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ANALYSIS of WATER QUALITY BASED on PHISICAL PARAMETER DATA POST-MINING of NICKEL LATERITES (A CASE STUDY: LAMBULUO RIVER NORTH KONAWE SOUTHEAST SULAWESI)

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Abstract—This study aims at analyzing the level of river pollution based on the existing physical data. The technique used for sampling location determination is purposive sampling.This sample is taken on three stations within three different days. The physical parameter being investigated is temperature, salinity, flow rate, turbidity, pH, and TSS (total suspended solid). For TSS parameter which at St. 1 it is still under the threshold, that is the average of 37,33 mg/L whereas at St. 2 and St.3 it is over the threshold, that is the average of 93,5 mg/L, pH value existed in the research location is still within the safety limit, that is the average of 7,56. The parameter of turbidity is beyond the threshold or the turbidity level is very high with the range of 68-156 NTU. The temperature in the tiver is still within the safety limit with the range of 30,8-31,9℃, whereas the parameter of salinity is still under the threshold with the average of 21,11‰. Overall, therefore, in terms of physical aspect, Lambuluo River has not been polluted.

Key Words—water quality, physical parameter, nickel laterites, lambuluo river

I. INTRODUCTION

River is used to collect and distribute water derived from the source, and it will be really indluenced by the land use and the width of river channel, so that the influence can be seen in the quality of river water (Odum,1996). The river which receives pollutant material is able to perform self purification quickly, especially to the waste causing a decline of oxygen level (oxygen demanding wastes) and waste heat. The river's ability in performing self purification from the pollution depends on the river size, flow rate, volume, and the frequency of the waste (Lehler in Miller,1975).LambuluoRiver is one river located in Motui Regency, where the distance between the river and the mining location of nickel laterite is quite adjacent. The impact of the open pit at the sediment management of nickel laterite has a significant influence regarding geochemical disruption to the water environment around the mining location. The change of the land use pattern into agricultural land, moor, and residences and the increase of industrial activities will contribute an impact to the hydrological condition in an area of the river channel. Moreover, various human activities in fulfilling their daily needs derived from industrial, domestic, and agricultural activities will produce wastes contributing to the decline of river water quality (Suriawiria,2003).

In line with the rapid development of mining industries recently, those industries also contribute both positive and negative impacts. The positive impact is in form of the increase of job vacancy and it helps people fulfill their daily needs, whereas the negative impact emerged from the industrial activities is the declining quality of water as a result of wastes (pollution) beyond the threshold.Metal contained in the water is generally categorized into two phases, that are dissolved in the water and the particulate adopted in the sediment. The metal trace in the water can be lifted through water by advection and diversion processes, whereas the fraction of particulates adopted can be lifted by means of the (Wu et *al.*, 2005).The heavy metal concentration contained in the river water and the sediment can be used as an indicator of polluted river, hence the quality of a river can be identified. Furthermore, the data report regarding metal concentration along the river can be developed into an interesting scientific report, such as the transfer of metal ion from the body of water to the sediment (Goegoen& Domini, 2003). The transfer process of metal ion from the water to the sediment especially through the process of water-sediment partitioning that is the transfer of metal from dissolved in the water to the sediment by means of adsorption process (Schnoor, 1996).

According to Priyambada et al. (2008) ,the change of land use characterized by the increase of domestic, agricultural, and industrial activities will influence and contribute an impact to the condition of water quality, especially for domestic activities which play a significant role regarding the greatest BOD concentration input to the body of the river.
Cottam (1969) stated that the water pollution is the increase of a material and each human activity affecting the water condition so that it can decline or even damage the water utility. Kumar (1977) argued that the water can be polluted if the quality or the composition both directly or indirectly is changed by human activities, recreations, or other intentions as before being polluted. The objective of this study is to analyze the level of river pollution based on the physical data existed. The water quality can be identified by parameter of water quality.

II. MATERIALS AND METHODS

This study was conducted in Lambuluo River, Motui Sub District, North Konawe Regency, Southwest Sulawesi Province. This study is an observational research by employing descriptive approach with laboratory test to identify the existing parameter content of environment. The technique used for sampling location determination in this study is purposive sampling. The sample was taken at three stations with three different days. The physical parameters examined were temperature, salinity, flow rate, turbidity, pH, and TSS (total suspended solid). The parameters of temperature, salinity, flow rate, and pH were directly measured at the research location. Meanwhile, the turbifity and TSS were measured in the laboratory due to the instrument limitation. The measurement of temperature and pH employed pH meter. Salinity measurement was conducted directly in each station by using hand-held refractometer. Meanwhile, flow rate was measured using a drifter. The environment parameter measured in the laboratory is turbidity and TSS. The turbidity was measured by using turbidimeter and TSS was measured by gravimeter.

III. RESULTS AND DISCUSSION

The measurement of environment parameter at Lambuluo River Motui Sub District North Konawe Regency was in conjunction with water and sediment sampling. Furthermore, the sample was analyzed by using Atomic Absorption Spectophotometer (AAS) (Table 1).

TABLE 1 - The DATA of SAMPLING RESULT at LAMBULUO RIVER

Fisical Parameter Data

No	Parameter	Unit	Day	Station			Quality Standard
				I	II	III	
1	TSS	mg/L	1	30	90	80	Mangrove 80
			2	40	98	110	
			3	42	87	96	
2	pH	-	1	7,18	7,7	7,8	7-8,5
			2	7,2	7,9	7,8	
			3	7,16	7,6	7,7	
3	Turbidity	NTU	1	68	128	78	<5
			2	75	118	92	
			3	76	156	98	
4	Temperature	°C	1	31,3	31,4	31,8	Mangrove 28-32
			2	31,2	31,5	31,9	
			3	30,8	31,4	31,2	
5	Salinity	‰	1	15	22	27	Mangrove s/d 34
			2	16	22	26	
			3	15	21	26	

Source: Research data primer in 2013, Based on the Minister of the Environment Decree No. 51 of 2004 on Standards of Quality of sea water for marine life

A. TSS Parameter

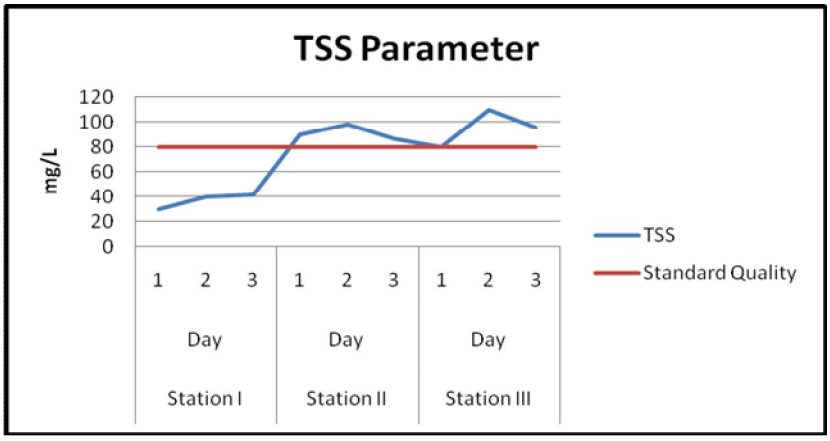

Figure 1 : Graph Parameter Total Suspended Solid in research area

The measurement result identified that TSS parameter at Station II and III in the first to the third day was beyond the threshold. The high concentration of TSS and the turbidity at station II and III in the first to the third day was caused by the waste supply derived from the mining activity of nickel. TSS and turbidity consisted of mud and fine sand and microorganism, which was particularly caused by erosion brought to the body of water, it influenced thehigh concentration of TSS and turbidity in the water at station II and III, so it was beyond the threshold defined, 80 mg/L (TSS) according to Decree of Minister for Environment No. 51 of 2004 (Figure 1).

B. pH parameter

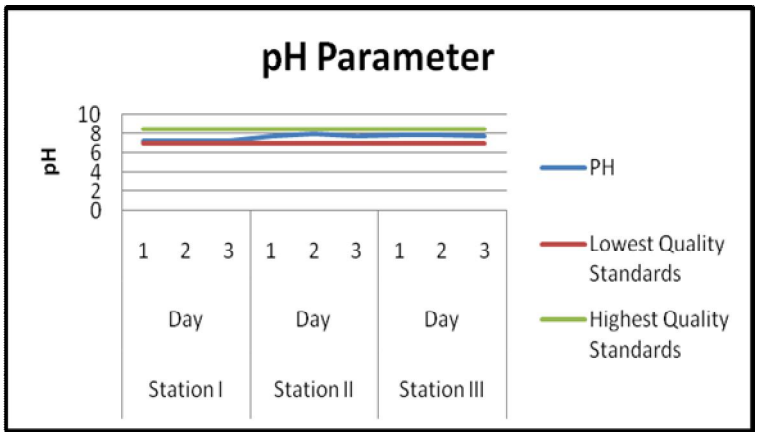

Figure 2 : Graph Parameter Acidity degree (pH) in research area

Acidity degree (pH) is a measure to determine the acidic and alkali features. The change of pH in the water is really influential to physical, chemical, and biological processes of the organisms living in the water. The acidity degree was expected to be influential to the toxic contained the pollutant and the solubility of gases, and to determine the substance form in the water. The pH value in the water was used to express the acidic condition (hydrogen ion concentration) of wastewater. The range of pH scale was 1-14. The range of pH value was 1-7 including acidic condition, pH 7-14 including the alkali condition, and pH 7 was the neutral condition. Wastewater and industrial wastes will change water pH which eventually will disrupt the life of aquatic biota.

Likewise, pH parameter tended to be high (alkali) but had not exceeded the defined threshold. The environmental factor also influenced the concentration of heavy metal at biotic environment, in this case depending on the metal concentration at water column, metal concentration in the sediment, salinity, and the water turbidity (Darmono, 2006).Metal solubility in the water was controlled by pH, the increase of pH declined the metal solubility in the water, for the increase of pH caused the increase of hydroxin ion in the water which binds to metal ion forming the sediment.

The condition caused the concentration of metal ion in the sediment higher compared to it in the water. It is accordant to the study result by Rochyatun and Razak (2007), metal is hard to dissolve in the water column with pH tended to be alkalic, it will slowly go down and settle in the sediment. According to the pH measurement result obtained from the research location, where the result was still in the defined threshold (Figure 2).

C. Turbidity parameter

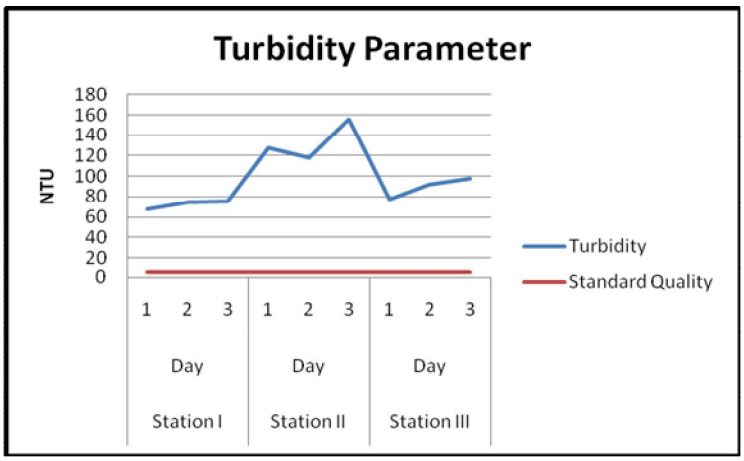

Figure 3 : Graph Parameter Turbidity in research area

The increase of total dissolved solid will increase the turbidity level at JatiLuhur Reservoir. The increase of suspended substance level from 11 mg/L to 50,5 mg/L or underwent an increase of 390%, whereas the turbidity increased from 6,6 NTU to 27,6 NTU or underwent an increase of 318% (Tontowi,2007).The impact of drinking water turbidity is able to cause underprovided estethic. The people judged the drinking water by firstly looking at the turbidity. The turbid water seen based on the esthetic, is not drinkable. Mahida (1986) defined turbidity as the intensity of opacity in the water caused by floating materials. The water turbidity is generally caused by suspended particles such as clay, mud, dissolved organic materials, bacteria, plankton, other organisms. Effendi (2003) stated that the high level of turbidity can also compound the purification and reduce the effectiveness of disinfection in the water purification process.

The high concentration of TSS and turbidity at station II and III in the first to the third day was caused by waste supply derived from nickel mining activity. TSS and turbidity comprised of mud, fine sand and microorganism, which was particularly caused by erosion brought to the body of water, it influenced the high concentration of TSS and the water turbidity at station II and III, so that it was beyond the defined threshold which was 80 mg/L (TSS) and <30 NTU (turbidity) (Figure 3).

D. Temperature Parameter

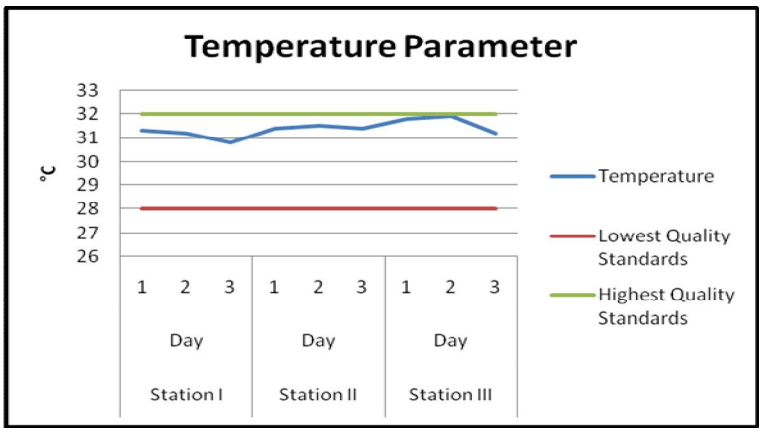

Figure 4 : Graph Parameter Temperature in research area

Temperature**,** *According to* Effendi (2003), temperature is body of water influenced by season, latitude, height above the sea level, time in days, air circulation, cloud cover, flow and the depth of water body, are the most important factors for the organism's life, for the temperature influenced both metabolism activities and the organisms to multiply.The chemicals issued by industry such as heavy metal in the river resulted temperature increase in the water (Kristianto, 2002). In the research location, in which the temperature measurement was still under the threshold and has not polluted the existing environment.

The temperature plays a significant role for oxygen to dissolve. Thermal population in the thermal organism took place in high temperature. Each species has its optimal temperature. There are fish with optimal temperature of 15°C, 24°C, or 32°C. These fish could tighten slightly the temperature difference, even able to do self-acclimatization but if the temperature is extremely different with the optimal temperature, the animal will die or migrate to a new place. The increase caused by the season changed from winter to summer can be detained by fish. The temperature is highly influential to the processes taking place in the body of water. The wastewater temperature is mostly higher from the temperature of water body. It is closely related to biodegradation. The observation of the temperature is intended to identify the water condition and interaction between temperature and habitat and other water biota health aspect. The increase of water temperature will cause several outcomes as follows: (1) the number of dissolved oxygen in the water declined, (2) the increasing rate of chemical reaction, (3) the life of fish or other water animals will be disrupted, (4) if deadly temperature limit has been exceeded, the fish and other water animals will die(Fardiaz, 1992). In the research location, the existing temperature is still in the defined threshold (Figure 4).

E. Salinity parameter

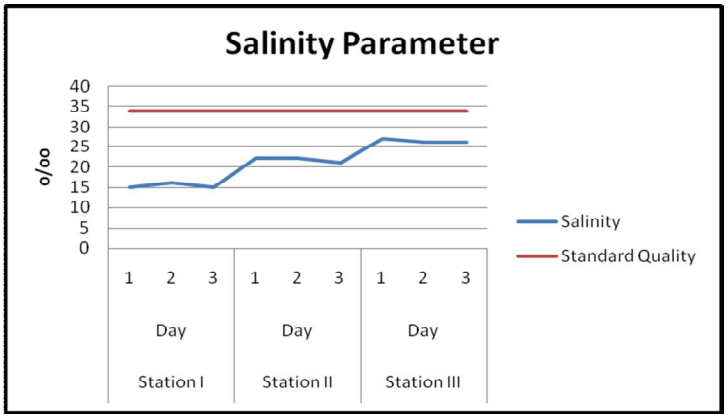

Figure 5 : Graph Parameter Salinity in research area

The salinity in eacg station still supported the life of water biota in the river, for it is still in the threshold. Salinity at station I is lower compared to station II and III, the range of salinity masurement result is 15-21 ‰. It is caused by station I is the upstream area which frequently obtained freshwater supply compared to station II and III is close to the creek so that the salinity at the station is higher. According to Mance *in* Wulandari *et. Al* (2009), highsalinity shows high concentration of chloride ion in the water forming a sediment of metal ions (Figure 5).

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