

Analysis of Water Quality Based on BOD and COD Levels in Unisma Hospital

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Humans are facing worsening environmental problems, such as the depletion of clean water. Pollution that occurs either through soil, or poor sanitation, will affect the quality of water produced by the water sources around Unisma Hospital. This study aims to analyse the quality of water around the area of Unisma Hospital. This research is an observational research that is descriptive in nature. The study sample was taken from a well in the area of Unisma Hospital. Lab tests were carried out to measure the water quality, with the dependent variables being the form of BOD, COD, and PH of the water sample. The results of the study indicate that the parameters (BOD, COD, PH), when compared to the standard quality requirements based on East Java Regional Regulation No. 2 of 2008 concerning Management of Water Quality and Water Pollution Control in East Java Province, reveal that water quality is influenced by the flow of waste, garbage, and other pollution. The results of measurements of well water quality indicate that there are parameters that do not meet the quality standard requirements. Well water quality is influenced by toilet distance, domestic liquid waste and other pollutants. Water quality and quality of well water has decreased, so increased supervision of the quality of well water is needed.

Key words: *BOD, COD, PH, Water Quality, Waste.*

Introduction

Water is a natural material that is needed by all living things, be it human, animal or plant. It is a daily necessity, either as a source of minerals or a medium for transporting food substances or other items. Regulation of the Minister of Public Works No. 14 / PRT / M / 2010 concerning Minimum Service Standards in the Field of Public Works and Spatial Planning, states that the average water requirement is 60L/person/day. The need for clean water is continuing to increase. According to Suripin (2002), in 2018 80% of clean water supply comes from Malang district. The main problems arising in relation to water resources are the quantity of clean water is unable to keep pace with the increasing need, and the quality of water for domestic needs is declining year on year. These problems can cause disruption, damage, and danger to living things that depend on water resources (Effendi, 2003). Water quality degradation is not only caused by industrial waste, but also due to household waste, in both liquid and solid forms (Lallanilla, 2013). Decreases in water quality occur in several regions of Indonesia, including in the city of Malang. The decline in water quality is caused by pollution from household and industrial waste that was not disposed of in accordance with the rules. This waste then affects the condition of the population's well water, river water or ground water.

Water is used daily by every human being and directly impacts their quality of health. In order to improve the degree of public health it is hoped that all available water sources are feasible. This research was carried out to check the quality of water used by health service providers.

Almost all water used by humans, for both consumption and industry, will produce wastewater which, in turn, if not properly processed, will create pollution. A determination on the quality of water can be done by observing several chemical parameters, such as dissolved oxygen (Dissolved Oxygen = DO) and biological oxygen requirements (Biological Oxy-gene Demand = BOD).

Method

This research is an observational research which is descriptive in nature. The research sample consisted of water used at Unisma Hospital. Water samples are well water with the following criteria: type of bore well (depth 10-30 meters) within the area of the hospital. Inspection of each parameter is done at the Water and Soil Laboratory, Water Resources Engineering Department, Faculty of Engineering, University Brawijaya.

BOD is found by measuring the initial dissolved oxygen content (DO_i) of the sample immediately after sampling, then measuring the dissolved oxygen content of the sample after

It has been incubated for 5 days in dark conditions and at a constant temperature (20°C); this process is often referred to as DO₅. The difference between DO_i and DO₅ (DO_i - DO₅) is the BOD value expressed in milligrams of oxygen per litre (mg / L). Oxygen measurements can be done analytically by titration (Winkler method, iodometry) or by using a device called a DO meter. The water is kept in dark conditions so that photosynthesis does not occur. It is kept at a constant temperature for five days as it is expected that the decomposition process occurs by microorganisms, which uses oxygen, and the remaining oxygen is denoted as DO₅. The important thing is to make sure that there is still oxygen left on the fifth day of observation so that DO₅ is not zero. If the DO₅ value is zero then the BOD value cannot be determined. BOD measurement requires certain water conditions, so that it may be necessary to neutralize pH, dilution, aeration, or increase the bacterial population, in any given water sample. Dilution and/or aeration of the sample is needed to ensure that enough oxygen remains on the fifth day. Because BOD involves microorganisms (bacteria) as decomposers of organic matter, the analysis is time consuming. Within 20 days, the oxidation of carbon organic matter reaches 95-99%, and within 5 days around 60-70% of the organic material is decomposed (Metcalf & Eddy, 1991).

COD is inversely proportional to Dissolved Oxygen (DO). That is, the less air content in the water, the greater the COD value will be. The COD value indicates that quantity of organic substances in water. Organic substances convert oxygen to carbon dioxide and water, if this continues to occur the water will lack sufficient oxygen. DO is an indicator of how much pollution has occurred.

Result

The following data is the result of the analysis of water quality in the Unisma Hospital area of Malang. The parameters that were tested include the value of BOD (Biological Oxygen Demand), and COD (Chemical Oxygen Demand).

Biochemical Oxygen Demand is a characteristic that shows the amount of dissolved oxygen needed by microorganisms (usually bacteria) to break down or decompose organic matter under aerobic conditions (Umayal and Cuvin, 1988; Metcalf & Eddy, 1991). Reiterated again by Boyd (1990), organic material decomposed in BOD, is organic material that is ready to decompose (readily decomposable organic matter). Mays (1996) defines BOD as a measure of the amount of oxygen used by microbial populations contained in waters in response to the entry of decomposed organic matter. From this understanding it can be said that the BOD value states the amount of oxygen, but for simplicity, it can also be interpreted as a description of the amount of biodegradable organics in the waters.

Chemical Oxygen Demand or COD, is the amount of oxygen needed to break down all organic matter contained in water (Boyd, 1990). Organic matter is intentionally decomposed by using potassium bichromate strong oxidizer under acidic and hot conditions with silver sulfate catalyst (Boyd, 1990; Metcalf & Eddy, 1991), so that all kinds of organic materials, both those which are easy to decompose and those which are easily complex and difficult to decompose, will oxidize. Thus, the difference in value between COD and BOD gives an idea of the amount of organic material that is difficult to decompose in the waters. It could be that the BOD value is the same as the COD, but the BOD cannot be greater than the COD as the COD illustrates the total amount of organic matter that exists.

Here is a table of results from the lab tests:

No Parameter Method Unit for Analysis Results Class I Water Standards

No.	Parameter	Method	Unit	Results	Class 1 Water Standards
1	BOD	Volume	Mg/L	22.78	2
2	COD	Volume	Mg/L	36	10

The BOD value obtained from observations indicates that there is high levels of organic matter in the water. According to Silalahi (2009), water with a BOD value smaller or equal to 22.78 mg/L is classified as polluted. The BOD value indicates the amount of organic material decomposed by aerobic bacteria, the higher the BOD, the more polluted the waters are. This is in accordance with Yogendra and Puttaiah (2008), who stated that BOD is a parameter for assessing organic load in water bodies.

The results indicated a COD value of 36 mg/L. A high COD value is caused by increasing organic matter in water. This is consistent with Hariyadi et al. (2008), who stated that the value of COD will increase in line with the increasing value of organic matter in the waters.

The results show that the water quality of Unisma Hospital cannot meet the Class I quality standards, that is, water that is classed as being suitable for consumption and other purposes. From these results, the water in the Unisma Hospital area can be downgraded into class II quality standards, i.e. water that is only suitable for use in recreation, infrastructure facilities, freshwater fish cultivation, animal husbandry, and irrigation. These classifications are based on Regulation Number 82 of 2001 concerning Management of Raw Water Quality. Many factors affected the results of this test, including the proximity of residential settlements around the hospital and sanitation in the hospital area.

Conclusion

From the results of the research, the following can be concluded:

1. There was a BOD (Biological Oxygen Demand) value of 22.78 mg/L and a COD (Chemical Oxygen Demand) value of 36 mg/L. These values are categorised as indicative of minor pollution until according to the Center for Environmental Quality Water Resources Development in Indonesia.
2. The BOD and COD values are still within the allowed quality standards, but the water quality is downgraded to group II
3. The sampled water is only suitable for recreation, infrastructure facilities, freshwater fish farming, animal husbandry, irrigation, or other purposes that require the same water quality as these uses.
4. Even though the COD and BOD parameters are categorised as mild and moderate pollution, the water must still be treated because of the existence of pollution.



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