PRELIMINARY STUDY OF WATER QUALITY INDEX OF STREAM AT UiTM PAHANG BRANCH, JENGKA CAMPUS

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Abstract

This study was carried out to determine the preliminary water quality status of stream at UiTM Pahang Branch, Jengka Campus based on the physicochemical and biological parameters. The sampling was conducted on rainy season with seven sampling points that were selected along the stream. A total of 10 water quality parameters were measured and analyzed using standard methods for the Examination of Water and Wastewater, APHA (2005). Malaysian Department of Environment Water Quality Index (DOE-WQI) was calculated and classified according to the National Water Quality Standard, Malaysia (NWQS). The physical and chemical variables were temperature, dissolved oxygen (DO), conductivity, pH, total dissolved solid (TDS), salinity, biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solid (TSS), and ammonia-nitrogen (NH3-N). Based on Malaysian WQI, the water in this study area is classified as Class III, which is classified as 'common of economic value and tolerant species and safe for livestock drinking'.

Keyword: Stream, water quality index, water quality parameters

Introduction

Water is a basic necessity of human life and the use of water is very important in daily activities such as bathing, cooking, farming, industrial use and others making it pretty much needed at all times (Das & Acharya, 2003). Over the most recent couple of decades, the quickened pace of mechanical advancement and dynamic development of populace caused in huge increment in the interest of fresh water (Ramakrishnaiah et al., 2009). The nature of surface and groundwater is identified in wording for its physical, substance, and organic parameters (Laukas, 2010). The water nature of streams is portrayed by an abnormal state of heterogeneity in existence, as a result of the qualification of spread land around. This regularly makes challenges to perceive water conditions and pollution sources, which are the key to control effectively contamination of water supply that contributed by the industry (Fawaz et al., 2013).

Moreover, the streams assume an imperative job in absorbing municipal and industrial effluent and runoff from agricultural land and the enclose zone in a watershed (Sigua et al., 2003; Chowdhury et al., 2018). As reported by Chen et al. (2003), waterways include the most essential water assets for water system throughout residential water supply, and nowadays, likewise, extraordinary purposes in a watershed, thusly tending to energize certified sterile and natural issues. Therefore, repulsion and controlling of conduit sullying and strong evaluation of water quality are a fundamental stipulation for effective organization.

In Malaysia, contamination sources are mainly from municipal and industrial waste water, animal's squanders wastes and agricultural activities (Daud et al., 2016). The current

approach used in Malaysia for stream water quality classification is very broad. In fact, the country's stream water quality is at standard. Right now, Malaysia has more than 1000 manual and automatic stream water quality observing stations in 146 basins, supervised by the Department of Environment (DOE) alone. These exclude different stations supervised by different organizations, for example, the Department of Irrigation and Drainage (DID) as well as the other related agencies (Zainudin, 2010). As reported in 2015 by ASEAN IWRM Performance Reports & Monitoring Indicators, in 2010 a total of 1055 stations located within 570 stream rivers in Malaysia were monitored and 51.4% rivers are clean, 35.6% are slightly polluted and remaining are polluted rivers. There are two essential methods utilized to classify the stream water quality checked which are the Water Quality Record (WQR) and Interim National Water Quality Measures (INWQS)(Zainudin, 2010; Ismail et al., 2014; Fawaz et al., 2013; Othman et al., 2007; Huang et al., 2015).

One of the techniques to monitor the wellbeing of any waterway is to observe the Water Quality Index (WQI). Information on water quality is utilized to decide the status of the spotted area by inspecting to record whether it is perfect, somewhat contaminated or polluted (Ismail et al., 2014,;Huang et al., 2015). The objective of this study is to identify the preliminary water quality parameters of river stream located in varsity. The output from this study will then be calculated, analyze and comparing with National Water Quality Standards (NWQS) for Malaysia in order to classified the water at the sample locations.

Study Area

UiTM Pahang, Jengka Campus is occupying almost 1000 acres of land in Bandar Pusat Jengka, Maran. The campus which is offering 23 academic programs has more than 8000 students and 700 staff (both academic and non-academic). The land allotment for the campus was divided into a 60:40 ratio, where 40 percent of the land is allocated for development areas, whereby the remaining 60 percent are utilized for agricultural purposes. Stand firmly with the value of ‘maintaining clean, green and harmonious environment by preserving and conserving nature to compensate for sustainable development’ as the environmental policy of UiTM Pahang, the management is determined to achieve this by designing, implementing & maintaining greenery in this campus.

Based on one of the strategic plans that have been developed, UiTM Pahang has decided to develop Edu-tourism within the campus area. This plan focuses on improving the existing lakes and provides necessary facilities so that it can transform into a recreational area with activities like kayaking and fitness. The existing lake naturally exists due to combination of three tributaries flowing at the northern area of the campus (**Figure 1**).

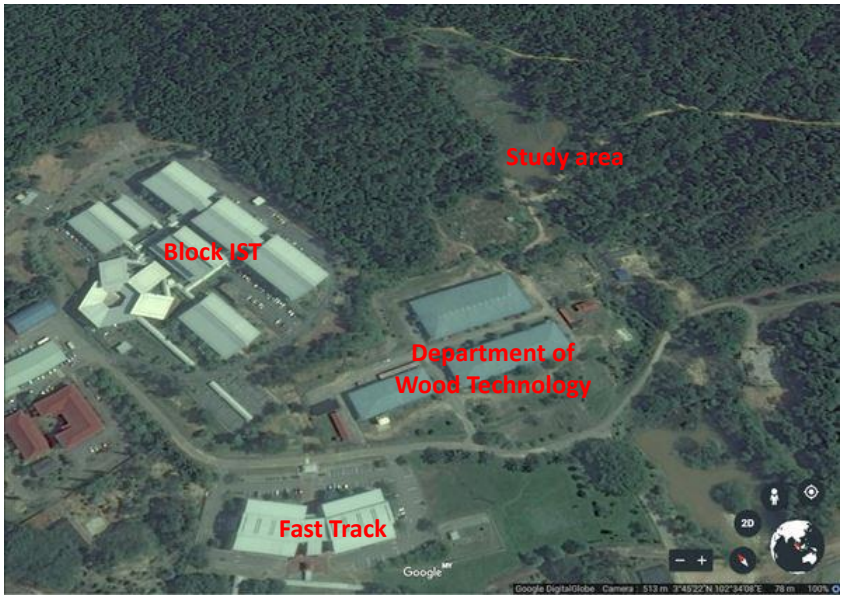

Figure 1 Location of the study area

The study area is about 3300 m^2 and surrounded by forests with no development activities found at the upstream. Travelling downstream or to the south of the study area, there are Department of Wood Technology, Tok Gajah College, Mat Kilau 1 & 2 College, Hal Ehwal Pelajar Building & Dewan Indera Segara (DIS) before the river flows out of the campus area. By observation of naked eyes, this area can be categorized as a pollution-free area. However, a study on water quality at the research site should be conducted as part of the feasibility study to develop the area for Edu-tourism. For the study, seven (7) sampling points were determined to get the water sample and to examine the quality of the water based on the standard procedures. **Figure 2** shows the location of each sampling points and **Table 1** summarize the description of each location.

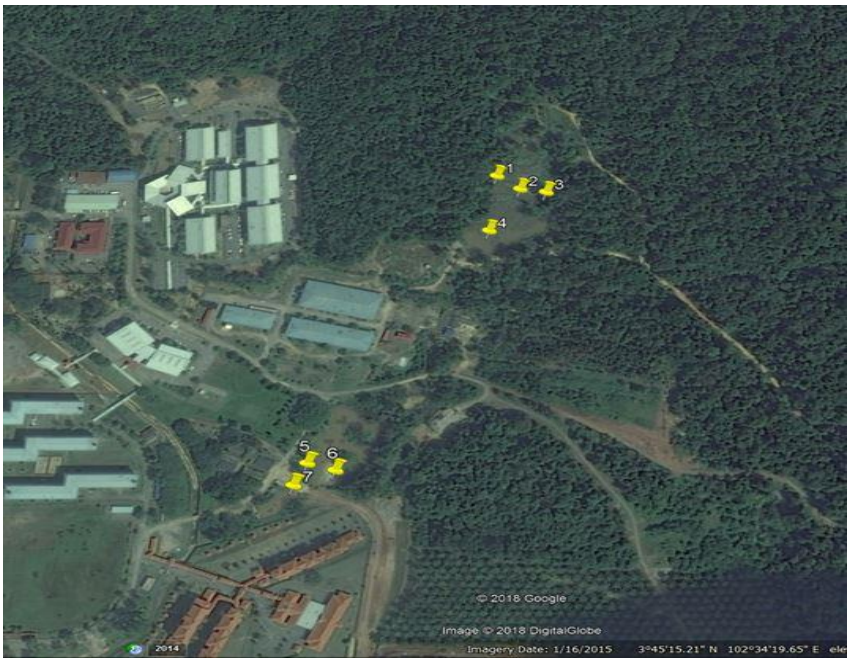

Figure 2 Location of sampling points

Table 1 Coordinate and detail description of the sampling points

Sampling point	Sampling station	Description
1	Inlet 3°45'30.48"N 102°34'6.51"E	One of the main sources of inlet of the lake
2	Inlet 3°45'29.79"N 102°34'7.17"E	One of the main sources of inlet of the lake
3	Inlet 3°45'29.60"N 102°34'8.40"E	One of the main sources of inlet of the lake
4	3°45'27.82"N 102°34'6.30"E	Center of the lake
5	Tributaries 3°45'17.99"N 102°34'1.23"E	Tributaries drainage from Fast Track block
6	Tributaries 3°45'17.74"N 102°34'2.10"E	Tributaries drainage from Tok Gajah Collage
7	3°45'16.85"N 102°34'1.03"E	Location is right after the bridge of Tok Gajah Collage

Materials and Methods

During the study, the physicochemical by using multi parameters probe and microbiological parameters by using standard laboratory procedure were measured. Six (6) parameters by usi ng multi parameters probe have been done in-situ which are salinity, TDS, pH, DO, conducti vity and temperature while four (4) laboratory testing have been done to enhance the in-situ r esults which are BOD, COD, NH_3-N and TSS. All four data from laboratory experiments are then tabulate in the water quality index (WQI) formula to determine the classification of each sampling points.

Results and Discussion

The result obtained from in-situ and laboratory tests represent in Table 2. The values in the data present the average value for each parameter. Tests were conducted according to the Standard Methods for the Examination of Water and Wastewater, APHA (2005).

Salinity

Salinity refers to the concentrations of salts in water or soils. Little measures of salt in natural water are significance for the life of aquatic plants and animals. Salt in water can come from the rainfall, land used activities, weathering process or others. Salinity values ranged from 0.02 – 0.05% for seven sampling points as shown in **Table 2**. In addition, the results are within the standard acceptable levels of NWQS and are classified as Class I. Generally many factor such as location of sampling, rainfall intensity and land used will affect the results of salinity (Othman et al., 2007).

Table 2 Average value of result obtained from in-situ and laboratory test

ITEM	Sampling Location						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Salinity (%)	0.03	0.03	0.02	0.03	0.05	0.03	0.03
TDS (mg/L)	39	41	37	49	76	65	89
pH	6.49	6.53	6.61	6.43	6.77	6.78	6.78
DO (mg/L)	5.80	5.37	5.43	5.71	6.27	6.51	7.48
Conductivity (µS/cm)	65	63	57	73	120	61	61
Temperature (°)	25.45	25.87	25.85	25.90	26.42	26.00	26.04
COD (mg/L)	38	75	65	38	27	31	37
BOD (mg/L)	10.53	11.32	11.12	10.77	10.17	9.89	9.50
Ammonia - Nitrogen (mg/L)	0.06	0.03	0.05	0.34	0.01	0.53	0.60
TSS (mg/L)	88.70	121.40	103.20	91.50	47.00	65.80	69.30

Total Dissolve Solid (TDS)

The concentration values of TDS are in the range of 37 to 89 mg/L. The highest value recorded is at the last sampling point which is point number 7 with value of 89 mg/L and the lowest value is at the inlet or sampling point number 3 with value of 37 mg/L. It was noticed that the upstream sampling point has lower TDS value compared to the downstream because anthropogenic and land used activities were much less at the upstream area. As reported by UNESCO, 2001 in Water Quality Assessment Book, the high TDS concentration in rivers is due to the presence of huge amount of anthropogenic activities along the river and also the effect of runoff with high suspended matter. However, the results obtained are within the standard range and classified under Class I based on NWQS.

pH

The pH values for this study area are in the range of 6.4 to 6.8 which is alkaline. The lowest pH recorded was at the sampling point number 4 which are 6.43 and the highest pH value is at sampling point number 6 and 7 which is 6.78. Generally, the pH value will be increase if there have a lot of photosynthetic algae activities since it consume carbon dioxide to react with. The range of pH from 6.5 to 9.0 is appropriate for aquatic life (Gandaseca et al., 2011). The results obtained in this study still in the range on NWQS and classified under Class I.

Dissolve Oxygen (DO)

The concentration of DO recorded for the study area is between 5.30 to 7.50 mg/L. This result is still in the range of NWQS and classified under class II. The highest DO is obtained at the sampling point number 7 while the lowest DO is recorded at sampling point number 2 which is one of the inlets to the lake. Oxygen is generally dissolved in water as a result of diffusion from the atmosphere and the release of oxygen through photosynthesis process of aquatic plant. The degradation processes of organic matter in water will consume DO thus polluted water will results to the lower value of DO (Astel et al., 2006).

Conductivity

Generally conductivity in fresh water like river and lake was affected by the inorganic dissolved solids such as calcium, nitrate, sulfate, iron and others that contribute by the surrounding such as soil. Organic compound such as oil, phenol and sugar also can affect the value of conductivity. Sampling number 3 and 5 showed the lowest and highest value of conductivity respectively. Moreover, this value is within the range of the NWQS value and it can classify into Class number I.

Temperature

Many factors can contribute to the temperature recorded on site such as weather, sampling time and also the location. For this study the temperature recorded is at the range of 25.45°C to 26.42°C. The three inlets (sampling point 1, 2 &3) recorded the temperature of 25.9°C while the sampling number 5 recorded the highest temperature with 26.42°C. All the values recorded are still within the normal range of NWQS.

Chemical Oxygen Demand (COD)

Sampling point numbers 2 and 3 show a very high value of COD which are 75 and 65 mg/L compare with another sampling points. Generally the lower value of COD indicates a low level of pollution and vice versa. This is means that the inlet (sampling point numbers 2 and 3) are more polluted rather than other points. The causes may due to the chemical and organic fertilizer, livestock and others. By referring to NWQS, the data obtained for COD is within the range of 100 mg/L for Class IV.

Biological Oxygen Demand (BOD)

BOD is a measure of the quantity of oxygen used by microorganisms in the oxidation of organic matter. The higher amount of organic matter will lead to increasing in concentration of BOD while decreasing the value of DO (Rosli et al., 2010). Natural sources of organic matter include plant decay and leaf fall. In this study, the concentration amount of BOD is highest at sampling location number 2 which is inlet (11.32 mg/L) and the lowest value concentration in at sampling point number 7 (9.50 mg/L). This value is under the range of NWQS for Malaysia and classified under Class IV.

Ammonia-Nitrogen (NH_3-N)

Sampling point number 2 and number 7 recorded the lowest and highest NH_3-N concentration respectively. The value is in the range of 0.05 to 0.60 mg/L. According to INWQS, the maximum concentration level of NH_3-N for Malaysian rivers which support aquatic life is 0.9 mg/L as reported by Rosli et al., 2010 and Fawaz et al., 2013. In this study the concentration value for NH_3-N is within the range and classified as Class III.

Total Suspended Solid (TSS)

The value of TSS is between 47 -121.4 mg/L where sampling point number 5 is the lowest an d sampling point number 2 is the highest point recorded. As reported by Rosli et al., 2010 and Fawaz et al., 2013, the maximum threshold limit of TSS for Malaysian river that will support aquatic life is 150 mg/L which is Class number III. However, the value of TSS in this study is within this range. Many factors that will contribute to the concentration value of TSS such as soil erosion near the riverbank, deforestation, mining, plantation activities and others.

Conclusion

The results of the study found that most of the parameter concentration is below the limit set out in the DOE, Malaysian Water Quality Standard categorized under standard for Class III (Marine & River). Only sampling points number 2 and 3 (inlet) categorized under Class IV but because of the flow of water from inlet 1 (sampling point number 1) is more than these two inlets, the dilution occurs and causes all downstream points to be recorded as Class III. This results show that the location is not suitable for Edu-tourism activities such as kayaking and fishing if and only if there have solution for this problems such as build a fountain to supply more oxygen to the water so that the DO will be increasing, increase the velocity of the water inlet to reduce the TSS and also to make a silt trap at the inlet for reduce the amount of suspended solid entering the lake area. In the other words, with the results obtained from this preliminary study, the Edu-tourism project proposed to be developed can be implemented if appropriate follow-up measures are taken into account.

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Conflict of interests

Author hereby declares that there is no conflict of interests with any organization or financial body for supporting this research.

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