Journal of Social Sciences and Technical Education, 3(1), 106-112
http://myjms.mohe.gov.my/index.php/jossted

Case Study: Analysis of Water Quality in Sungai Siring, Melaka

(Kajian Kes: Kajian analisis kualiti air di Sungai Siring, Melaka)

JUSMINE HANIS ABDULLAH[1], *NOR FAIZAH ZOHARDIN[2], ABDUL RASHID TALIB[3]
Civil Engineering Department, Politeknik Merlimau, Malaysia[1, 2]
Kolej Komuniti Kota Melaka, Malaysia[3]

* Corresponding author: jusminehanis@pmm.edu.my

ARTICLE INFO

Article History:
Received 03.05.2023
Accepted 13.06.2023
Published 23.11.2023

Abstract

This research was conducted to identify river quality at Sungai Siring, Melaka. The parameters used to study this water quality are Total Suspended Solid (TSS), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Dissolved Oxygen (DO), pH Value (pH) and Salinity experiments. The study location is divided into three locations: upstream, downstream, and middle of the river. 27-litre sample for this laboratory water quality test. This test was performed at Melaka Biotechnology Laboratory, Ayer Keroh, Melaka. Overall, the river water quality at each sampling station was unclean (class IV based on the Water Quality Index). In conclusion, the water quality of Sungai Siring is not clean. It can be used for crops but more for irrigation, dust suppression, food waste removal from restaurants, and sewage disposal. Irrigation is often studied in conjunction with drainage, which is the transfer of surface or subsurface water from a particular area naturally. Thus, river water in class IV like Sungai siring may just use for irrigation.

Keywords: Water Quality Index (WQI), Water Quality Parameter

INTRODUCTION

Rivers are very important for humans and other living things because rivers are an important element of the environment. The river and its surroundings are invaluable assets that need to be cared for and protected together so that they do not continue to be over-exploited and uncontrolled, eventually leading to environmental destruction and water pollution that is too expensive and difficult to restore. Based on the study,87% of the reviewed studies indicated urban land use as a major source of water pollution, while 82% indicated agricultural land use, 77% indicated forest land use, and 44% indicated other land uses (Camara et al., 2019). For instance, cases in Malaysia like the increasing of constructions, human activities, industrial, wet markets, and food outlets like in Kelantan State have declined the water quality in Kelantan River from Class II (in 2005) to Class III (in 2010 and 2011) and to become Class IV in 2017 to 2018 (Fitri et al., 2020). In Cameron Highlands, factors such as soil erosion, landslides, agriculture activities, urbanization, and unplanned development associated with land use change have significantly influenced the river water quality in the Cameron Highland areas.(Razali et al., 2018). The heavy usage of the river and human activities in the watershed makes it vulnerable to water quality degradation (Ling et al., 2017).

Rivers are the main source of water supply. The quality of the water needs to be maintained to maintain its usefulness to humans and the environment. Water is extremely important for the continuation of life. Water is life (Kılıç, 2020). Access to clean water is a basic essential requirement or need of human life (Nithyanandam et al., 2015). The accessibility to clean water will be more challenging if pollution continues to occur. Fresh water is not only vital for protecting public health, but it also plays some important roles, especially in providing ecosystem habitats. Therefore, it is important to determine the water quality for the classification of the current river. It is important to have good water quality for a healthy river (Nithyanandam et al., 2015).

Pantai siring, Melaka is now a focal point for local visitors. The surrounding area has various types of food sales, especially in the evening. Local tourists also like to see the sunset in this area and it is famous for selling seafood because there is a fishing pier in this area. However, due to the relatively active tourism activities in this area, it is seen that this area is facing pollution problems. A study on the quality of small rivers located in the Sungai Siring has been identified to see the to what extent of water quality pollution in this Sungai Siring and the factors that drive this pollution.

Figure 1. Condition of Sungai Siring

Based on surveys and empathy activities in Pantai Siring, problems, and complaints by the surrounding residents that the water smelled bad. Second dirty, and murky river water in the Sungai Siring. The condition of Sungai Siring as Figure 1. Next, river in the area there is scattered garbage. Lastly, Lack of adequate water in the area. If there is no action

taken, the pollution of the Sungai Siring will make the water quality in the river more uncontrollable.

MATERIALS AND METHOD

This study only focused on the Sungai Siring area. This research selected three stations in the river area for the purpose of sampling for instance upstream, middle and downstream. The location of Sungai Siring is as in Figure 2. Water sampling activity is one of the activities for the collection and delivery of river water samples from the study area located in Sungai Siring, which is at Longitude: 102.3602 & Latitude: 2.1408 (upstream). Longitude: 102.3585 & Latitude: 2.1422 (middle) and Longitude: 102.3556 & Latitude: 2.1445 (downstream). Among the parameters being analyzed to determine the quality of the river were Chemical Oxygen demand (COD), Biochemical Oxygen demand (BOD), Ph testing, Total Suspended Solid (TSS), Dissolved Oxygen (DO), and Salinity. The selected parameters are based on the parameters found in the standard water quality index of the Department of Environment (JAS). The selected parameters are based on the parameters found in the standard water quality index of the Department of Environment (DoE). These samples were taken at 3 stations which are upstream, middle and downstream of Sungai Siring. After the water sample is obtained from the research results, the water sample will be taken to the Melaka Biotechnology Corporation.

Figure 2. Location of Sungai Siring Melaka

The importance of this research is that we can understand the water quality index in Sungai Siring and we can be able to know the causes of river water pollution and control it. Besides that, they are able to apply river monitoring methods that have been conserved to maintain the quality of the river.

These samples were taken at 3 stations (500m each) in Sungai Siring. Then the experiment we will send to Biotechnology Melaka for 9 litres in each station (27 litres). In the process of analyzing, the data that has been collected will be analyzed. After the water sample is obtained from the research results, the water sample will be taken to the Melaka Biotechnology Corporation. Water quality analysis is to measure the required water parameters, following standards methods, to check whether it is in accordance with the standard, namely River Water Quality Index, Table 1. WQI Classes and uses can be justified in Table 2. This classification was based on National water quality standards for Malaysia. (Department of Environment, 2019)

Table 1. River WQI Classification

Parameter	Class				
	I	II	III	IV	V
BOD (mg/L)	<1	1-3	3-6	6-12	>12
COD (mg/L)	<10	10-25	25-50	50-100	>100
TSS (mg/L)	<25	25-50	50-150	150-300	>300
pH Value	>7	6-7	5-6	<5	>5
DO (mg/L)	>7	5-7	3-5	1-3	<1
Salinity (mg/L)	6.5-8.5	6-9	5-9	5-9	-
WQI	>92.7	76.5-92.7	51.9-76.5	31.0-51.9	<31.0

Table 2. WQI Classes and Uses

Class	Definition
I	• Conservation of the natural environment. • Water supply I - Practically no treatment necessary (except by disinfection or boiling only). • Fishery I - Very sensitive aquatic species.
IIA	Water supply II – Conventional treatment required. • Fishery II - Sensitive aquatic species.
IIB	Recreational use with body contact.
III	Water supply III – Extensive treatment required. • Fishery III - Common of economic value, and tolerant species; livestock drinking.
IV	Irrigation
V	None of the above.

The Water Quality Index (WQI) is the formula used to measure the level of pollution and the suitability of water use types as outlined by the National Water Quality Standards (NWQS). WQI is obtained based on the 6 parameters. Furthermore, WQI values will indicate the level of water contamination by providing policymakers and environmentalists with input on water quality. The water quality index for a particular sample is calculated using the WQI equation shown in Equation 1 after the results of the laboratory analysis were recorded (Department of Environment Malaysia, 2020)

$$WQI = (0.22SIDO) + (0.19SIBOD) + (0.16SICOD) + (0.15SIAN) + (0.16SISS) + (0.12SIpH) \quad \text{Equation 1}$$

RESULTS AND DISCUSSION

Based on the data in Table 3, it was found that the BOD value is at level V which is extremely polluted. All upstream, middle and downstream areas recorded BOD above 12 mg/L. The BOD is an important parameter for assessing water quality. It deals with the amount of oxygen consumption (mg O_2 L^{-1}) by aerobic biological organisms to oxidize organic compounds. Sewage with high BOD can cause a decrease in oxygen in receiving waters, which in turn can cause the death of some organisms.

According to data, COD data for upstream is 53 mg/L which is classified in class IV (irrigation). COD in the middle of Sungai siring is 32 which is classified in class III while COD in the downstream area is 43 which is classified in class III which means extensive treatment is required. The chemical oxygen demand (COD) test is commonly used to indirectly measure the number of organic compounds in liquid waste. It is expressed in milligrams/grams per litre, which indicates the mass of oxygen consumed per litre of solution (Carbajal-Palacios et al., 2012). Dissolved oxygen (DO) data for all upstream, middle, and downstream areas were classified in class IV where DO Upstream is 1.56/L, the middle is 1.74 mg/L and downstream is 1.69 mg/L. Referring to Table 3.1, data shows

Total Suspended Solid (TSS) test for all upstream, middle, and downstream areas were classified in class III which in all above 50 mg/L.

Table 3. Average Value, sub-index and WQI data

Location	Unit mg/L	Average value	Subindex value	Total WQI
Upstream	Biochemical Oxygen Demand (BOD)	27.4	99.48	48.09
	Chemical Oxygen Demand (COD)	53.23	42.53	
	Dissolved Oxygen (DO)	1.56	8.95	
	Total suspended solid (TSS)	97.33	55.36	
	pH value	6.2	93.71	
	Salinity	4880	4.48	
Middle	Biochemical Oxygen Demand (BOD)	16.5	100.57	51.33
	Chemical Oxygen Demand (COD)	32	61.04	
	Dissolved Oxygen (DO)	1.74	100	
	Total suspended solid (TSS)	86.67	58.6	
	pH value	6.5	96.94	
	Salinity	1300	1.3	
Downstream	Biochemical Oxygen Demand (BOD)	23.9	99.83	45.58
	Chemical Oxygen Demand (COD)	42.67	9.56	
	Dissolved Oxygen (DO)	1.69	10.4	
	Total suspended solid (TSS)	57.67	68.91	
	pH value	6.6	97.75	
	Salinity	373	0.37	

Table 3 above shows the average of every parameter tested and the overall sub-index and Water Quality Index for upstream, middle, and downstream that have been calculated. From the data as in Table 3.2, the pH level upstream is 6.2 which is in class II, while pH in the middle is 6.5 and Ph downstream is 6.6 also classified in class II. This indicates all areas were slightly acidic.

Salinity tests were also conducted in this study because the Sungai Siring is very near to the ocean. The salinity test refers to the concentrations of salts in water (Sakai et al., 2021). Based on the result, the value of salinity in the upstream, middle, and downstream of Siring River is very high which is more than 370 mg/L. This data was expected to be very high because the location is very near the ocean.

The water quality index in Sungai Siring was calculated to identify which Class of WQI of Sungai Siring classified. The use of water quality indices (WQIs) as a tool to evaluate the status of water quality in rivers has been introduced since the 1960s (A. Dhany Sutadian, 2020). According to analysis, the three areas of the sample taken were classified as Class IV which WQI in upstream, middle, and downstream is 48.09, 51.33 and 45.58. all were categorized as irrigation. Irrigation means dust suppression, sewage disposal, and mining. It is not suitable for daily use.

CONCLUSION

In conclusion, three stations that conducted the study have been contaminated as class IV category on Water Quality Index (WQI). Referring to WQ), the river in category IV is categorized as Irrigation. Irrigation water has a huge impact on the health and sustainability of water sources. Not only that, but it also affects living plants and organisms, the health of the population and the economy. The total availability of water is significant as the cost of treatment of contaminated water is too high and polluted water is not susceptible to consumption is reduced. Most sources of pollution have been caused by human activity as our residents' response towards questionnaires, although some come from natural sources of contamination. Based on observations while taking water samples at the study site, the causes of water pollution may be due to the presence of village areas and food stalls. Through the test data obtained and calculations, we have been achieving our objective for this case study. Among these are to identify the sources of pollution in Sungai Siring and to determine the pollution load in Sungai.

Based on this project, after completing the Water Quality Study in Sungai Siring, we were able to formulate and present some recommendations and views after seeing and knowing the results. Among the following suggestions are firstly, the role of the Federal and State Governments needs to be strengthened in terms of information sharing and enforcement. Secondly, carry out water quality monitoring programs continuously over a long period of time to assess the status of water quality and the level of pollution. Besides that, need some efforts to enhance enforcement capabilities through strategies to increase capital, and equipment and diversify intelligence resources. Other than that, necessary to strive to raise public awareness to jointly help detect pollution activities and appreciate rivers as an important core of daily life. Lastly, perform intensive treatment of river water.

REFERENCES

A. Dhany Sutadian, N. M. (2020). *Development of river water quality indices - A review*, 274–282.

Camara, M., Jamil, N. R., & Abdullah, A. F. Bin. (2019). Impact of land uses on water quality in Malaysia: A review. *Ecological Processes*, *8*(1). https://doi.org/10.1186/s13717-019-0164-x

Carbajal-Palacios, P., Balderas-Hernández, P., Ibanez, J. G., & Roa-Morales, G. (2012). Replacing dichromate with hydrogen peroxide in the chemical oxygen demand (COD) test. *Water Science and Technology*, *66*(5), 1069–1073. https://doi.org/10.2166/wst.2012.288

Department of Environment, M. (2019). *Tahunan Annual*.

Department of Environment Malaysia. (2020). Environmental Quality Report 2020. *Portal Rasmi Jabatan Alam Sekitar*, 36–105.

Fitri, A., Abdul Maulud, K. N., Pratiwi, D., Phelia, A., Rossi, F., & Zuhairi, N. Z. (2020). Trend Of Water Quality Status In Kelantan River Downstream, Peninsular Malaysia. *Jurnal Rekayasa Sipil (JRS-Unand)*, *16*(3), 178. https://doi.org/10.25077/jrs.16.3.178-184.2020

Kılıç, Z. (2020). The importance of water and conscious use of water. *International Journal of Hydrology*, *4*(5), 239–241. https://doi.org/10.15406/ijh.2020.04.00250

Ling, T. Y., Soo, C. L., Phan, T. P., Nyanti, L., Sim, S. F., & Grinang, J. (2017). Assessment of water quality of Batang Rajang at Pelagus area, Sarawak, Malaysia. *Sains Malaysiana*, *46*(3), 401–411. https://doi.org/10.17576/jsm-2017-4603-07

Nithyanandam, R., Huan, T. W., & Thao Thy, N. H. (2015). Case study: Analysis of water quality in Sungai Batu Ferringhi. *Journal of Engineering Science and Technology*, *10*(Special Issue 2), 15–25.

Razali, A., Syed Ismail, S. N., Awang, S., Praveena, S. M., & Zainal Abidin, E. (2018). Land use change in the highland area and its impact on river water quality: a review of case studies in Malaysia. *Ecological Processes*, *7*(1). https://doi.org/10.1186/s13717-018-0126-8

Sakai, K., Takatori, N., Ogura, D., Wakiya, S., & Abuku, M. (2021). Investigation of the transport properties for saline water in porous materials - Modeling of the permeability coefficient for saline water. *Journal of Physics: Conference Series*, *2069*(1), 8–11. https://doi.org/10.1088/1742-6596/2069/1/012214