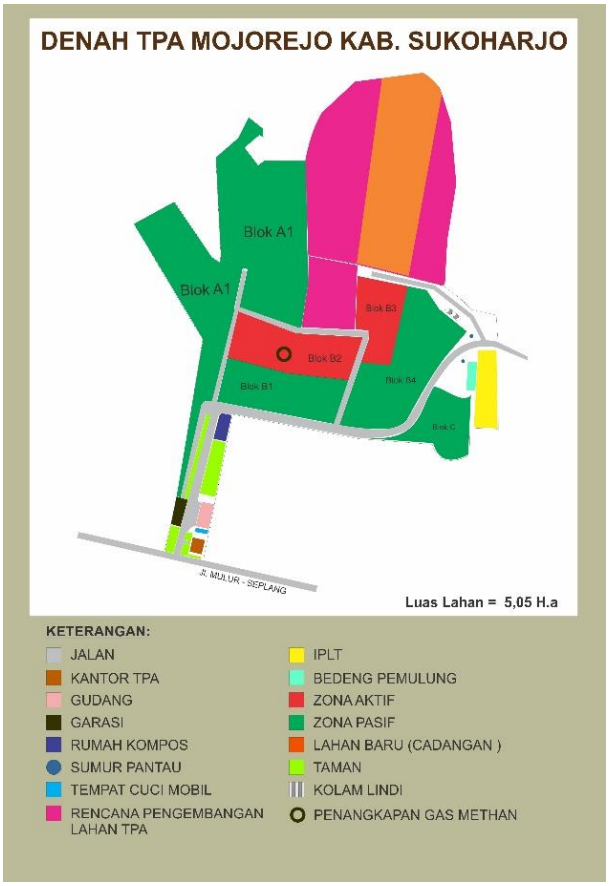
RESULT AND DISCUSSION

Mojorejo TPA is one of the TPAs located in Sukoharjo Regency. Mojorejo TPA is located in Mojorejo Village, Bendosari District, Sukoharjo Regency. The Mojorejo landfill area is 4.5 hectares. TPA Mojorejo was established in 1994 and was initially held by the DPU. However, since 2017, it has been held by DLH. The waste entering the Mojorejo landfill is around 187 tons/day. Mojorejo TPA is included in the Landfill Controller TPA and is a waste storage facility. To reduce environmental disturbances, the landfilled waste is covered with a layer of soil. The distance between the landfill and residential areas is around -+ 500 meters.

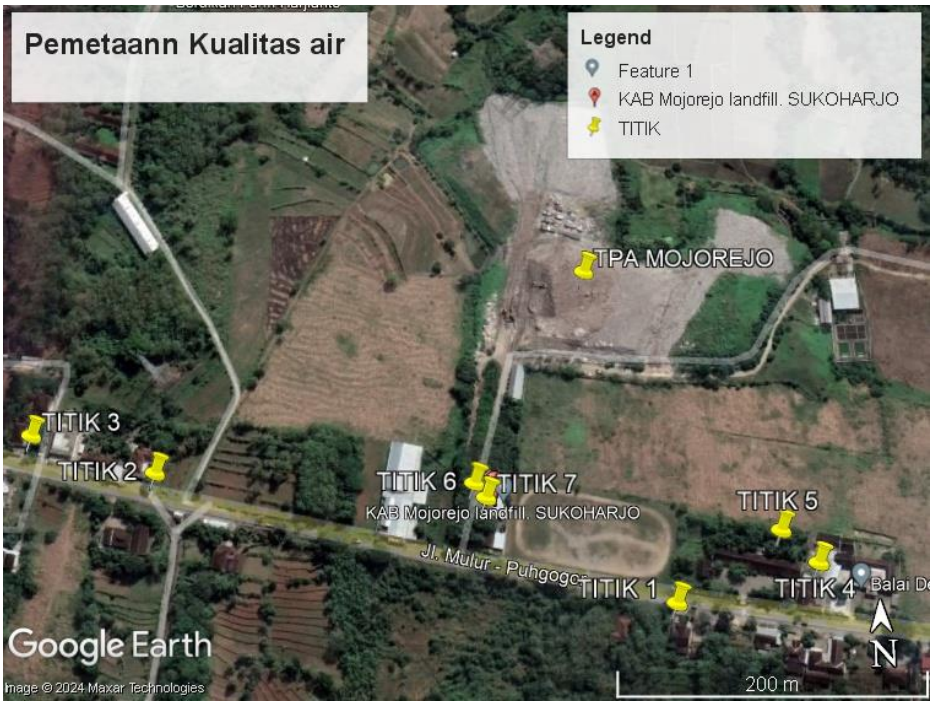
Measurements were carried out in Masan and Mojorejo hamlets, Mojorejo Village, and Sukoharjo Regency. Measurements were carried out at seven clean water points used by residents within a distance of 500 meters from the Mojorejo TPA (Picture 2).

The TDS, temperature, colour and iron parameters in the three sample wells still meet the standards of Regulation of the Minister of Health of the Republic of Indonesia Number 32 of 2017 (Menteri Kesehatan Republik Indonesia, 2017). ecause it still meets the required quality standards. For odour and pH, the research area shows that it has exceeded the maximum threshold allowed according to water quality criteria based on Regulation of the Minister of Health of the Republic of Indonesia Number 32 of 2017 concerning clean water quality requirements, namely odourless and for pH not exceeding 6.5-8.5.

The results of the analysis show that the clean water used by the community around the Mojorejo TPA with a distance of 500 meters from the TPA meets the requirements for clean water use even though there are several water parameter results from the sampling site that do not meet the criteria. Based on interviews from the community at one of the sampling locations, it was stated that the poor condition of healthy water quality around the landfill area is an indication of groundwater pollution due to seepage of leachate, which enters the well together with rainwater and enters river flows as well as groundwater. The condition of This is even worse during the rainy season when the leachate discharge becomes large so that it can overflow out of open drains so that residents no longer use their own pumped well water and it has been permanently closed. Before PAMSIMAS was built, many people still depended on ground well water, but the increasing piles of rubbish made the groundwater increasingly polluted, which made the community's well water black and smelled terrible, so people closed their wells permanently and started to depend on PAMSIMAS.



Picture 1 Mojorejo Sukoharjo landfill plan



Picture 2 Research Setting

Based on the results obtained through direct examination at the time of collection, it showed that of the seven samples that did not meet the requirements, five samples were obtained with a percentage of (57%) and the remaining two samples or (43%) met the criteria. The samples that showed that they did not meet the requirements were due to the collection location being very close to the landfill, which was right behind the Mojorejo landfill, causing more significant odour contamination to occur in these samples (Rahmi et al., 2018).

Table 4. Water Quality Measurement Results

Parameter	Sampling Location							Description
	1	2	3	4	5	6	7	
Odor	Od	Sm	Od	Sm	Sm	Sm	Sm	Not eligible
TDS (mg/L)	225	297	212	193	200	287	298	Eligible
Temp	27	30	28	29	30	31	31	Eligible
Color	Co	Co	Co	Co	Co	Co	Co	Eligible
pH	7,65	7,02	7,94	7,98	1,25	13,35	13,69	Not eligible
Iron (FE)	<0.000	<0.000	<0.0004	<0.000	<0.037	<0.000	<0.000	Eligible

Abbrevation: Temp= temperature; Od= odorless; Sm= smells; Co= colorless

The TDS value of groundwater in the study area varies between 193.0 mg/l-298.0 mg/l. According to Minister of Health Regulation No. 32 of 2017, the maximum clean water quality standard for TDS is 1000 mg/l. Therefore, all groundwater falls into the category suitable for use as clean water. Groundwater TDS values are influenced by various factors, such as rock weathering and runoff from the soil (Rinawati et al., 2018). A TDS sample can be measured using a TDS meter. How to use it: First, open the bottom cover of the TDS meter. Please note that the safe limit for dipping a TDS Meter is not to exceed the TDS Meter closing line. Second, turn on the TDS Meter by pressing the ON/OFF button until the monitor shows the number 0000. Third, dip the TDS Meter in the water where you want to check the TDS level. Remember to dip the TDS Meter only to the safe limit, as explained in the first point. Fourth, read the indication values on the monitor. Press the Hold button when lifting the TDS Meter from the water so that the numbers shown on the monitor do not disappear or change to 0000. Water that has high TDS levels can be at risk of leaving stains in the form of deposits on equipment and also produce water with an unpleasant taste (Sasongko et al., 2014).

The water temperature should be 10-25 0C (cool) so that there is no dissolution of chemical substances in the channels or pipes, which can endanger health. The water temperature permitted by the 2010 Minister of Health Regulation is ± 30 0C. According to the research results, the temperature of the groundwater samples sourced from Pamsimas meets the clean water quality requirements, namely in the range of 27-300C. The way to measure temperature is to insert the thermometer into the water sample, wait 2-3 minutes, and then read the scale or number printed on the thermometer. The water temperature should be cool or not hot, mainly so that there is no dissolution of chemicals in the channels/pipes, which can endanger health and inhibit the growth of microorganisms (Fauzia et al., 2023).

Quality groundwater must meet physical requirements, where the requirements for the water used are clear and transparent. Based on the research results, as many as (100%) of the water samples were colourless. Thus, if we refer to the sample results, 100% of the groundwater is categorized as suitable for clean water, according to the Minister of Health

Regulation No. 32 of 2017. The geological factors that influence the colour quality of the groundwater are the condition of the soil and lithology in the research area. According to Putra, D., B., E., and Yuniarti, Y, clay and silt lithology also make the water more turbid. Apart from that, the Fe and Mn content of groundwater also affects the colour of groundwater. High Fe and Mn levels can change the colour from yellowish to brown. The Fe and Mn content of groundwater can influence the colour of groundwater (Munfiah et al., 2013).

Standard water quality requirements for pH based on Minister of Health Regulation No. 32 of 2017 are in the range of 6.5 – 8.5. A total of 7 groundwater samples were sampled; of the seven samples, three samples exceeded the limit, so these three samples were not suitable for use in clean water because they had a pH value < 6.5 (acid), namely in the range of 1.25 – 13.69 Water pH which tends to be acidic can also dissolve iron and increase the concentration of iron in the water. Low water pH causes a sour taste in the water, while high pH causes a bitter taste (Fauzia et al., 2023). To measure acidity or pH, take a water sample whose pH level you want to measure (put it in a container), turn it on by pressing the on button on the pH meter, and insert the pH meter into the container. The container contains the water to be tested, and when immersed in water, the number scale will move randomly. Wait until the number stops and does not change. The results will be visible on the digital display.

The requirement for clean water to have a maximum Fe content of 1 mg/l is sourced from Minister of Health Regulation No. 32 of 2017 concerning Water Quality Standards. The Fe content of groundwater in the study area varies between 0.000 mg/l to 0.037 mg/l. Thus, 100% of groundwater meets the requirements if the Fe content is above one mg/l, causing eye and skin irritation. If the solubility of iron in water exceeds ten mg/l, the water will smell bad (Febrina & Ayuna, 2014). Iron or Fe measurements are carried out at the Regional Health Laboratory of Sukoharjo Regency.

CONCLUSION

The conclusion of this research is based on the results of measurements of clean water samples carried out around settlements 500m from landfills. For odour parameters, the results showed that 57% of the water had a clean smell, and only 43% had no scent. The TDS value for groundwater in the research area varies between 193.0 mg/l-298.0 mg/l, which means that the groundwater in the research area has met the quality standards in accordance with Minister of Health Regulation No. 32 of 2017, with a maximum TDS quality standard value of 1000. mg/l, the water temperature permitted by Minister of Health Regulation No. 32 of 2017 is ± 30 0C and based on research results, it shows that the water sample temperature meets the clean water quality requirements, namely in the range of 27-300C. For colour parameters, based on research results, as many as (100%) of the water samples were colourless and met quality standards. For pH parameters based on Minister of Health Regulation No. 32 of 2017, water quality standards are in the range of 6.5 – 8.5 and of the seven water samples, three samples exceed the limit, namely sample 5 with a pH of 1.25 (acidic) and a pH value of 13 .35 and 13.69 (fundamental). The Fe content of groundwater in the research area varies between 0.000 mg/l to 0.037 mg/l and meets the quality standard for iron, namely one mg/l.

Thus, based on Minister of Health Regulation No. 32 of 2017 concerning Water Quality Standards, 100% of groundwater meets the requirements. Residents around the Mojorejo TPA already understand that their wells are polluted, so the villagers close their

wells and use other water sources, such as PAMSIMAS, for their daily clean water needs. Still, regular checks on PAMSIMAS, which residents use to pay attention to water quality, are needed so that there are no long-term effects or dangers to health.

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