Water Quality Assessment of Lakes in Yangon

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Outlines

- Introduction
- Problem Statement
- Water Quality Parameters
- Results and Discussion
- Conclusions
Introduction

Location of Lakes in Yangon

Inya Lake

Kandawgyi Lake
Kandawgyi Lake

- popular recreational area
- Catchment area: 1.421 km²
- Water surface area: 160 acre (65 Ha)
- Average Depth: 6 ft
- Maximum Depth: 12 ft

- Algae blooming
Inflow

- Domestic Wastewater
- Storm Water
Inya Lake

- Popular recreational area
- Distribute to Kandawgyi Lake
- Catchment area: 3 sq-miles
- Water surface area: 1.5 sq miles
- Water holding capacity: 4000 MGal
Parameters to be analysed

- Temperature
- Chemical oxygen demand
- Biochemical oxygen demand
- Total alkalinity
- Total solids
- Total suspended solids
- Total dissolved solids
- Nitrogen (NH$_3$ + NO$_3$)
- Phosphorus
Kandawgyi Lake
Location of Inlets and Sampling Stations
Total Dissolved Solids

- Station number
- Total dissolved solids (mg/L)
- Sep, Oct, Nov
Total Alkalinity

The graph shows the total alkalinity (mg/L) for different station numbers across different months.

- Station numbers range from 1 to 23.
- Total alkalinity values range from 40 to 200 mg/L.
- Stations are recorded for Sep, Oct, and Nov.

The graph indicates variations in total alkalinity across the stations and months, with some stations showing higher variability than others.
Oxygen Demand

(a) COD concentration
Of Kandawgyi Lake

(b) BOD concentration
Of Kandawgyi Lake
Nitrogen Concentration (NH3-N+NO3-N) for recreation

Graph showing nitrogen concentration levels for different months (Sep, Oct, Nov) across various station numbers. The graph includes a threshold line labeled INWQS.
Nitrogen Concentration (NH3-N+NO3-N)

It is compared with the limit for eutrophic state (ammonia+nitrate=0.3 mg/L) of a lake in New York (source: NYS Citizens Statewide Lake Association Program, 2006).
Phosphorus concentration for recreation

station number

phosphorus (mg/L)

Sep
Oct
Nov
INWQS

0
0.1
0.2
0.3
0.4
0.5
0.6
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
Phosphorus Concentration

It compared with the limit for eutrophic state (0.02 mg/L) of a lake in New York (source: NYS Citizens Statewide Lake Association Program, 2006).
Inya Lake
Sampling Stations of the study area

Legend
- Inya Lake
- Stations in lake
- Stations at Inlets
- Spillway

= Catchment Area
= Shop or Stall
= Hotel
Temperature
(In-lake Stations)

![Graph showing temperature data for different stations and dates]

- Temperature (°C)
- Station No.

Temperature
(Inlet Stations)
pH (In-lake Stations)

INWQS Class IIB limit = 6~9
pH (Inlet Stations)


A  B  C  D  E  F  G
DO (In-lake Stations)

Station No.


DO (mg/l)

5mg/L

7mg/L

5mg/L

Station No.

No.1  No.2  No.3  No.4  No.5  No.6  No.7  No.8  No.9  No.10  No.11  No.12  No.13  No.14
DO (Inlet Stations)

Station No.

A   B   C   D   E   F   G

DO (mg/l)

BOD (In-lake Stations)

Station No. | Date       | BOD
------------|------------|-----
No.1        | 3.12.15    | 3mg/L
No.2        | 29.12.15   | 3mg/L
No.3        | 25.2.2016  | 3mg/L
No.4        | 15.3.2016  | 3mg/L
No.5        | 5.4.2016   | 3mg/L
No.6        | 26.4.2016  | 3mg/L
No.7        | 22.6.2016  | 3mg/L
No.8        | 9.8.2016   | 3mg/L
No.9        | 30.8.2016  | 3mg/L
No.10       |           | 3mg/L
No.11       |           | 3mg/L
No.12       |           | 3mg/L
No.13       |           | 3mg/L
No.14       |           | 3mg/L
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<th>Station No.</th>
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<th>BOD (mg/l)</th>
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<td>A</td>
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<td>1</td>
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<tr>
<td>B</td>
<td>21.2.2016</td>
<td>2</td>
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<td>C</td>
<td>5.3.2016</td>
<td>3</td>
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<tr>
<td>D</td>
<td>30.3.2016</td>
<td>4</td>
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<tr>
<td>E</td>
<td>4.4.2016</td>
<td>5</td>
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<tr>
<td>F</td>
<td>25.4.2016</td>
<td>6</td>
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<tr>
<td>G</td>
<td>21.6.2016</td>
<td>7</td>
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<td>H</td>
<td>8.8.2016</td>
<td>8</td>
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<tr>
<td>I</td>
<td>28.8.2016</td>
<td>9</td>
</tr>
</tbody>
</table>
COD (In-lake Stations)

Station No.

COD (mg/L)

- 3.12.15
- 29.12.15
- 25.2.2016
- 15.3.2016
- 5.4.2016
- 26.4.2016

25 mg/L
COD (Inlet Stations)

Station No.

- A
- B
- C
- D
- E
- F
- G

- 10.12.15
- 21.2.2016
- 5.3.2016
- 30.3.2016
- 4.4.2016
- 25.4.2016

COD (mg/L)
Turbidity (In-lake Stations)

INWQS Class IIB limit - 50 NTU
Turbidity (Inlet Stations)

Turbidity (FTU)

Station No.


A  B  C  D  E  F  G

0  10  20  30  40  50  60  70  80
Electrical Conductivity (In-lake Stations)

Conductivity, EC (µS/cm)

Station No.

No.1 No.2 No.3 No.4 No.5 No.6 No.7 No.8 No.9 No.10 No.11 No.12 No.13 No.14

Electrical Conductivity (Inlet Stations)

Conductivity, EC (µS/cm)

Station No.

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TDS Variation
(In-lake Stations)
TDS Variation (Inlet Stations)

TDS (mg/L)
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**Total Alkalinity (In-lake Stations)**

- **Total Alkalinity (mg/L)**
Total Alkalinity (Inlet Stations)
Nitrogen Concentration (In-lake Stations)

- NH$_4^+$-N+NO$_3^-$N (mg/L)
- Station No. 1 2 3 4 5 6 7 8 9 10 11 12 13 14
Nitrogen Concentration (Inlet Stations)

NH$_4$-N + NO$_3$-N (mg/L)


Station No.: A B C D E F G
Trophic State Index

Waterbody classification based on tropic states

- *oligotrophic*
- *Mesotrophic*
- *Eutrophic*
- *hypereutrophic*.

Trophic State Index (TSI)

**TSI for Phosphate (PO4)**

\[
\text{TSI} = 14.42 \ln(\text{PO4} \text{ (μg/L)}) + 4.15
\]

- TSI $< 40$ \quad \rightarrow \quad \text{Oligotrophic lake}
- $40 < \text{TSI} < 50$ \quad \rightarrow \quad \text{Mesotrophic lake}
- $50 < \text{TSI values} = 70$ \quad \rightarrow \quad \text{Eutrophic lake}
- TSI values $> 70$ \quad \rightarrow \quad \text{Hypereutrophic lake}

Source: Omkar Singth, 2008, 12th world lake conference
Eutrophy

<table>
<thead>
<tr>
<th>TSI 50-60</th>
<th>Lower boundary of classical eutrophy: Decreased transparency, anoxic hypolimnion during the summer, macrophyte problems evident, warm-water fisheries only.</th>
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</thead>
<tbody>
<tr>
<td>TSI 60-70</td>
<td>Dominance of blue-green algae, algal scums probable, extensive macrophyte problems.</td>
</tr>
<tr>
<td>TSI 70-80</td>
<td>Heavy algal blooms possible throughout the summer, dense macrophyte beds, but extent limited by light penetration. Often would be classified as hypereutrophic.</td>
</tr>
<tr>
<td>TSI &gt; 80</td>
<td>Algal scums, summer fish kills, few macrophytes, dominance of rough fish.</td>
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Eutrophication Status Based on Phosphate Concentration in Kandawgyi Lake

Trophic State Index of lake

- Oligotrophic
- Mesotrophic
- Eutrophic
- Hyper-Eutrophic

station number

1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17  18  19  20  21  22  23
Phosphorus in Inya Lake (In-lake Stations)

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<tr>
<th>Date</th>
<th>No.1</th>
<th>No.2</th>
<th>No.3</th>
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<td>31.12</td>
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<td>15.2.</td>
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<td>30.3.</td>
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Note: The graph shows the concentration of phosphorus (mg/L) at various stations and dates.
## Phosphorus concentration in Inya Lake (Inlet Stations)

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<tr>
<td>A</td>
<td>0.1</td>
<td>0.01</td>
<td>0.05</td>
<td>0.1</td>
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<td>0.05</td>
<td>0.1</td>
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<tr>
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<td>0.01</td>
<td>0.05</td>
<td>0.1</td>
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Discussion & Conclusion

- in situ measurements & laboratory analysis, compared with INWQS Malaysia Std. for in-lake W.Q.
- Most of assessed parameters of Kandawgyi lake are greater than the acceptable limits of INWQS
- pH, DO, BOD & Turbidity of Inya lake are in the acceptable limits of INWQS
- BOD and COD are much greater than the limit of the compared standard (especially in inlet drain waters)
- Dilution process is occurred in the wet season in Inya lake.
Conclusions

- In both lakes, TSI values are within eutrophic state in most of the stations and are within hyper-eutrophic state in some stations.
Thank You for your kind attention