

CHARACTERISTICS OF OPEN COAL MINE WASTEWATER CONDITIONS IN TANAH BUMBU DISTRICT, SOUTH KALIMANTAN, INDONESIA

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Abstract:

This research aims to determine the waste condition in terms of the quality of the elements Fe, Mn, pH and T.S.S. and to determine the tendency of this waste in the settling pond of coal mines in Tanah Bumbu Regency, South Kalimantan. The research results show that at the settling pond location of the open coal mine, the concentration of Fe quality is between (0.023 - 6.50) mg/lit and Mn (0.02-2.14) mg/lit, and the T.S.S. quality is 76 mg/lit to 801 mg/lit and the pH is between 6.40 to 8.10. Trends in Fe waste Most of the results are still below environmental quality standards; only in July 2022 will the quality increase to 6.5 mg/lit. Meanwhile, Mn waste for a year is still below the government's environmental quality standards, but the highest quality is in September 2024, reaching 3.35 mg/lit; this quality is still below environmental quality standards. The trend in pH quality in general is still expected; only in February 2024 will the quality exceed environmental quality standards, increasing to 8.10 mg/lit. Finally, the trend is decreasing for T.S.S. quality from January to August 2024. In September, it increased significantly to 801 mg/lit and gradually decreased until December 2024 to 182 mg/lit.

Keywords: Environmental quality standards, Coal mine wastewater, trends quality.

INTRODUCTION

The impact of mining results on the environment in various countries is different, such as the disposal of coal mine wastewater in Australia causing water pollution and river ecological degradation. Around the mine site, macroinvertebrate diversity decreased by 65%. The resulting wastewater has a very low electrical conductivity (E.C.), namely 30.0 μ S/cm with an acidic pH (5.6). The Zeng concentration is 101.5 μ g/ltr, and the permitted quality standard is 2500 μ g/ltr. Apart from that, the water discharge in the Wollangambe River, due to the mining process from open pit mines, also impacts water temperature, especially in the downstream areas of the National Park area at that location. (Belmer., et al., 2014)

Based on research by Ekwule O R, Akpen G D, and Ugbebe G M in 2019, the influence of open-pit coal mining on water quality in Nigeria impacts physicochemical qualities such as electrical conductivity (E.C.), total dissolved solids (T.D.S.), turbidity and pH.

Characteristics of the concentration of mining waste elements in Malaysia such as Fe, Mn and Al at dumping locations, Fe content between (0.15-0.77) mg/lit, Mn (0.04-0.08) mg/lit, and Al between (0.04-0.08) mg/lit (Othman et al. Q.A.M., Ramya R., 2016). This differs from research results (Pan.L., 2021) that the impact of open-pit coal mines in southern China produces an increasingly acidic pH, with Fe, Mn, Cu, Zn and other toxic elements.

Mining activities use water haphazardly without anticipating its negative impacts on the ecology and biodiversity of the region. Acid mine drainage is also a common phenomenon related



to mining. In addition, disease and death are caused by contaminated water around mining sites. The critical situation of water bodies in and around mines also contains various contaminants and pollutants (Kamble P H, Kumbhar J S., 2019)

Domestic waste from open coal mine employees' mess in Palembang, South Sumatra, also has an impact on water, where the T.S.S. concentration is two mg/l, oil concentration is 2.8 mg/ltr, B.O.D. is 43 mg/ltr, C.O.D. is 135.3 mg/ltr and ammonia 25.41 mg/ltr and pH 7.1. (Fitriyanti. R., 2020)

The open-pit mining process in Satui, South Kalimantan, also impacts water temperature between 31.3 °C and 29.7 °C. The T.S.S. concentration in settling ponds ranges from 20 – 23 mg/liter. T.D.S. concentration is between 131-258 mg/liter, pH value is between 6.15-7.67, C.O.D. quality is around 5.58-6.95 mg/liter, and B.O.D. is 3.5-4.5 mg/liter. Quality Arsenic (As) <0.01 mg/l, Cobalt (Co) <0.02 mg/l, Barium (Ba) <0.277 mg/l, Boron (B) <0.1 mg/l, Selenium (Se) <0.006 mg/l, Cadmium (Cd) <0.0004 mg/l, Hexavalent Chrom (Cr 6+) <0.001 mg/l, Copper (Cu) <0.006 mg/l, Iron (Fe) 0.018 mg/l, Manganese (Mn) <0.007 mg/l, Lead (Pb) <0.0002 mg/l, Zinc (Zn) <0.004 mg/l and Mercury (Hg) <0.00009 mg/l. The results of this water quality certainly impact life at the mine site. (Said., N.I., 2021)

METHODS

This research was carried out in Tanah Bumbu Regency, South Kalimantan. The types and sources of data are: Wastewater samples from open coal mining activities were taken from the settling ponds of open coal mines and then analyzed at the Environmental Laboratory of the Tanah Bumbu Regency Environmental Service, Jl Dharma Praja. Tanah Bumbu High Mountain, South Kalimantan. Next, they were compared with environmental quality standards set by the government.

RESULT AND DISCUSSION

The impact of open-pit coal mining will produce pollutants, which generally contain heavy metals, such as Fe and Mn, pH and T.S.S., by Government Regulation 22 of 2021. The origin of the waste elements Fe, Mn, pH and T.S.S. in open-pit coal mining activities is:

1. Sedimentary rocks containing the element iron occupy the fourth most prominent position. This element is in the form of ferrous (Fe²⁺) and ferric (Fe³⁺) cations. If this element is in water, the pH will be seven, and the oxygen level is sufficient, so ferrous ions are easily dissolved and oxidized to become ferric ions, according to Efendi in Kiswanto (2020).
2. Manganese (Mn) is a metal cation element with the same chemical properties as iron. This element can form manganous (Mn²⁺) and manganic (Mn³⁺). The element manganese with a high concentration is found in waters at low pH levels (Dimkic M A, Brauch H J, Kavanaugh M., 2008).
3. T.S.S. (Total et al.) is obtained if the water is turbid; if the water is not turbid (transparent), the quality is low.

Tables 1 to 3 show the results of the laboratory analysis at the Environmental Laboratory of the Environmental Service in Batulicin, Tanah Bumbu Regency, South Kalimantan, of pollutants in the waste storage pool inlet from coal mining activity locations, which were taken every month from January to December 2022.

Waste from the open coal mining process shows that the condition of wastewater at the waste coal mine location from January to December 2022 does not exceed environmental quality standards. Only in July was the concentration of Fe element quality very high, showing that in that month,



mining was in an area with lithologies that have high Fe elements, such as hematite and other minerals. A list of T.S.S. waste analysis results from Waste of Coal Mine can be seen in Table 1.

Table 1. List Of Results Of Analysis Of Fe And Mn Quality Waste From The Mine's Inlet Settling Pond

No.	Location	Quality Standards		Quality		Measurement month OF 2022
		Fe (mg/l)	Mn (mg/l)	Fe (mg/l)	Mn (mg/l)	
1	Waste of Coal Mine	7.00	4.00	0.023	0.68	January
2		7.00	4.00	0.023	1.14	February
3		7.00	4.00	0.150	0.23	March
4		7.00	4.00	0.120	0.07	April
5		7.00	4.00	0.090	0.02	Mey
6		7.00	4.00	0.090	0.02	June
7		7.00	4.00	6.500	0.04	July
8		7.00	4.00	0.023	0.22	August
9		7.00	4.00	0.023	3.35	September
10		7.00	4.00	0.023	0.12	October
11		7.00	4.00	0.430	1.29	November
12		7.00	4.00	0.140	2.14	December

The condition of T.S.S. waste from the mining process at the research location from January to December 2022 is that the T.S.S. content still needs to be below environmental quality standards. However, in January and March 2022, it is slightly above environmental quality standards, and in September and October, The T.S.S. concentration is very high. The list of T.S.S. waste analysis results from the Waste of Coal Mine can be seen in Table 2.

Table 2. List of T.S.S. waste analysis results from Waste of Coal Mine

No.	Location	Quality Standart	Quality	measurement month OF 2022
		T.S.S. (mg/l)	T.S.S. (mg/l)	
1	Waste of Coal Mine	200	394.00	January
2		200	159.00	February
3		200	263.00	March
4		200	182.00	April
5		200	76.00	Mey
6		200	76.00	June
7		200	169.00	July
8		200	159.00	August
9		200	801	September
10		200	548	October
11		200	234	November
12		200	182	December

The condition of the pH analysis results in mine wastewater shows that the results generally do not exceed environmental quality standards set by government regulations; only in February 2022 did the results exceed environmental quality standards, namely 8.10. Table 3 lists the results of the waste pH analysis from the Waste Coal Mine.



Table 3. List of results of waste pH analysis from Waste of Coal Mine

No.	Location	Quality Standart		Quality pH	measurement month Of 2022
		pH Max	pH Min		
1	Waste of Coal Mine	9	6	7.30	January
2		9	6	8.10	February
3		9	6	7.70	March
4		9	6	7.10	April
5		9	6	7.90	Mey
6		9	6	7.90	June
7		9	6	7.50	July
8		9	6	8.00	August
9		9	6	7.4	September
10		9	6	6.9	October
11		9	6	7.6	November
12		9	6	6.4	December

Trends in the quality of Mn and Fe elements in coal mine waste. Research results from laboratory analysis at settling pond locations in open-pit coal mines from January to December 2022 total Mn and total Fe. Most of the results still need to be below environmental quality standards; only in July 2022 will the quality of Fe be considered because the results are 6.5 mg/l. Meanwhile, the environmental quality stone is 7 mg/l.

The quality of Mn is still excellent, but in September 2022, the results were relatively high, namely 3.35, which is almost close to environmental quality standards. Figure 1 shows the trend in the quality of the Mn and Fe elements of coal mine waste in Tanah Bumbu Regency.

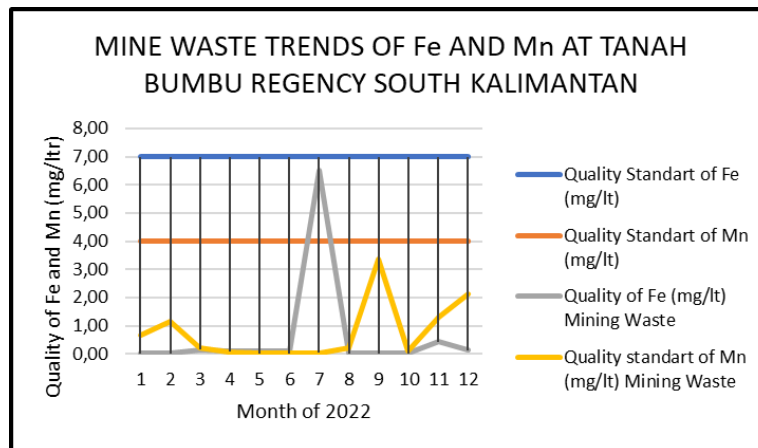


Figure 1. Waste Trend Coal Mine Fe and Mn at Tanah Bumbu South Kalimantan for 12 Month at 2022

Trends in the quality of pH and T.S.S. elements of coal mine waste. The trend in pH quality concentration from January to December 2022 is almost even and still below environmental quality standards. However, in December 2024, the pH decreased to 6.4. This is due to the mining process in December 2024 in areas where the quality of coal with high sulfur, Waste Trend Coal Mine pH at Tanah Bumbu South Kalimantan for 12 Months in 2022 can be seen in Figure 2.

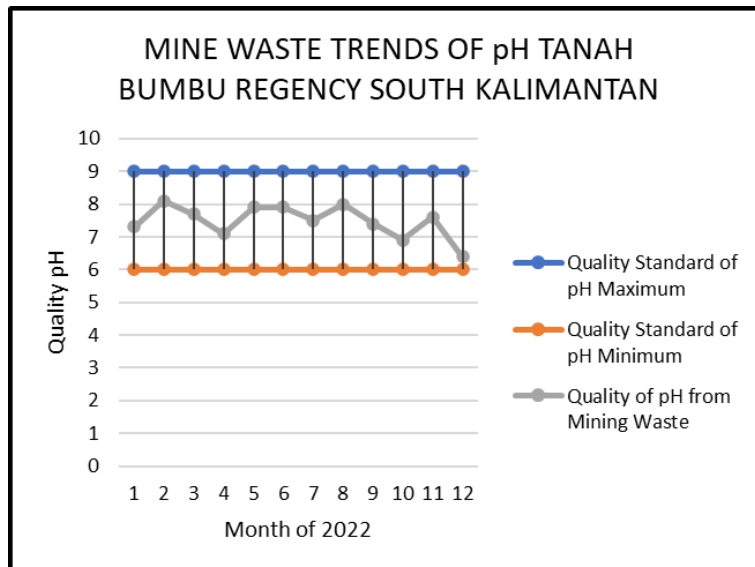


Figure 2. Waste Trend Coal Mine pH at Tanah Bumbu South Kalimantan for 12 Months in 2022

The results of laboratory analysis for trends in T.S.S. quality from January to December 2022 are as follows. In January 2022, the quality concentration was the same as the quality determined by the government, namely 400 mg/ltr. Furthermore, in the following months, the quality decreased until May and June, amounting to 76 mg/ltr. Still, it increased significantly in September, exceeding the environmental quality standard limit of up to 801 mg/ltr. In the following months, namely November and December, the quality was significantly decreased to 182 mg/ltr.

Figure 3 shows the Waste Trend at Tanah Bumbu South Kalimantan's T.S.S. coal mine for 12 Months in 2022.

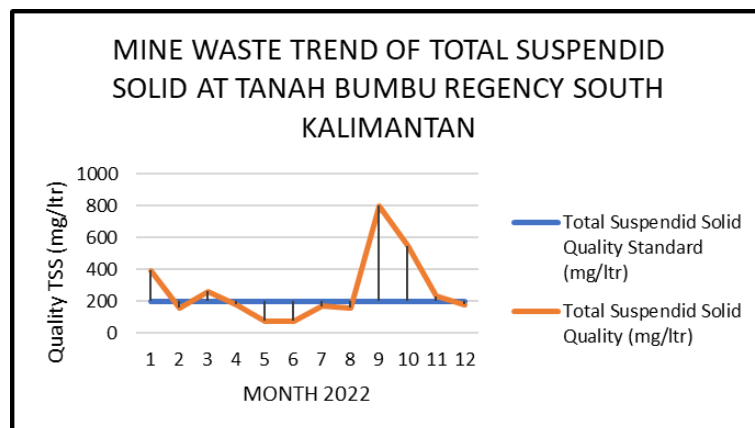


Figure 3. Waste Trend Coal Mine TSS at Tanah Bumbu South Kalimantan for 12 Month at 2022

CONCLUSION

The conclusions that can be drawn from this research are as follows:

1. Coal open pit mine waste at the mine inlet settling pond location in Tanah Bumbu, South Kalimantan, shows that its quality is generally below environmental standards. Meanwhile, the above environmental standards for Fe quality are in July 2022 and T.S.S. quality in September, October and November 2022.



2. Trends in Fe and Mn waste, pH and T.S.S. In general, the quality of Fe, Mn and T.S.S. needs to be paid attention to because in July, the quality of Fe was 6.5 mg/lit, and Mn was 3.5 mg/lit. Meanwhile, T.S.S. increased in September to 801 mg/lit.

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