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Submission date: 10-Mar-2023 10:59PM (UTC-0500)
Submission ID: 2034449515
File name: ECOLOGY_JOURNAL_SYAMAD_CS.pdf (225.06K)
Word count: 1569
Character count: 8496

International Journal of Ecology and Environmental Sciences
www.ecologyjournal.in
Online ISSN: 2664-7133, Print ISSN: 2664-7125
Received: 06-04-2022, Accepted: 21-04-2022, Published: 07-05-2022
Volume 4, Issue 2, 2022, Page No. 52-54

Prediction of kendisan river sedimentation rate in coal mine land PT Multi Sarana Avindo in Kutai Kartanegara Regency

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Abstract
The purpose of this research was to determine the rate of sedimentation on land Kendisan River coal mine PT Multi Sarana Avindo in Kutai Kartanegara regency. Sedimentation rate prediction using mathematical equations developed by Asdak (2002) [2]. This research was conducted at the site Mining Permit and Production Operations Coal PT Multi Sarana Avindo (PT MSA) with an area of 4050.91 hectares located in the Kutai regency. Water sampling is done from the surface of the water, the middle, to the bottom of the water. After the composited into a plastic bottle until it reaches 1500 ml size for solids to suspention analyzed in Laboratory FPIK Mulawarman University, Samarinda. The results of measurements and calculations show that the value of the measured total suspended solids remain at the threshold I and II standards for water quality management and water pollution quired and than prediction of sediment at the downstream rate is higher when compared with the results of measurements on the upstream side. Alternative management to do that is to localize the water runoff from the land by creating openings traps, as well as taking care of the drainage network and sediment trap units periodically.

Keywords: sedimentation prediction, river kendisan, coal mine land

Introduction
Utilization of natural resources through the exploitation of a component in an ecosystem, especially land, in fact will lead to changes in the ecosystem and implications for the entire life of the system network. Naturally the natural resources available on earth in balance, but the existence of a modification due to human activities affecting it is possible to change the balance. Mining is an economic activity that utilizes natural resources, and the nature of the mining activities are changing the landscape (Young and Peng, 1978) [12]. Positive impact of increasing employment opportunities, improving the economy of sectors and sub-sectors of others around him, and increase state and local income in the form of royalties and tax (Latifah, 2003) [6]. Activities that do not consider the balance and the carrying capacity of the land and not managed properly, can have a negative impact on the environment including the physical, chemical, and biological soil and water conditions (Ari, 2007). The impact on it of course would disrupt ecosystems, including water management (Subardja, 2007) [11]. Among the environmental impact of mining coal is washed away soil erosion runoff to the water bodies and result in sedimentation (Rahmawati, 2002). Erosion runoff was main resources of causal factor on the rivers pollution and resovoar flooding (Schwab *et al*., 1997) [10].

Research Methods
This research was conducted at the site Mining Permit and Production Operations Coal PT Multi Sarana Avindo (PT MSA) with an area of 4050.91 hectares located in the Kutai Kartanegara Regency. Water sampling is done from the surface of the water, the middle, to the bottom of the water. After the composited into a plastic bottle until it reaches 1500 ml size for solids to suspention analyzed in Laboratory FPIK Mulawarman University, Samarinda. According Asdak (2002) [2], the sedimentation rate can be calculated using the following formula:

$$Qs = 0.0864\ QC$$

Description:
Qs = sedimentation rate (ton.ha^{-1})
Q = discharge runoff (m3.dt^{-1})
C = suspended solids (mg.l^{-1})

Results and Discussion
A. Morphometry
Kendisan river flow patterns including dendritic type with an area 3064.91 ha and empties into the River Loa Haur. The results of the morphometric measurements Kendisan River is shown in Table 1.

Table 1: Morphometry River Area Kendisan in IUP-OP Coal PT Multi Sarana Avindo

No.	Kendisan River	Width (m)	In (m)	Flow Speed (m.dt^{-1})	Debit moment (m^3.dt^{-1})
1	Downstream	10,0	0,73	0,22	1,60
2	Upstream I	5,0	0,92	0,06	0,28
3	Upstream II	2,2	0,12	0,09	0,02

Source: Analysis Results, 2019

B. Sedimentation

Based on the results of the analysis of water samples taken from the three-point observations in the downstream, upstream I and II River upstream Kendisan, it can be seen the amount of sediment in the water content of the material (C). Then by knowing instantaneous discharge (Qs) of each observation point, it can be predicted that the magnitude of the sediment load carried by the flow of the river. Results Kendisan river sediment load calculations can be seen in Table 2.

Table 2: Kendisan River Sediment Load Prediction on Location IUP-OP Coal PT Multi Sarana Avindo

No.	The observation point	Q (m^3.detik^{-1})	C (mg.l^{-1})	Qs (ton.hari^{-1})
1	Downstream River Kendisan	1,60	50,00	6,91
2	Upper River Kendisan Kendisan I	0,28	17,50	0,42
3	Upper River Kendisan Kendisan II	0,02	32,50	0,06

Source: Analysis Results, 2019

Description

Qs = suspended sediments from streams (ton.day^{-1})
Q = flow rate of the river (m^3.second^{-1})
C = Average ingredients sediment in river water (mg.l^{-1})

Total suspended solids are sized from 1 lm solids that cause turbidity water because solids is a water movement that causes to mixed fine mud and erosion of soil by the movement (Saeni, 1989) [9]. Water containing clay in the form of a suspension can last for many months, except when the balance is disturbed by other substances, which causes clotting, followed by deposition (Fardiaz, 1999). The results of measurements of total suspended solids from 17.50 to 32.50 mg.l^{-1} at the upstream and 50.00 mg.l^{-1} at the downstream. In general, the value is still at the limits of environmental quality standards I and II East Kalimantan Provincial Regulation No.02 of 2011 on the management of water quality and water pollution control is required not to exceed 50.00 mg.l^{-1}. Activity focused the activities at the downstream sediment causing ingredients in water higher and its width at the downstream part of the river will increase the discharge runoff resulting in increased sedimentation loads. The consequences of land stripping is the presence of open land in a fairly wide stretch downstream of giving opportunity to the possibility of soil erosion which swept away and into the water bodies. Sedimentation is a derivative impact erosion that enter water bodies affected by river flow and sediment content of the material in the river water. Total suspended solids is an aggregate of carbonate, bicarbonate, chloride, sulfate, phosphate, nitrate and other salts (Ward, 2001). Suspended solids will reduce the penetration of sunlight into the water and thus affects the regeneration of oxygen from photosynthesis in the water. According to Connell and Miller (1995) [3], the concentration of dissolved oxygen in the water is determined by the rate of photosynthesis. The process of photosynthesis causes an increase in dissolved oxygen during the day and reached a maximum in the afternoon, then the concentration of dissolved oxygen decreases towards the night into the morning by the activity of the organism respiration and decomposition of organic matter. Metcalf and Eddy (1991) [7] added, dissolved oxygen is an important water quality parameters for marine life because it is closely associated with the process of respiration in the water.

Conclusions and Recommendations

A. Conclusions

1. Suspended solids are on the threshold standards for water quality management and water pollution control are required.
2. Prediction rate of sediment in the lower reaches higher than upstream.

B. Recommendations

Alternative management to do them perform erosion control measures on land openings, localized water runoff from the land by creating openings trap sediment (sediment trap), as well as taking care of the drainage network and trap sediment units periodically.

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