TECHNICAL NOTE

PRELIMINARY ASSESSMENT OF LAKES WATER QUALITY STATUS AT CAMPUS AREA IN SELANGOR, MALAYSIA

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Abstract: A study was conducted to assess the water quality status of Engineering and Serumpun Lakes located in campus area. Selected water quality parameters (Biochemical Oxygen Demand - BOD, Chemical Oxygen Demand-COD, Dissolved Oxygen-DO, turbidity, Suspended Solids-SS, pH and Ammonia Nitrogen-NH_3-N) were determined for about two months observation in the wet season and the average results were compared to Malaysian standards. The status of lakes were determined by using Water Quality Index (WQI) and classified according to the Interim National Water Quality Standards (INWQS), Malaysia. The observed values for seven parameters of Engineering Lake were classified as IIA/B and V classes as well as Serumpun Lake. From the results, the lakes can be used for recreational purposes. However, based on WQI calculated value, the status of the lakes during the study period was indicated as polluted; 31.6 and 32.5 for Engineering and Serumpun lakes, respectively. Both lakes were classified as Class IV and the water suitable for irrigation uses only.

Keywords: *Lakes, Malaysian standard, water quality index, water quality parameters*

1.0 Introduction

Water quality assessment is a major concern since it has effect on human's health and quality of life. The quality of surface water has become a global concern since it is envisaged that fresh water will be scarce resources in the future. For this reason, water quality monitoring programme is highly necessary for the protection of fresh water resources. This has been stated in Pesce and Wunderlin (2000) who studied the impact of city on rive quality by using water quality index. To ensure effective monitoring, pollution from point source and non-point source (NPS) need to be investigated since they are responsible for poor water quality. Pollution investigation and control from NPS may have adverse effect on water quality management because they are difficult to control. In Malaysia, pollution sources are mainly from municipal waste water, industrial waste water, livestock wastes and other agricultural activities.

River pollution is primarily caused by deposition of waste water substances on the river body. This is a common trend in many developing countries including Malaysia. In Universiti Putra Malaysia (UPM), there are a lot of lakes, which serve the purpose of recreation and their location in the university environment beautifies the landscape. The major problem facing the lakes has to do with pollution from non-point source majorly from agricultural and domestic sources. Rainfall occurrence in Malaysia is almost all year round, runoff originating from agricultural fields and domestic waste enter the lakes continuously and this in a way depletes the water quality status of the lakes.

To improve the water quality of the lakes, the type of pollution from different sources into the lakes must be identified and investigated so that measures can be put in place to control these pollution sources without economic implication. Enormous study have documented regarding to the quality parameters of some lakes in Malaysia focusing on physical and chemical properties also the sediment and contamination level (DOE, 2002; Mohammad *et al*., 2007; Nik Daud *et al.,* 2013; Said *et al.,* 2014). The concept of water quality index (WQI) to convert complex water quality data into simplified form was introduced by Horton (1965). In Malaysia, the water quality index has been used widely in order to analysis the status of surface water (DOE, 2006; DOE, 2008; Zainuddin, 2010; Akinbile *et al*., 2013).

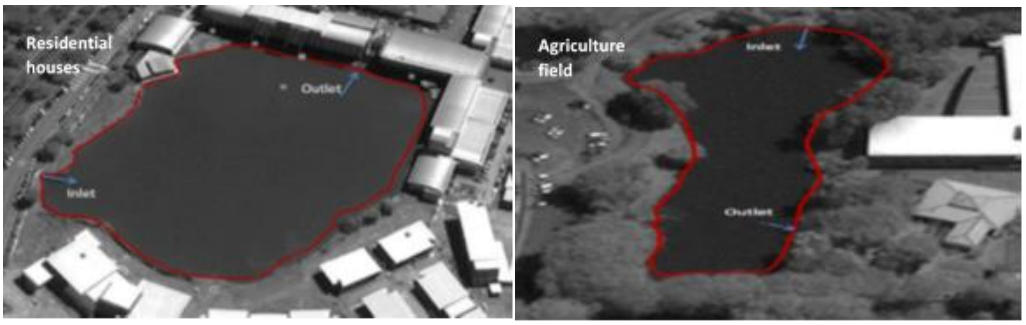
The objectives of this study are to investigate the water quality parameters of campus lakes located in varsity. The results from observation will compared according to the Malaysian and USEPA standard and water quality index will be calculated so that the lakes can be classified referring to the Interim National Water Quality Standards (INWQS), Malaysia.

2.0 Materials and Methods

2.1 Site Description

Two lakes were chose to carry out the assessment of lake water quality in varsity environment which are Engineering Lake and Serumpun College Lake. The lakes have been chose because their location is nearby the academic building and college area and its good location for recreational activities (e.g.: fishing, canoeing etc.) for varsity staff and students. The Engineering Lake is located at the center of faculty administrative buildings, lecture halls, library and pedestrian crossing. The Serumpun Lake is located at the middle of international college, college mosque, and commercial center and agricultural fields. The source of lake water is majorly from precipitation events and runoff from different channels. Unfortunately, there was an improper discharge have been identified lately and the lakes quality in visible state is bad. For Engineering Lake, the discharge are suspected come from other faculty's waste pond and from main pipe of

nearby residential (Figure 1a). Serumpun Lake also facing the same issues when heavy rain occurred, there was a discharge from agriculture area located nearby the lake (Figure 1b).



(a) (b)

Figure 1: Location of varsity lakes a) Engineering Lake and b) Serumpun College Lake.

2.2 Physical and Chemical Properties Tests

The study will be focused in the water quality tests carried out in the laboratory (seven parameters will be considered). Parameters involved are Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), pH, Turbidity, Dissolved Oxygen (DO), Ammonia-Nitrogen (NH_3) and Suspended Solids (SS). Samples will be collected at the influent and effluent point of lake (Fig 1a and 1b) on daily bases of laboratory activities which will have duration of two months in the month of August and September 2013. All experiment procedure was referred by Water and Wastewater Standard Methods (Andrew *et al*., 2005) and the results will be compared to USEPA water quality standards and Interim National Water Quality Standard, Malaysia.

The water quality index calculation (DOE, 2006) will be used for the computation of observed data comprises six water quality parameters (Eq. 1).

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

Where;
SIDO = Sublndex DO (% saturation)
SIBOD = Sublndex BOD
SICOD = Sublndex COD

SIAN = Sublndex NH_3-N
SISS = Sublndex SS
SIpH = Sublndex pH

3.0 Results and Discussion

In this section, the results will be discussed. The geometry and environmental conditions of lakes is shown in Table 1.

Table 1: Geometry and environmental conditions of lakes

Parameter	*Engineering Lake*	*Serumpun Lake*
Geometry		
Area	24120m^2	4403m^2
Length	160.17m, Latitude (200.06^o)	136.48m, Latitude (271.63^o)
Width	150.59m, Latitude (280.06^o)	32.26m, Latitude (271 .63^o)
Volumetric Loading		
**Maximum depth	6.5m (measured data)	4.8m (measured data)
**Minimum depth	2.56m (measured data)	1.3m (measured data)
Environmental Condition		
Mean Evaporation	1.652mm	1.6mm
***Wind speed	1.27m/s (Malaysian Meteorological Station)	1.27m/s (Malaysian Meteorological Station)
**Mean surface water temperature	28.6^{o}C (observed data)	28.03^{o}C (observed data)
Temperature range	±4^{o}C	±6.7 (observed data)
*Total Precipitation	318mm	318mm

*JPS, 2013; **Measured data; ***Malaysian Meteorological Station, 2013

According to USEPA (2014), under water body survey and assessment, it is important to identify the several factors including physical factors that may be examined to determine whether an aquatic life protection use is attainable for a given water body. The physical factors listed including in stream characteristics (size, volume, wind speed etc.)

3.1 Water Quality Assessment

The results of physical and chemical analysis of the lake water samples are presented in Table 2 for two months observation from August to September 2013 in wet season.

Table 2: Physical and chemical analysis results of Engineering (ENG) and Serumpun (SER) lakes

Date of Sample (2013)	BOD (mg/L)		BOD (mg/L)		DO (mg/L)		TSS (mg/L)		pH		NH_3-N (mg/L)		TUR (NTU)	
	ENG	SER	ENG	SER	ENG	SER	ENG	SER	ENG	SER	ENG	SER	ENG	SER
21st Aug	149.9	22.4	210.3	45.5	0.23	0.30	55	32.5	7.2	7.3	0.12	0.66	12.9	16.7
23rd Aug	96.0	37.3	187.7	315.3	0.90	1.00	135	62.5	7.3	7.4	0.42	0.45	12.1	15.7
29th Aug	118.4	53.3	232.7	307.8	0.70	1.60	60	92.5	7.4	7.6	0.63	0.39	11.0	8.4
10th Sept	81.6	80	292.8	263.8	1.00	0.83	25	55.0	7.1	7.2	0.33	0.23	14.4	13.3
18th Sept	48.0	70.4	210.3	315.3	1.40	1.00	75	92.5	7.2	7.3	0.37	0.45	12.6	14.1
26th Sept	27.2	38.4	210.3	98.0	0.43	0.80	55	17.5	7.1	7.2	0.33	0.23	13.5	14.8
30th Sept	27.2	38.4	142.7	142.7	0.70	0.33	15	110.0	7.1	7.0	0.36	0.51	15.1	14.0

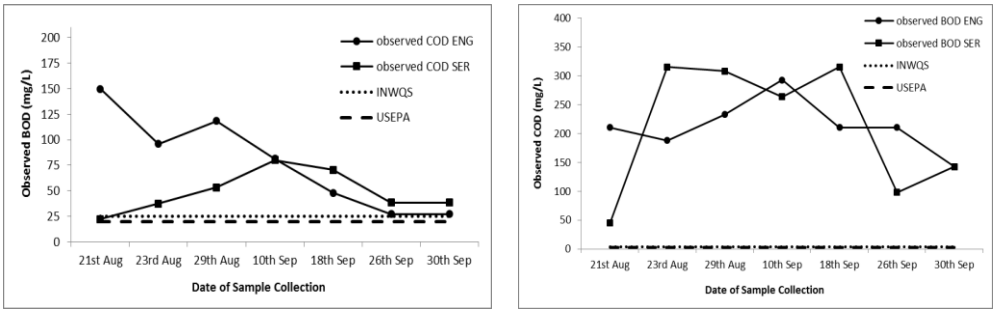
* BOD - Biochemical Oxygen Demand, COD - Chemical Oxygen Demand, DO - Dissolved Oxygen, TSS – Total Suspended Solids, pH and NH_3-N - Ammonia –Nitrogen

From the table, the dissolved oxygen for both lakes is low and according to water quality standard for Malaysia, based on the value, those lakes can be classified in Class V. The results show that the depletion of oxygen concentration could be as a result of organic matter on the surface of Engineering Lake and organic waste accumulation from agricultural areas for Serumpun Lake. Total suspended solid for both lakes are 60 and 66 for Engineering and Serumpun Lake, respectively. The pH for both lakes as observed was the most stable parameter which did not signify drastic changes throughout the period of sampling and it is in the range for Class I to IIB.

A well distributed pattern of chemical properties (DO, TSS, pH, NH_3-N and turbidity) were observed for the Engineering Lake. This probably could be due to fairly distributed rainfall (Mohammad *et al*., 2007). Since point source and non-point source were significant sources of DO and NH_3-N, pollution control will be reasonably effective by controlling pollution from the two points of samplings for Engineering and Serumpun Lake, this approach will minimize efforts of pollution control as a result of point source.

Figure 2 shows the observed data for BOD and COD of Engineering and Serumpun Lake. The Interim National Water Quality Standards (INWQS) and U.S. Environmental Protection Agency (USEPA) standards were used in comparison purposes. The average values of BOD are 78.33 and 48.6 mg/L for Engineering and Serumpun Lake, respectively. However, the average values of COD are 212.4 and 212.63 mg/L for

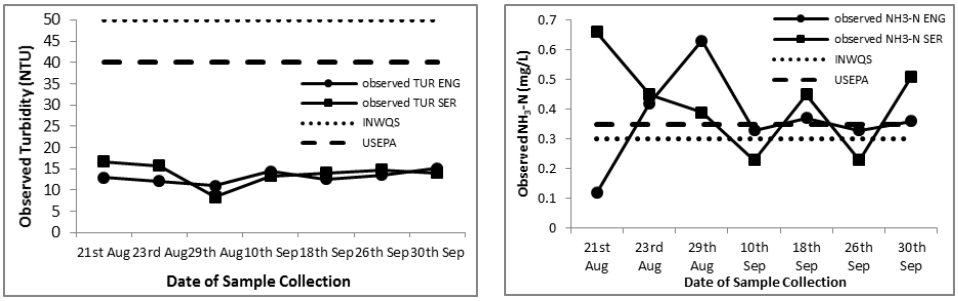
Engineering and Serumpun Lake, respectively. Those results were compared to INWQS and USEPA standard, indicated that the results are beyond the limit.



(a) (b)

Figure 2: Observed data of a) BOD and b) COD for Engineering and Serumpun Lakes compared to INWQS and USEPA standards.

The effect of turbidity on the lake (Figure 3a) showed the average values are 13.09 and 13.86 NTU for Engineering and Serumpun Lake, respectively. Referring to the water quality classification, it can be classified in Class IIA which is suitable for recreational purposes. Moreover, the comparison values with standards showed that the lakes turbidity still below the limit stated. The average values of Ammonia-Nitrogen are 0.37 and 0.42 mg/L for Engineering and Serumpun Lake, respectively (Figure 3b). The parameter values also classified in Class IIA/IIB.



(a) (b)

Figure 3: Observed data of a) Turbidity and b) NH_3-N compared to standards for Engineering and Serumpun Lake

In general, the observed values for seven parameters of Engineering Lake were classified as IIA/B and V classes as well as Serumpun Lake. From the individual

parameters results, the lakes can be used for recreational purposes. However, based on WQI calculated value, the status of the lakes during the study period was indicated as polluted; 31.6 and 32.5 for Engineering and Serumpun lakes, respectively. Both lakes were classified as Class IV and the water suitable for irrigation uses only.

4.0 Conclusions

The importance of this study is to investigate the water quality status in both Engineering and Serumpun Lakes located in campus environment. The location of those lakes are suitable for body contact recreational activities. However, before any activities is allow to take place, the preliminary assessment has to carry out. Seven selected chemical parameters were tested in laboratory for about two months in a wet season. The observed values of Engineering Lake were classified as IIA/B and V classes as well as Serumpun Lake. From this results, the lakes can be used for recreational purposes. However, based on WQI calculated value, the status of the lakes during the study period was indicated as polluted; 31.6 and 32.5 for Engineering and Serumpun lakes, respectively. Both lakes were classified as Class IV and the water suitable for irrigation uses only.

5.0 Acknowledgements

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