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Analysis of Water Pollution in The Musi River Due to Community and Industrial Activities Using Onlimo

Yunita sari Purba[1*], Uci Sulandari[1*], Lelitasari[1], Defi Arjuni[1]

[1] Dosen Keselamatan dan Kesehatan Kerja, Universitas Binawan, Indonesia.

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Corresponding Author:
Uci Sulandari
uci.sulandri@binawan.ac.id

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Abstract: The Musi River is a natural resource which is one of the main trade routes and the largest air supplier for the people of South Sumatra. However, the condition of the Mus River has undergone changes due to dense settlements and industry. Water quality is an important factor in the sustainability of an ecosystem. Ecosystem damage can start from declining air quality which results in industrial waste that pollutes the Musi River. Water quality measurement parameters include measurements of oxygen, TSS, COD, BOD. Observation station sampling was carried out using Onlimo telemetry technology. Onlimo is a remote, online and real-time air quality monitoring technology developed by BPPT. Sampling was carried out during the transition season on the Musi River which was divided into station 1 located in the Musi River (PDAM Tirta Randik area, Balui Air Unit, Sanga Desa District). On May 10, 2023 there was a pollution index of 7.32 with moderate contamination with the critical parameters Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD). There was an increase in the Pollution index of 7.51 due to an increase in Nitrate from 16 May 2023 to 17 May 2023 due to input from anthropogenic waste caused by differences in sampling time, besides that season and rainfall are reported to play an important role in dissolving a number of components in the waters. For this reason, to prevent and improve the function of the Musi River, namely the government must act decisively on violations committed by factories or companies or the public who dispose of waste carelessly.

Keywords: Musi River; Onlimo; Plant Waste; Water Pollution

Introduction

Rivers are one of the largest water suppliers for the needs of living creatures which have an important function for human life (Postel & Richter, 2012). The Musi River is a natural resource which is one of the main trade routes and the largest water supplier for the people of South Sumatra (Setianto & Fahritsani, 2019; Trisnaini et al., 2018). However, the condition of the Musi River has changed due to dense settlements and industries such as oil refineries, fertilizer factories, processing of natural rubber, plywood and others (Purwiyanto et al., 2020). The variety of human activities along the Musi River has an impact on the physical condition of the river and the habitat of the aquatic animals that inhabit the waters (Rahutami et al., 2022).

In the upstream part of the Musi River, the urea fertilizer industry is located, liquid waste resulting from the processing process can be discharged into the waters of the Musi River, thereby affecting water quality. Apart from that, there are also dense residential areas in Palembang City with the Musi River flowing through the settlement, where residents' activity in the river waters is still quite high. High activity in river waters can of course also have an impact on river water quality, and can even cause river water pollution (Dutta et al., 2020; P. I. A. Gomes & Wai, 2020; Meng et al., 2020).

Pollutants include organic and inorganic waste. This waste pollution causes disturbances and physical, chemical and biological changes in the river waters and ultimately causes pollution1 stating that water quality degradation can occur due to changes in water quality

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parameters which can be caused by waste disposal activities, both factory/industrial waste, agricultural as well as domestic waste from a residential area into a body of water (Cahyaningtyas et al., 2013; Rudiyanti, 2009).

The Palembang Musi River between Polokerto and Salah Nama Island was completely polluted with mercury. Total mercury levels in water range from 17,250 – 21,750 ppb, while total mercury levels in sediment range from 1,125 – 2,521 ppb. Based on laboratory examinations of the Palembang City Health Service for samples of Palembang City Musi River water in 2010 which were carried out in ten sub-districts, the results showed that the water quality at these ten points no longer met the requirements, both from the results of physical, chemical and bacteriological examinations. 3

The National Clean Water Act (Federal Clean Water Act) has designated macroinvertebrates as a target and prerequisite parameter in monitoring the success of water quality management (Govenor et al., 2017; Kenney et al., 2009). The use of macroinvertebrates is then known as biotylics (Agustina, 2022), as a form of examination that can provide accurate results, is easy to carry out, and does not require complicated and expensive equipment. This is the main advantage of biometric monitoring (Rini, 2011). Mentions that pollution that can occur in rivers includes pollution by microorganisms, various germs that cause disease in living things, such as bacteria, viruses, protozoa and parasites, which often pollute the water. Organic waste causes a lack of dissolved oxygen. Contamination of inorganic chemicals such as acids, salts and toxic metals such as Pb, Cd, Hg in high levels can cause water that is unpalatable to drink and sediment and suspended materials such as sand, mud, soil and materials inorganic chemicals become suspended materials in the water, so that these materials become the highest cause of pollution in the water (C. S. F. Gomes et al., 2021; Ikpesu et al., 2021).

Method

Time and Place

Sampling was carried out during the transition season on the Musi River which was divided into station 1 located within the Musi River (PDAM Tirta Randik Balui Water Unit area, Sanga Desa District, which is an area densely populated and with shipping activities.

Data Collection and Analysis Procedures

The water quality parameters measured in the research were Nitrate, BOD, COD, Dissolved Oxygen Concentration (DO), PH, and TSS (Abdul Maulud et al., 2021; Aniyikaiye et al., 2019; Ariany et al., 2022; Nayar, 2020). The data obtained during the research is tabulated in tables and figures to determine the status of the aquatic environment. The upstream part of the Musi River was analyzed by comparing with analysis by comparing with standard seawater quality standards for marine biota6

Research Methods

The method used in online monitoring system development activities using GSM communication technology here is a combination of these three telemetry models, because this system is designed to carry out monitoring according to time intervals that can be set according to needs (Time Base). Apart from that, changes to time interval settings can be made from the data center by sending commands using communication media (Polling Base), and if there is a violation of the predetermined quality standards, the data logger system program will send a message automatically to the data center (Event Base).

The combination of these three methods really depends on the quality of the program that can be embedded in the micro controller as the data logger. The development of digital technology allows data loggers to carry out data measurements with a high level of accuracy.

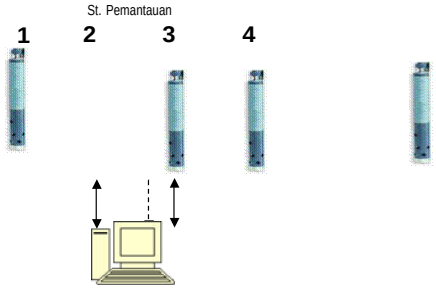

Figure 1. Developed Onlimo telemetry model

Thanks to advances in data communications and electronics technology today, data loggers can be made to transmit data cheaply and very quickly. So the data logger can immediately send data to the data center if there is water pollution or an incident where the measurement results exceed the quality standards.

Result and Discussion

Physiography of the Musi River

Palembang is the capital of South Sumatra Province and is also the largest city and center of socio-economic activities in the South Sumatra region. The area of Palembang City is 400.61 km² or 40,061 Ha. From a hydrological perspective, Palembang City is divided by the Musi River into 2 (two) large areas, namely Seberang Ulu and Seberang Ilir. The Musi River is the largest river by average width 504 meters (Surnata et al., 2022). The other three large rivers are the Komering River, Ogan River and Keramasan River which are located in Seberang Ulu. Besides these large rivers, there

are other small rivers located in Seberang Ilir which function as urban drainage.

The Musi River is a river located in South Sumatra Province, with a length of 750 km and is the longest river on the island of Sumatra. The Musi River, which passes through the Palembang City administration, divides Palembang City into two areas, namely Seberang Ilir in the north and Seberang Ulu in the south. The Musi River has an important role in people's lives, therefore its preservation and continuity of function must be maintained by securing the surrounding area. The reality on the ground is that the function and structure of the river has begun to be disrupted due to activities developing around it (building interventions and rubbish thrown into the river body) and resulting in disruption of the river ecosystem, decreasing river water quality, and water overflowing in river border areas.

To prevent greater losses resulting from river damage, it is necessary to organize river border areas with conservation activities, utilization and control of the resources available in the river. The upstream segment with protected forest ecosystems has experienced changes in land use up to the downstream which is full of settlements and industries such as oil refineries, fertilizer factories, processing of natural rubber, plywood and others, thus potentially causing degradation of the quality of the river water environment.

Figure 2. Musi River

Even in the downstream part, the Musi waters are a source of water, not only for residents along the river, but also a source of water and a place for disposing of liquid waste by industry, which has an impact on decreasing the quality of the Musi waters. The variety of human activities along the Musi River has an impact on the water quality of the Musi River.

Industry

Water quality is an important factor in the sustainability of an ecosystem. Ecosystem damage can start from a decrease in water quality caused by industrial waste which flows directly into the Musi River. Water quality measurement parameters include measurements of oxygen, TSS, COD, BOD.

Total Suspended Solids (TSS)

Total Suspended Solids (TSS) or suspended solids consist of particles that have a smaller size and weight than sediment, such as clay, microorganism cells, certain organic materials and others7. The presence of Total Suspended Solid levels is a characteristic of the erosion process which can increase the level of turbidity in a body of water.

Biological Oxygen Demand (BOD)

BOD levels are one of the parameters that can be used as a benchmark for the pollution load of waters. BOD examination is very important to trace the flow of pollution because it can determine the pollution load due to waste water and design a biological disposal system for polluted water.

Nitrate Concentration

Nitrogen compounds are compounds that are very important for organisms because they are needed in the synthesis of complex protein molecules. Nitrogen compounds that are found abundantly in waters are nitrates, following nitrite and ammonia. The nitrogen compound found in abundance in waters is nitrate, followed by nitrite and ammonia. There are several things that trigger high nitrate concentrations in the water column, including input from anthropogenic waste

Chemical Oxygen Demand (COD)

The level of pollution in waters can also be analyzed based on COD (Chemical Oxygen Demand) levels. The COD analysis results are a parameter that shows the amount of oxygen used for chemical oxidation.

Onlimo

The Onlimo sensor used is a multiprobe sensor consisting of temperature parameter sensors, electrical conductivity, TDS, turbidity, DO, pH and nitrate. The probe on the sensor used has been calibrated regularly and periodically beforehand. Data from water quality measurements from the sensor will be temporarily stored by the data logger. The data logger used has two types of monitoring intervals, namely periodic and EWS / early warning system, the water quality measurement time delay for EWS is 60 seconds.

Data storage and transmission monitoring intervals can be monitored from the data center, as well as having an onsite display to display measurement results at any time in the field.9.

Like the water quality status in Figure 3. On May 10 2023 there was a pollution index of 7.32 with moderate pollution with the critical parameters Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD).

Figure 3. Quality Status on May 10 2023 & Trend Graph

A week later there was an increase in the Pollution index of 7.51 due to an increase in Nitrate from 16 May 2023 to 17 May 2023 due to input from anthropogenic waste caused by differences in sampling times, apart from that season and rainfall are thought to play an important role in dissolving a number of chemical components in the waters. It is in Figure 4.

Figure 4. Quality Status on May 17 2023 & Trend Graph

Discussion

From the results of research on the use of Onlimo through observations, surveys or laboratory test results, it can be concluded that the pollution that occurs in the waters (Anggoro & Mailangkay, 2021; Arinda et al., 2023; Damayanti et al., 2022) of the Musi River originates from organic factors originating from household waste and industrial waste disposal. The high levels of COD, BOD and DO levels of organic waste mostly come from used laundry water, water from the kitchen, bathroom water and overflow water from septic tanks (Aziz, 2023; Ramadhawati et al., 2021; Salim, 2021).

Industrial waste contains dangerous substances that can threaten human life (Mishra et al., 2019; Muhammad et al., 2021). The nature of industrial waste is that it contains poison, has a high temperature, causes irritation, produces odors, is flammable, and reacts to body tissue, and is included in the category of hazardous materials (Hassan & Saleh, 2022).

Dangerous impacts on health can be in the form of disruption of body organ function or disruption of biochemical processes characterized by tissue damage, organ function abnormalities, disruption of enzyme and endocrine systems. Management of industrial liquid waste in Palembang City still receives little attention. Part of industrial liquid waste, especially large industries, is processed directly by each industry, where the system is very dependent on the type of waste produced, however, there are several industries that dispose of it directly into water bodies. This is very worrying because it has huge potential to pollute the environment. The City Government regularly monitors the processing of industrial waste, which is carried out by the Palembang City Environmental Agency (BLH).

Conclusion

There are two factors of pollution in the Musi River in Palembang City, namely pollution originating from industrial activities. Pollution in the waters of the Musi River is largely dominated by organic waste in the river water, indicating that household waste is the main determining factor that pollutes the Musi River. The high levels in the waters of the Musi River can be seen from the quality status of BOD, COD and Nitrate. The management of industrial waste in Palembang City still receives little attention. Industrial liquid waste, especially large industries, is partly processed directly by each industry, where the system is very dependent on the type of waste produced, however, there are several industries that dispose of it directly into water bodies. To prevent and improve the function of the Musi River, the government must act decisively against violations committed by factories, companies or people who dispose of waste carelessly. Apart from that, company or factory permits must have regulations to preserve the environment. It is necessary to reforest forests located in river flows so as to reduce landslides. So, government, companies. factories and communities must work together to preserve the Musi River

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Conflicts of Interest
The authors declare no conflict of interest.

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