
| RESEARCH ARTICLE

pH Monitoring Online

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| ABSTRACT

As the largest coal exporting country in the world, Indonesia needs efforts to prevent various negative things for coal mining activities to maintain the balance of the surrounding nature. One of the many affected by mining activities is water. The wastewater quality must be checked regularly before it flows into water bodies. This research aims to describe the company's program created by the Safety Health & Environment (SHE) department and Center of Excellence (CEO) Department to monitor wastewater generated from mining activities for 24 hours. This research uses a descriptive method with a qualitative approach. This descriptive research explains the program for monitoring pH in mining wastewater. The results showed that this online pH monitoring was made to measure the pH of water from mining waste and was carried out to reduce the potential for disruption of biodiversity in the environment around wastewater disposal. The creation of this program also has an impact on cost efficiency because it can be used online and can be controlled remotely.

| KEYWORDS

Mining, Water Quality, Water Ph Monitoring

| ARTICLE INFORMATION

ACCEPTED: 01 July 2023

PUBLISHED: 10 July 2023

DOI: 10.32996/jeas.2023.4.2.2

1. Introduction

Indonesia is the second largest brick exporter in the world after Australia. The coal that is mostly exported is sub-bituminous coal which can present Indonesia's coal production; in 2003, coal production in Indonesia increased by 11.1%, and the number of exports increased by 18.3% in the same year (Annisa, 2018).

According to KepMen LH No. 113 Year 2003, the coal mining business involves mining and coal processing/washing activities. Coal mining activities are coal extraction which includes excavation, transportation and stockpiling in both open pit and underground mines. Coal processing/washing activities are crushing, washing, concentrating, and or removing impurity rocks/minerals and/or sulfur compounds from coal without changing its chemical properties.

Wastewater of coal mining business and or activities is water originating from coal mining activities, including excavation, transportation and stockpiling in open pits and underground mines. The coal wastewater quality standard measures the limit or level of pollutant elements and/or the number of pollution elements tolerated in coal wastewater that will be discharged or released to surface water. (Nugeraha et al., 2010). In addition, sulfide minerals that bind to oxygen in the water can result in the presence of heavy metals and low pH. The exploitation of natural resources (mining activities) can cause environmental damage, one of which is water pollution. Therefore, it is better to analyze the quality of water levels before it flows into the river as a form of supervision and control of water quality by the government to maintain and protect the preservation of biodiversity against the impact of mining activities (Amir et al., 2021). Mine wastewater management efforts are important to minimize negative risks to human health and the environment (Desiana et al., 2022). Therefore, it is necessary to control water pollution by limiting the burden

of wastewater pollution entering water bodies. One of the efforts in controlling water pollution is to check the quality of wastewater regularly before it is flowed into water bodies (Suryani et al., 2022).

In the case of severely decreased soil pH, it will disrupt the nutrient balance of the land area, and the drastic decrease in pH will increase the solubility of heavy metals in the surrounding environment. Thus, environmental conditions with low pH result in the unavailability of macro-nutrients because these macro-elements are bound by metal elements, while at the same time, in these conditions, the solubility of micro-nutrients will increase (Ashari, 2016).

Previous research conducted by Wahyudin et al. (2018) showed the importance of analyzing the handling and purification of acid mine drainage so that acid mine drainage management can be carried out based on quality standards and AHP (Analytic Hierarchy Process) test of the parameters used. Aryanto (2014) also sought alternatives to manage acid mine drainage by reducing operational and maintenance equipment. Passive management relies on biochemical processes that occur continuously naturally in increasing pH and binding and precipitation of dissolved metals.

Wastewater generated from mining activities has the potential to disrupt biodiversity, and the pH of mining water fluctuates. Therefore, the wastewater produced must always be monitored before being discharged into the environment; monitoring is limited if done manually and only a few moments the water can be monitored. Therefore, making online pH monitoring helps monitor water quality, especially the pH parameter, in real time for 24 hours.

2. Methodology

This research uses a descriptive method with a qualitative approach. The qualitative approach emphasizes the meanings and understanding of things around us, of course, directly related to our daily lives. Qualitative research is research with data from written or oral words from observations (Firmansyah et al., 2021). Descriptive research aims to explain the meaning and describe various phenomena, both natural and engineered, with more emphasis on the characteristics, quality, and interrelationships between activities (Utami et al., 2021). This research describes the PT Antareja Mahada Makmur site Multi Harapan Utama program created by the Safety Health & Environment (SHE) Department and Center of Excellence (CEO) Department to monitor wastewater generated from mining activities for 24 hours.

3. Results and Discussion

3.1 Brief Description of the Online pH Monitoring Program

PH online monitoring is a program created by the department between the Safety Health & Environment (SHE) Department and the Center of Excellence (CEO) Department of PT Antareja Mahada Makmur site Multi Harapan Utama.

3.1.1 Tool components:

- a. Arduino Uno
Arduino Uno is a microcontroller board based on ATmega328 (datasheet), which has 14 input pins of digital output where 6 input pins can be used as PWM outputs and 6 analog input pins.
- b. ESP 8266
ESP8266 is a Wi-Fi module that functions as a microcontroller enhancement on Arduino so that it can connect directly to Wi-Fi and establish a TCP / IP connection.
- c. Simcard module
The simcard module is an internal integrated circuit (ICC) physical, electronic device that securely identifies and authenticates between users and wireless operators.
- d. RTC module
The RTC (Real Time Clock) module is an electronic module that provides accurate time information in the form of digital data. This RTC module is used because the online pH monitoring will be on and can be used for 24 hours.
- e. Analog PH meter
A PH meter is a laboratory tool that serves to determine the acid and base values of a solution. Of course, this pH meter is used because the program created is a tool to measure the pH of water.
- f. Duct connector 3 pin
A duct cable is a fiber optic cable whose installation uses duct /sub duct pipe protection; this cable is buried in the ground (underground).
- g. Duct connector 2 pin
- h. 100wp solar panel
Solar panels are devices that convert sunlight into electricity using photovoltaic cells.
- i. 40A solar panel mppt controller

Solar charge controller or Solar Charge Controller (SCC); One of its functions is to prevent excessive battery energy charging. MPPT charge controller can store excess power that is not used by the load into the battery, and if the power required by the load is greater than the power generated by the PV, then the power can be taken from the battery.

j. Battery 12v, 75A

The battery circulates electrical energy from high potential to low potential to power an electronic device. Battery function the battery serves to provide or supply electrical energy for electronic devices without having to be connected to the mains.

k. Box panel

The electrical panel box is used as a protective place and controls the electricity flow cable.

l. Display (led p10)

This display functions to display information in the form of text and images that we can set the display as desired.

m. Cable contents 8

This cable functions for data transmission.

3.2 How it Works

The results of the pH data of wastewater discharged into the environment are monitored by the PH meter panel then the data is forwarded and read through the application on the cellphone. If a deviation is found in the pH quality of the water or does not meet the quality standards, the team immediately closes the water gate to treat the wastewater.

The following picture shows how the online pH monitoring program works.



Figure 1. How the online pH monitoring program works

3.3 Benefits of Online pH Monitoring

3.3.1 Impact of Innovation on the Environment:

Acid Mine Drainage (hereinafter AAT) is one of the negative impacts caused by mining activities because it can damage biodiversity (Suryadi & Kusuma, 2019). Indonesia is famous for its flora diversity, but it also has high fauna diversity. Indonesia has 115 species of mammals, 1,500 species of birds, 600 species of reptiles, and 270 species of amphibians (LIPI, 2020). Indonesia also has high fish diversity (Lasabuda, 2013). Some of the terrestrial and aquatic fauna only exist in Indonesia. According to LIPI (2021), 97 species of reef fish and 1,400 species of freshwater fish are only found in Indonesia. However, Indonesia is known as a country with a high decline in biodiversity (flora and fauna). Out of 20 countries whose natural types are threatened, Indonesia occupies the 5th position, and according to National Geography Indonesia (2019), Indonesia ranks sixth as a country with the most biodiversity extinction, one of which is due to the influence of mining activities. (Setiawan, 2022). Thus, efforts to reduce the negative impact of acid mine drainage need to be made by mining companies, both through the use of chemicals and biologically. One of the active treatment processes is by adding chemicals that can neutralize the acidity of the waste. Some neutralizing agents that are widely used include calcium oxide, calcium carbonate, sodium hydroxide, magnesium oxide and magnesium hydroxide (Aryanto, 2014).

The creation of this online pH monitoring program is to measure the pH of acid mine water carried out by PT Antareja Mahada Makmur site Multi Harapan Utama. The quality of water pH can be controlled continuously so that the quality of the receiving

water body/river is maintained and does not interfere with biodiversity, especially in receiving water bodies or swamps around mining.

3.3.2 Impact of Innovation on Cost Efficiency:

The current era of globalization has created a lot of competition. This results in the company facing an increasingly high level of competition and is required to keep up with the competition in order to remain able to grow and survive. Controlling costs in the company is one form of effort that can be done by the company in order to reduce and control costs without having to reduce the quality and quantity of production (Ticoalu & Supriyono, 2020).

Making this online pH monitoring program can reduce costs because the distance from the office to the mining wastewater disposal area is about 3 km; if monitoring is carried out once every hour, the cost of renting a car and diesel to commute to the wastewater disposal area is around Rp. 500,000 / day. With online pH monitoring, it can save costs of Rp. 500,000 / day.

4. Conclusion

Based on the results of the research, the PT Antareja Mahada Makmur site Multi Harapan Utama program created by the Safety Health & Environment (SHE) Department and Center of Excellence (CEO) Department to monitor wastewater generated from mining activities for 24 hours is made for internal companies without any other duplicates. As the name implies, this online pH monitoring measures the pH of water from mining waste. This effort is made to reduce the potential for disruption of biodiversity in the environment around wastewater disposal. The creation of this program also has an impact on cost efficiency because it can be used online and can be controlled remotely.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

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