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Water Quality Assessment of Tasik Biru Seri Kundang for Potable Drinking Water

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ABSTRACT

Malaysia's water supply has shifted from abundant to scarce, prompting a thorough examination of potential solutions, particularly using Tasik Biru Seri Kundang's untapped resources. Assessing the reservoir's capacity to provide clean water consistently amidst increasing demand is crucial. The objective was to analyze Tasik Biru Seri Kundang's water characteristics to determine its suitability as a drinking water source, which was evaluated through the Water Quality Index (WQI) and heavy metal concentration measurements. The water quality analysis involved field and laboratory testing, assessing parameters such as pH, dissolved oxygen, turbidity, chemical oxygen demand (COD), biochemical oxygen demand (BOD), suspended solids (SS), and ammonia-nitrogen (AN). The findings of the study showed that the pH was 7.26 and 7.67, the dissolved oxygen (DO) was 9.77 and 7.15 mg/L, the chemical oxygen demand (COD) and biochemical oxygen demand (BOD) was 0 mg/L each, the suspended solids (SS) were 10 and 7 mg/L. The ammonia-nitrogen (AN) was 0.08 and 0.1 mg/L, separately. According to the results, all input points were categorized as Class I, indicating that no treatment was required for the water supply. Concentrations of heavy metals, including chromium (Cr), iron (Fe), copper (Cu), zinc (Zn), and manganese (Mn), were measured at levels such as 0.017 and 0.086 mg/L for chromium (Cr), 0.25 and 0.53 mg/L for iron (Fe), 0.21 and 0.26 mg/L for zinc (Zn), 0.09 and 0.08 mg/L for copper (Cu), and 0.021 and 0.044 mg/L for manganese (Mn). While most parameters met WHO standards, chromium levels at the outlet exceeded the permissible limit of 0.05 mg/L, indicating a high concentration of heavy metals. Tasik Biru Seri Kundang exhibits favourable water quality characteristics, primarily meeting drinking water standards. However, elevated chromium levels at the outlet point necessitate corrective measures to ensure compliance with regulatory guidelines and safeguard public health.

Keywords: Ex-mining lake; heavy metals; Water Quality Index (WQI); water quality

INTRODUCTION

Water is very necessary for human survival. The main concern now is the need for a reliable and sustainable source of drinking water. Moreover, the assessments of lake water quality are important, particularly in Malaysia, where most of the nation's drinking water comes from surface water sources like lakes and rivers. The significance of water quality assessment for lake water in terms of potable drinking water comes from its significant role in ensuring that the population has access to safe and hygienic drinking water.

Additionally, the scarcity of freshwater globally, with only 3% of the water on Earth being freshwater. Ponds, lakes, streams, rivers, and groundwater all include freshwater, which is non-salty water. 98% of the water consumed in Malaysia comes from rivers and streams with or without reservoirs; the remaining 2% comes from groundwater (SPAN 2021). Most water used for home and industrial purposes in Malaysia comes from surface sources. According to the National Water Resources Study 2000-2050, Malaysia's population in the residents, industrial, and agricultural has a high water demands which will be expected to rise by 103% in 2050 (Air Selangor 2022).

Malaysia has a multitude of lakes. One of the lakes is Tasik Biru Seri Kundang which is strategically selected as a reservoir because of its advantageous natural features, including size, depth, and location. Furthermore, this research will focus on exploring the untapped potential of Tasik Biru Seri Kundang. Despite the growing demand for clean water, the reservoir's capacity still needs to be surveyed. According to (Muhammad et al. 2011), contamination of water resources has major negative effects on the natural environment and human health. In addition to that, the country's water supply quality has become an increasingly pressing concern in Malaysia.

Consequently, there is a need to evaluate the suitability of the lake water to determine its viability as a drinking water source. These standards cover various chemical, microbiological, and physical parameters to guarantee water safety for human use. Regulatory bodies, such as the World Health Organization (WHO) and local health agencies, play a crucial role in establishing and updating these standards through scientific research and risk assessments (MOH 2018; WHO 2017).

Thus, regular monitoring of water quality enables timely actions to combat pollution and apply necessary treatments for safeguarding human health and preserving the environment. Exploring the capabilities of Tasik Biru Seri Kundang, a recreational lake which addresses immediate water needs and contributes to long-term sustainability, promoting a comprehensive approach to water resource management. Understanding water quality is crucial to ensure the delivery of safe drinking water to the community. Hence, assessing Tasik Biru Seri Kundang's water which previously an ex-mining lake on the Water Quality Index (WQI) criteria and the heavy metals measurement are vital to identify potential contaminants and establish its fitness as a drinking water source. In line with that, the aim of this paper is to assess the safety of water sources, specifically Tasik Biru Seri Kundang as the case study. The objectives comprise the evaluation on the characteristics of the lake water of Tasik Biru Seri Kundang and the determination of heavy metals concentration in the lake's water. Therefore, the results outcome can display the potential of Tasik Biru Seri Kundang's as being one of the sources for potable drinking water following the WQI (DOE 2023).

METHODOLOGY

AREA OF STUDY

The study area is at Tasik Biru Seri Kundang in Kampung Melayu Sri Kundang, Rawang, Selangor. It is an ex-mining lake that developed during British colonial times. The lake was formerly one of the major mining locations in Selangor and the largest in the Rawang district at some point in its history. It is approximately 25 km north of Kuala Lumpur and at latitude 3.2501292°N and longitude 101.5235633°E coordinate (see Figure 1). The lake encompasses about 32 hectares (80 acres) with a depth of over 60 meters. Local and foreign visitors use this lake for water sports and recreational purposes (MPS, 2016). Tasik Biru was named after its bluish water, and the blue water phenomenon happened around 1950 to 1965, which was soon after Chinese miners stopped the mining work in that lakes area. Before being given the name Tasik Biru, they named this mine in conjunction with the work of tin mining and using strong water jets or tin shots. The lake is unique from other recreational areas in Selangor since it has an island in the middle. After colonial times, Tasik Biru was a leisure region among locals and tourists, particularly those who love jet-skiing, picnicking and every so often canoeing (Zulhilmi, 2015).

SAMPLE COLLECTION

Water samples from surface water were gathered on a day with clear skies and no history of rain in the surrounding area as this consideration was taken into account to obtain accurate results of measurement. Approximately 2 litres of water were collected at each point at the inlet and outlet of the selected location in the case study (see Figure 1).

FIGURE 1. Location of Intake Points (Google Map 2023)

IN-SITU PARAMETER

The water samples were examined in situ using portable HORIBA equipment for physical characteristics such as temperature, turbidity, pH, and dissolved oxygen (DO) (HORIBA 2016).

LABORATORY PARAMETERS

The water samples were examined in the laboratory for total suspended solids (TSS), ammonia-nitrogen (NH_3-N), chemical oxygen demand (COD), and biochemical oxygen demand (BOD) following the APHA, (2023). The concentrations of copper (Cu), chromium (Cr), zinc (Zn), iron (Fe), and manganese (Mn) for heavy metals were also being measured using a HACH Spectrophotometer (HACH 2007). The Guidelines for Drinking Water Quality (MOH 2018) served as the base for these concentrations. All the samples were tested in triplicate, and the average value was calculated.

TABLE 1. Water Quality Classification Based on Water Quality Index (DOE, 2023)

Sub Index & Water Quality Index	Unit	Index Range		
		Clean	Slightly Polluted	Polluted
Biochemical Oxygen (BOD)	mg/L	91-100	80-90	0-79
Ammonia-nitrogen (NH_3-N)	mg/L	92-100	71-91	0-70
Suspended Solids (SS)	mg/L	76-100	70-75	0-69
Water Quality Index (WQI)		81-100	60-80	0-59

The Water Quality Index (WQI) equation is created as follows to summarize the data on water quality (DOE, 2023):

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

Where;
WQI = Water Quality Index
SIDO = Subindex DO (% saturation)
SIBOD = Subindex BOD
SICOD = Subindex COD
SIAN = Subindex NH3-N
SISS = Subindex SS
SIpH = Subindex pH
$0 \leq WQI \leq 100$

RESULTS AND DISCUSSION

WATER QUALITY INDEX (WQI)

A water quality index is a numerical grading system representing the total water quality at certain places and times, considering various water quality criteria. The Department of Environment Water Quality Index utilizes chosen metrics from several phases of water classes to determine and convey the overall water quality (see Table 1) (DOE, 2023). The data in Tables 2 and 3 display the parameters evaluated from Tasik Biru Seri Kundang. According to Tables 4 and 5, the WQI level for Tasik Biru Seri Kundang's water is categorized as Class I, which is clean.

TABLE 2. Results of in-situ test for the inlet and outlet intake points

Parameter	Intake point	
	Inlet	Outlet
pH	7.26	7.67
Temperature (°C)	31.07	31.30
Dissolved oxygen (%)	131.80	96.70
Dissolved oxygen (mg/L)	9.77	7.15
Turbidity (NTU)	46.5	31.9

TABLE 3. Results of laboratory test for the inlet and outlet intake points

Parameter	Intake point	
	Inlet	Outlet
COD (mg/L)	0	0
BOD (mg/L)	0	0
TSS (mg/L)	10	7
AN (mg/L)	0.08	0.1

TABLE 4. Characteristics of water of Tasik Biru Seri Kundang for inlet intake points based on WQI

Subindex Parameter	Sample	Range	Subindex	Water Classes * (Water Quality Classification Based on WQI)
SIDO (in % saturation)	131.80	for 8 < x < 92 %	100	I * (Clean)
SIBOD	0	for x > 5	100	I * (Clean)
SICOD	0	for x ≤ 20	99	I * (Clean)
SIAN	0.08	for 0.3 < x < 4	92	I * (Clean)
SISS	10	for x ≤ 100	92	I * (Clean)
SIpH	7.26	for 7 ≤ x < 8.75	98	I * (Clean)
WQI	-	> 92.7	97	I * (Clean)

Notes: 1. * = relatable water classes

TABLE 5. Characteristics of water of Tasik Biru Seri Kundang for outlet intake points based on WQI

Subindex Parameter	Sample	Range	Subindex	Water Classes * (Water Quality Classification Based on WQI)
SIDO (in % saturation)	96.70	for 8 < x < 92 %	100	I * (Clean)
SIBOD	0	for x > 5	100	I * (Clean)
SICOD	0	for x ≤ 20	99	I * (Clean)
SIAN	0.10	for 0.3 < x < 4	90	I * (Clean)
SISS	7	for x ≤ 100	93	I * (Clean)
SIpH	7.67	for 7 ≤ x < 8.75	95	I * (Clean)
WQI	-	> 92.7	97	I * (Clean)

Notes: 1. * = relatable water classes

The on-site observation included pH analysis, temperature °C, dissolved oxygen %, and turbidity NTU (Hashim et al. 2018). The pH values at the inlet intake locations are 7.26 mg/L, but at the exit intake points, they are 7.67 mg/L. According to the DOE, (2023), the pH value was within the optimal range and designated as Class I. Water is considered neutral when pH is 7.0, which signifies the equilibrium between the quantities of hydrogen ions and hydroxyl ions (Nayla, 2019). Pure water has a pH of 7.0.

Given that a pH range of 6.5 to 8.5 is suitable for drinking water and favored by most aquatic creatures, it is deemed excellent (Nayla, 2019). The pH elevation from the entrance to the outflow may be attributed to several factors, such as natural activities inside the lake that influence pH levels. For instance, pH may be influenced by biological activities such as photosynthesis carried out by aquatic plants or microbial activity (Fondriest 2019). Based on the research done by (Youssif et al. 2019), it has been determined that human activities such as unintentional spills, agricultural runoff (including pesticides, fertilizers, and soil leachates), and sewage overflow have the potential to alter the pH levels of an ecosystem.

The temperature ranged from 31.07 °C to 31.30 °C during the sample period. Since the data was collected between 10:32 am and 11:01 am, this value may be attributed to intense solar radiation and high temperatures. Weather fluctuations may influence the water temperature, and two important elements that might impact it are the sample time and location (Miswan et al. 2019).

The dissolved oxygen (DO) number may be used to quantify the oxygen concentration in water. A positive correlation exists between the dissolved oxygen level and the water quality—salinity, pressure, and temperature influence water's dissolved oxygen quantity (Nayla 2019). The research conducted on the water of Tasik Biru Seri Kundang reveals that the mean dissolved oxygen (DO) content throughout sampling ranged from 9.77 mg/L to 7.15 mg/L. The water sample's dissolved oxygen (DO) level falls within the range of over 7 mg/L, classifying it as Class I according to the DOE, (2023). Regarding the WQI, the DO subindex is at 100% saturation, which falls within the Class I classification. It indicates that the lake is free from contaminants (Baharim et al. 2022).

Turbidity in water may serve as a valuable indicator for detecting the presence of potentially hazardous particles and contaminants. The Nephelometric turbidity unit, NTU, is the universally accepted unit of measurement for turbidity (Nayla, 2019). According to Ismail et al. (2019) turbidity over 5 NTU is visible to the unaided eye. The turbidity data indicated that the inlet intake sites have a greater value of 46.5 NTU compared to the outlet intake points, which have a value of 31.9 NTU. The decreased turbidity at the exit intake locations (31.9 NTU) compared to the inlet intake points (46.5 NTU) indicated that the water has reduced cloudiness or turbidity as it traverses the lake. Bottom sediment resuspension occurs when water turbulence caused by windstorms or precipitation disturbs the bottom sediment (EPA, 2021).

The lower concentration limit has been used to ascertain the amount of Chemical Oxygen Demand (COD) for the water sample using the data acquired for this study (HACH 2007). COD, or Chemical Oxygen Demand, is a quantitative measure used to evaluate the extent of contamination in a given environment. As per (Hashim et al. 2018), COD refers to the amount of oxygen required to oxidize the chemicals being studied. The COD levels of these lakes are below the 10 mg/L guideline limit, categorizing them as Class I (DOE, 2023). The lake's pollution impact is negligible, as shown by the inlet and outlet intake sites' value data showing a COD level of 0 mg/L, indicating a low level of contamination. In this case, organic pollutants may not consider the lake a substantial source or destination (Nike et al. 2022). It is a positive indication of the ecological health of the water body.

The measurement of Biological Oxygen Demand (BOD) is often used to accurately predict the amount of oxygen needed to decompose organic substances (Hashim et al. 2018). The system acquires oxygen via the bacterial breakdown of organic molecules in the water sample, increasing the oxygen levels. As stated by Youssif et al. (2019), it quantifies the organic contamination in the water that may be biologically removed, often expressed as milligrammes of O_2 per litre. Since the data collected is below the normal threshold of 1 mg/L, the BOD values for these ingestion points remained within Class I (DOE, 2023). The data indicates a lower occurrence of organic pollution in the water. BOD level below the regulatory threshold often indicates superior-quality water. Low levels of organic pollutants benefit aquatic ecology due to the reduced loss of oxygen from the water, which may impact aquatic life. In ensuring the safety of the water for various uses and the health of the marine environment, it is crucial to meet the WQI level of 1 mg/L (DOE, 2023). As to the study conducted by Baharim et al. (2022), water is classified as highly polluted if its BOD value exceeds 12 mg/L according to the WQI classification (DOE 2023).

The quantity of solid material suspended in water is calculated using the method of suspended solids in water. High SS levels result in turbidity and sedimentation issues (Hashim et al. 2018; Rutledge et al. 2023). High SS content water is unfit for residential use. The Tasik Biru Seri Kundang water's maximum SS values are found at inlet intake locations (10 mg/L) instead of exit intake points (7 mg/L). It implies that when lake water flows through the lake, it experiences artificial or natural processes that reduce the amount of suspended solids. The sedimentation processes in the lake may be natural or synthetic, allowing suspended materials to settle before they reach the exit (Zhao et al. 2021). The reduced TSS levels at the outlet intake locations may result from this. The biological characteristics of the lake may also have an impact on the variations in TSS concentrations. For instance, the decrease of suspended particles may be aided by aquatic plants, algae, or certain microbes. Due to its low percentage of suspended particles, the suspended solids examination shows that this lake's water quality is classified as Class I (DOE, 2023; Zhao et al. 2021).

The research findings suggest that the water sample is classified as Class I, indicating a clean level of ammonia-nitrogen (AN) (Rahim & Kasmuri, 2020). The AN concentration was determined to be 0.08 mg/L and 0.1 mg/L. The elevated concentration near the outflow may be attributed to several factors, including the accumulation or change of nitrogen compounds inside the lake, release from specific locations, or other local environmental circumstances. The incoming water might originate from a comparably pristine source with reduced levels of ammonia-nitrogen. The elevated ammonia- nitrogen levels are due to the closeness of the outflow intake point to the food industry. Food waste undergoes breakdown by microbes when disposed of in landfills or elsewhere. Through decomposition, organic nitrogen molecules in food waste break down, forming ammonia-nitrogen as one of the resultant byproducts (Adeniyi et al. 2023). In has been identified by Youssif et al. (2019), the fertilizers, animal and human waste, and residues from industrial production processes contributed as the potential sources of ammonia in lakes and streams, which later promoted eutrophication. The detection of NH_3N in water indicates that the pollution originates from animal or human excrement. NH_3N is very toxic to aquatic organisms (Ben 2024; Hashim et al. 2018). Based on the data in Table 6, the WQI values for both the inlet and out intake points suggest that the water quality in the study region falls within Class I, indicating cleanliness.

TABLE 6. Water Class for Water Quality Index (WQI).

Parameter	Unit	Water Classes	
		Inlet	Outlet
Water Quality Index (WQI)	-	Class I	Class I

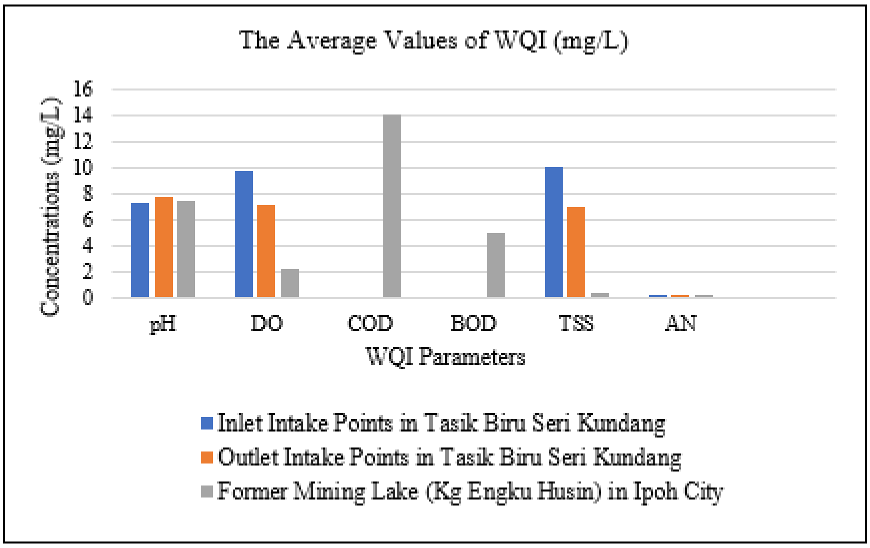

FIGURE 2. Bar Chart Comparison of WQI values

The historical records of lakes originating from mining sites connect with the earlier research conducted by (Hashim et al. 2018). Hence, comparative data are used. The preliminary research findings indicated from the previous research for the four former mining lakes (Gunung Lang, Taman Indah, Kg. Temiang and Lahat) are deemed suitable for water recreation, falling into Class II with a WQI exceeding 81, signifying a clean status—however, one lake, Kg. Engku Husin is classified as Class III, necessitating intensive treatment before it can be utilized for recreational purposes.

For this study, Tasik Biru Seri Kundang's inlet and exit intake sites had WQI values that fell into Class I because they were over the 92.7 index range (Baharim et al. 2022). The comparison of WQI results between Tasik Biru Seri Kundang and Kampung Engku aims to provide a comprehensive understanding of water quality across distinct geographical locations. Examining and juxtaposing WQI values at these sites, potential disparities in water quality parameters, contamination sources, and overall suitability for drinking water can be identified (Figure 2) (Baharim et al. 2022). This comparative analysis offers insights into regional water quality trends, contributing to a more thorough evaluation of water resources in diverse environments.

Furthermore, it facilitates the formulation of targeted strategies for water management and emphasizes specific areas that may require attention in terms of water quality improvement initiatives.

Based on Malaysia's WQI, the Class I is very high and suitable for many applications (DOE, 2023). It is ideal for safeguarding the environment and promoting the well-being of lakes, rivers, and other aquatic ecosystems. In addition, Class I water requires little processing, making it ideal for direct use as a drinking water source for humans. Class I water is of outstanding quality and meets stringent criteria, making it safe for use without extensive treatment processes and enhancing public health (DOE, 2023). From other previous research stations which are classified as Class III may be used for water recreational activities involving human-water interaction, they must undergo extensive treatment to improve their WQI values (Hashim et al. 2018).

HEAVY METALS

The heavy metal analysis focused on chromium, iron, copper, manganese, and zinc. The HACH DR 2800 spectrophotometer method was used to determine heavy metals (HACH 2007). The data shown in Table 7 and 8, which covers the inlet and outlet intake points, summarizes the heavy metal concentrations found in lakes once used for tin mining in Selangor.

TABLE 7. Concentrations of Heavy Metals in inlet intake points

Parameter	Concentration	Standard Value (WHO)	Remarks
Chromium (Cr)	0.017	0.05	Pass
Iron (Fe)	0.25	1.0 – 3.0	Pass
Copper (Cu)	0.09	0.5 – 2.0	Pass
Manganese (Mn)	0.021	0.4	Pass
Zinc (Zn)	0.21	1.0 – 3.0	Pass
Concentration Order	Fe > Zn > Cu > Mn > Cr		

Notes: units in mg/L

TABLE 8. Concentrations of Heavy Metals in outlet intake points

Parameter	Concentration	Standard Value (WHO)	Remarks
Chromium (Cr)	0.086	0.05	Not Pass
Iron (Fe)	0.53	1.0 – 3.0	Pass
Copper (Cu)	0.08	0.5 – 2.0	Pass
Manganese (Mn)	0.044	0.4	Pass
Zinc (Zn)	0.26	1.0 – 3.0	Pass
Concentration Order		Fe > Zn > Cr > Cu > Mn	

Notes: units in mg/L

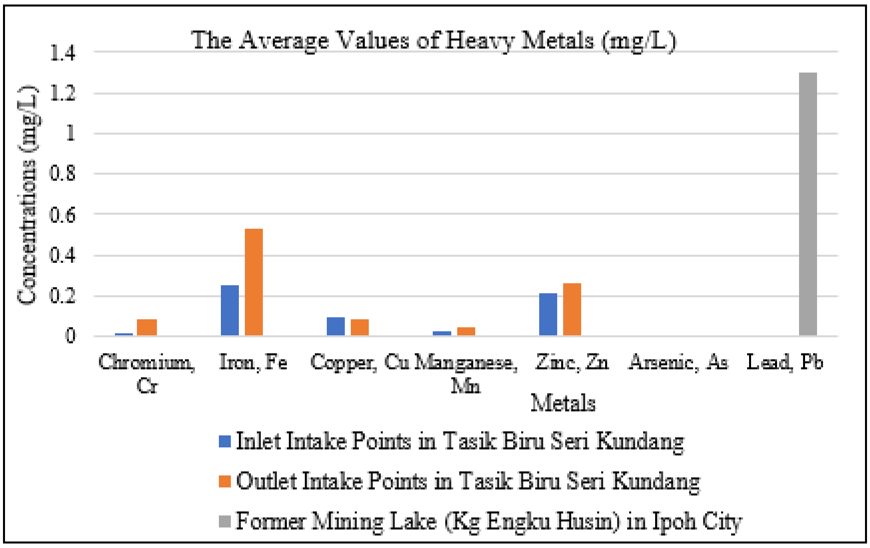

FIGURE 3. Bar Chart Comparison of Heavy Metals between Two Lakes

According to the World Health Organisation, the concentration of heavy metals in each region can be compared to the standard range established by the WHO for heavy metals (WHO 2017). These include Zn and Fe, which have a desirable limit range of 1.0 - 3.0 mg/L, Cr with a limit of 0.05 mg/L, Cu with a range of 0.5 - 2.0 mg/L, and Mn with a limit of 0.4 mg/L (MOH, 2018). Table 7 demonstrates that the concentration of heavy metals parameters, namely Chromium (Cr), Iron (Fe), Copper (Cu), Manganese (Mn), and Zinc (Zn), at the inlet input locations meet the standard value set by the (WHO, 2017).

In Table 8, the levels of heavy metals, namely Iron (Fe), Copper (Cu), Manganese (Mn), and Zinc (Zn), all meet the limit set by the (WHO, 2017) at the outlet intake locations. However, Chromium (Cr) did not surpass the standard value. The order of maximum concentration, starting from the highest, is Fe > Zn > Cr > Cu > Mn. The chromium levels in Tasik Biru Seri Kundang do not adhere to the required standards, likely attributed to its history as a former mining lake. Residual contaminants, notably chromium, from past mining activities may contribute to the elevated concentrations.

Additionally, natural geological processes, such as chromium leaching from rocks and soil, further contribute to the heightened levels. The potential inflow of urban runoff, carrying chromium from roads or stormwater, adds to the challenges.

Consequently, Tasik Biru Seri Kundang must meet the necessary drinking water criteria, surpassing the limits the World Health Organization set for chromium concentration (WHO 2017). This situation poses a significant risk to individuals using the water for drinking.

Following previous research (Hashim et al. 2018), only one of the lakes, Kampung Engku Husin, has been given the class III designation. It will need considerable repair to be suitable for recreational use. Heavy metals such as As, Zn, and Cu were all at the standard level, except Pb, which exceeded the limitations that had been set. The following data summarise the quantities of heavy metals discovered in lakes once used for tin mining.

The data shows Tasik Biru Seri Kundang's chromium content was higher than 0.05 mg/L (MOH, 2018). The results indicated that the Pb content in the old mining lake (Kg. Engku Husin) in Ipoh City is much higher at 1.30 mg/L than the standard limit (0.4 mg/L) (MOH, 2018). These lakes were once tin mines, which accounts for the high values of Cr and Pb (Figure 3).

When the concentration of chromium in water exceeds the permissible limit set by the World Health Organization, concerns arise about the safety of consuming the water (WHO 2017). Prolonged exposure to the toxic heavy metal chromium may harm human health. Exceeding the limits established by the World Health Organisation for chromium concentration in water might threaten those who use the water for drinking purposes (MOH, 2018).

An elevated concentration of chromium in a water body may harm the environment and human health. Chromium has several oxidation states, and hexavalent chromium [Cr (VI)] is very toxic. Elevated chromium concentrations may result in water contamination and adversely affect aquatic ecosystems. Marine species, including fish and invertebrates, may accumulate chromium, which can cause disturbances in their physiology and reproductive functions (Sharma et al. 2022).

Excessive amounts of chromium in water may have significant implications for human health. Exposure to chromium is linked to a range of health concerns, such as respiratory disorders, skin irritation, and, in severe instances, cancer-causing effects. Prolonged exposure to high levels of chromium in drinking water has been associated with heightened chances of developing cancer (Dong et al. 2023).

This study thoroughly examines Tasik Biru Seri Kundang's water, focusing on key parameters such as pH, turbidity, dissolved oxygen, chemical oxygen demand, biological oxygen demand, suspended particles, and ammonia-nitrogen. The primary goal is to acquire detailed insights into the lake's overall quality and ecological condition.

The results specifically emphasize in assessing heavy metal concentrations in Tasik Biru Seri Kundang's water, encompassing chromium, iron, copper, manganese, and zinc. This analysis seeks to quantitatively measure and identify the presence of these heavy metals, contributing to a comprehensive understanding of water quality.

Thus, the evaluation on Tasik Biru Seri Kundang's water suitability for drinking has been assessed using the WQI as a standardized tool (DOE 2023). This valuation conclusively determines if the lake water aligns with established criteria for safe drinking.

CONCLUSION

Water quality directly impacts human health, sustainable development, and ecological health, making it a crucial subject to understand. Potable and uncontaminated water is vital for consumption, agriculture, manufacturing, and recreation. Monitoring water quality is essential for promoting community well-being, safeguarding the aquatic ecosystem, and detecting and addressing pollution origins.

The data demonstrates that most of the water quality standards are excellent. The discrepancies in the readings between the inlet and outflow were attributed to the fluctuations in the water's flow velocity, temperature, and overall composition along the path from the intake to the output locations. Based on the Water Quality Index (WQI) results, this old mining lake, known as Tasik Biru Seri Kundang, is classified as Class I, which is> 92.7 mg/L and is deemed appropriate for direct human consumption as a water source (DOE, 2023). Class I water is of exceptional quality and meets stringent criteria, making it safe to drink without extensive treatment and enhancing public health.

In addition, the lakes included concentrations of heavy metals at the intake locations at the inlet and exit, such as 0.017 and 0.086 mg/L of chromium (Cr), 0.25 and 0.53 mg/L of iron (Fe), 0.21 and 0.26 mg/L of zinc (Zn), 0.09 and 0.08 mg/L of copper (Cu), and 0.021 and 0.044 mg/L of manganese (Mn). The WHO's reference limit for lead, zinc, and copper is 0.5–2.0 mg/L, Mn 0.4 mg/L, Zn 1.0–3.0 mg/L, Fe 1-3 mg/L, and Cr 0.05 mg/L. In contrast, due to their unique characteristics, significant amounts of chromium, Cr is 0.086 mg/L, were found where water is discharged from the mining lakes. When the concentration of chromium in water exceeds the permissible limit of 0.05 mg/L set by the (WHO, 2017), concerns arise about the safety of consuming the water. Prolonged exposure to the toxic element chromium may harm human health. Exceeding the limitations of chromium level (WHO, 2017), when identified, might pose a risk to those who use the water for drinking purposes, potentially endangering public health. In ensuring the safety of the water supply, it may be necessary to implement measures such as water treatment or sourcing water from locations with lower levels of chromium. Public health and access to safe drinking water need regular monitoring and strict compliance with established water quality standards.

In summary, this research collectively aims to meticulously assess Tasik Biru Seri Kundang's water, covering its general characteristics, suitability for drinking, and potential harmful heavy metals. This comprehensive methodology is a foundation for informed decision-making in water resource management and environmental protection initiatives.

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DECLARATION OF COMPETING INTEREST

None.

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