Journal of TROPICAL BIODIVERSITY E-ISSN: 2774-4116

Water Quality Index Analysis of Situ Cilodong, Depok, West Java Using Storet Method

Astri Zulfa[1], Farhan Apriansyah[1], Tsabitah Athifah Qonitah[1], Fahriza Kemal Vansha[1], Marcelita Putri Utami[1], Hendrawan Bakri[2], Ziyadatul Hoiroh[2], Afifah Intan Kamila[2*]

[1] *Department of Biology, Faculty of Biology and Agriculture, Universitas Nasional, Jakarta 12520, Indonesia*
[2] *Kelompok Studi Ekologi Perairan (KSEP), Department of Biology, Faculty of Biology and Agriculture, Universitas Nasional, Jakarta 12520, Indonesia*

*Correspondence email: aikamila.2000.aik@gmail.com

Submission	:	August, 09th 2023
Revision	:	October 08th 2023
Publication	:	December 30th 2023

Abstract

Situ Cilodong is located in Kalibaru, Cilodong, Depok. Situ Cilodong served as a beautiful, strategic area and thus served as a local water tourism. However, human activity causes it to contain household wastes and other fillings that leak into the body of the water. The study was intended to determine the quality of the water and was held by storet methods. Storets method works by comparing data on water quality with water quality adjusted to it to determine water quality status. The parameters used in this study are the physical parameters in the form of temperature and brightness, also chemical in the form of pH and DO, all parameters were measured insitu in the morning. We also do identyfication of plankton. Data retrieval times occurred periodically each week of November 2021. Based on its designation, Situ Cilodong is included in class 2. The sampling station point is at the inlet station, center and outlet. The research results show that the waters at Situ Cilodong were classified as a light polluted lake based on stroret's methods score on the inlet -10 station, -8 and -10 outlets. The most frequently identified type of planton species is from the phytoplanton group.

Keyword: Situ Cilodong, STORET system, Water quality

INTRODUCTION

Situ is one of the gathering places for water. However, these days it is known as a waste reservoir. Much waste collects in situ so that it can be suitable for bacteria. It is suspected that bacteria that are pathogenic to humans have grown and developed there (Pratiwi, 2015). There are also many places used as recreation areas, one of which is Situ Cilodong. Situ Cilodong is located in Kalibaru Village, Cilodong District, Depok. Situ Cilodong has a fairly beautiful and strategic area. This is what causes people to make Situ Cilodong a place of choice for water tourism. Problems faced in Situ Cilodong include domestic waste pollution, siltation and water weeds (Dinas Kebersihan dan Lingkungan Hidup Kota Depok, 2007).

Analysis that can be done to identify problems in the aquatic environment is to determine the status of water quality. Water quality status is the level of water quality conditions that indicate polluted or good conditions in a water source within a certain time by comparing with established water quality standards (Pardamean, 2015). Water quality status is important to describe pollution conditions in a water body. After the water quality status is known, stakeholders can make policies related to pollution control efforts (Yohannes et al., 2019).

According to Purwoto (2023), a statistical approach from existing parameters in a water quality index system can be used because it can provide a value that simply measures many pollutant parameters and can be interpreted easily. The use of the Water Quality Index can be removed in different areas. The method of evaluating the quality of water bodies in Indonesia uses the water quality index regulated in the Decree of the State Minister of Environment No. 115 of 2003 (Kepmen LH, 2023) concerning guidelines for determining water quality status (Karliansyah, 2016). Article 2 states that determining water quality status can be done by the STORET system or the Pollution Index (IP) Method. This method is used because the tested parameters can be used for all parameters in the water quality standard. Water quality standards used for comparison are based on Government Regulation of the Republic of Indonesia No. 22 of 2021 (PP, 2021). The STORET system is one method used to determine water quality status. The word storet stands for Storage and Retrieval developed by the Environmental Protection Agency (US-EPA). In principle, the STORET method compares water quality data with water quality standards that are adjusted to determine water quality status.

Situ Cilodong has not yet known the status of water quality, so in this study the determination of water quality status was carried out using the STORET system in Situ Cilodong. The parameters used in this study are temperature, transparency, pH, and dissolved oxygen (DO). Based on the background that has been submitted, the research conducted aims to determine the status of Situ Cilodong water quality using the STORET method.

METHOD

Data was collected in Situ Cilodong, Kalibaru Village, Cilodong District, Depok, West Java. The data collection time is carried out periodically to produce data from time to time (time series data) every week in November 2021. Sampling is done every morning between 8 to 9 o'clock. The sampling station points are at the inlet, center and outlet stations (Figure 1).

The tools used in this study were pH meters, Winkler bottles, drip pipettes, volumetric pipettes, Erlenmeyer flasks, measuring cups, bulbs, analog thermometers, buckets, secchi disks and glass bottles. The materials used in this study were $MnSO_4$ 48%, Winkler reagent, H_2SO_4 concentrated, $Na_2S_2O_3$ 0,025 N, amylum 1%, aquadestilata.

The condition of river water quality in Situ Cilodong, Depok is measured using several physical and chemical water parameters including temperature (insitu, analog thermometer), transparency (insitu, secchi disk), pH (insitu, pH meter) and DO (insitu, Winkler titration) (Mahajarifar et al., 2021). Biological parameters in the form of identification of plankton types are also carried out. Situ Cilodong based

on its designation is included in class 2. Class 2 can be used for water recreation infrastructure/facilities, freshwater fish farming, animal husbandry, water to irrigate crops, and other designations requiring the same water quality as these uses (PP, 2021). Determining water quality status using the STORET method uses the US-EPA value system by classifying water quality into four classes, as presented in Table 1.

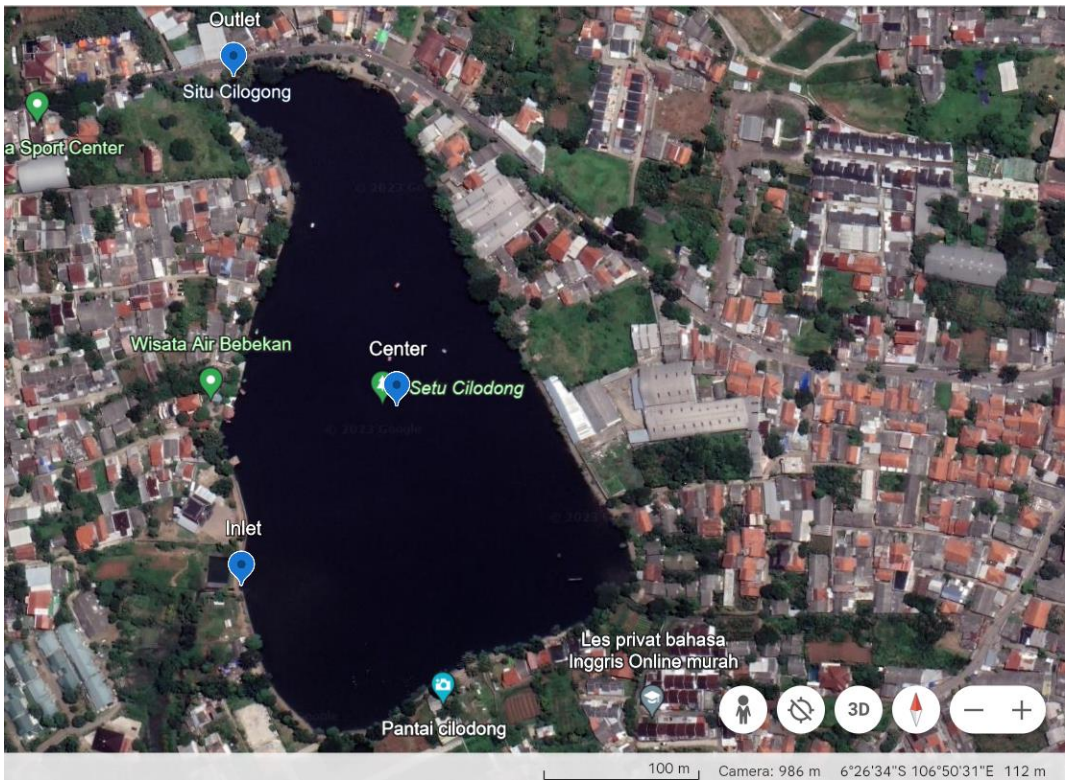

Figure 1. Water sampling location (Google Earth, 2021)

Table 1. Water quality classification (Kepmen LH, 2003)

Class	Total score	Information
A	0	meet quality standards
B	-1 s/d -10	lightly polluted
C	-11 s/d -30	moderate polluted
D	≥-31	heavy polluted

This STORET method has several conditions for its use. Here are the steps for conducting a water quality test using the STORET system:

- Periodic collection of water quality data is carried out to produce data from time to time (time *series data*).
- Compared measurement data from each water parameter with quality standards by the water class
- If the measurement results meet the value of water quality standards (measurement results <quality standards) then a score of 0 is given. If the measurement results do not meet the value of water quality standards

(measurement results > quality standards), then they are scored according to table 2.

- The results are seen as the negative sum of all parameters is calculated and the quality status is determined from the scores obtained using the scoring value system.

Table 2. Determination of a value system to determine water quality status (Kepmen LH, 2003)

Number of Examples 1)	Nilai	Parameters		
		Physical	Chemical	Biology
<10	maximum	-1	-2	-3
	minimum	-1	-2	-3
	average	-3	-6	-9
≥10	maximum	-2	-4	-6
	minimum	-2	-4	-6
	average	-6	-12	-18

[1)] Number of parameters used for determination of water quality status

RESULT

The sampling results conducted in November 2021 every week present data in a time series, *from* this *time series* data we can see whether the status of water quality is good, lightly polluted or heavily polluted using the STORET system. The score obtained based on the analysis of physical and chemical test parameters can be seen in table 3.

Table 3. Measurement of water quality standards with the STORET method

	Parameter	Unit	Baku Mutu	Station	Max	Min	Average	Number of Scores
Physical	**Temperature**	°C	Deviase 3	Inlet	31.00	28.00	29.50	0.00
				Center	29.00	27.00	27.75	0.00
				Outlet	30.00	27.00	28.25	0.00
	Transparency	m	4	Inlate	0.85	0.52	0.63	0.00
				Center	1.10	0.40	0.80	0.00
				Outlet	0.76	0.70	0.74	0.00
Chemical	**pH**	-	6-9	Inlate	7.13	6.95	7.05	0.00
				Center	7.13	6.25	6.85	0.00
				Outlet	7.28	6.00	6.76	0.00
	DO	mg/L	6	Inlate	5.10	3.20	4.35	-10.00
				Center	6.10	3.80	4.51	-8.00
				Outlet	5.50	4.40	4.93	-10.00

Based on the calculation of the STORET method, a total score of -10 (inlet), -8 (center) and -10 (outlet) is obtained. These results show that the waters of Situ Cilodong are classified as lightly polluted. Situ Cilodong as a water tourism spot still meets class B water quality standards according to the Kementerian Lingkungan Hidup (2003).

Based on samples collected from 3 sampling points, several phytoplankton and zooplankton species were identified (Figure 2). Types of phytoplankton identified include *Navicula* sp, Chaetoceros sp, *Rhisozolenia* sp, Coscinodiscus sp, Prorocentrum micans, and *Oscillatoria* sp. The zooplankton identified include *Nauplius larvae*, *Brachionus* sp and *Cyclops* sp.

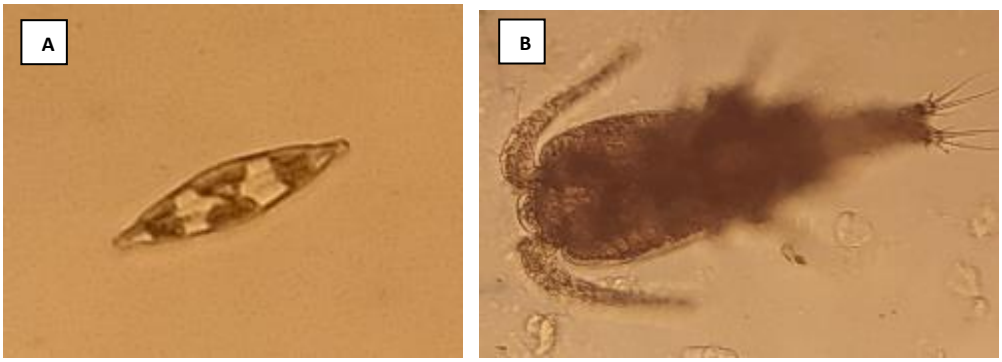

Figure 2. Jenis-jenis Plankton dari Situ Cilodong
(A: *Navicula* sp - Phytoplankton, B: *Cyclops* sp – Zooplankton)

DISCUSSION

Physical parameters measured include temperature and transparency. Data collection is carried out insitu on the water body of Situ Cilodong with the help of analog thermometers and secchi disks. Water temperature plays a role in controlling the condition of aquatic ecosystems. Increasing temperature can result in increased decomposition of organic matter by microbes. In general, the surface temperature of the waters ranges from 28-31ºC. Based on the results of temperature measurements, values range from 27°C-31°C by quality standards, namely a deviation of 3°C from the air temperature (PP, 2021). According to Kulla et al (2020) the development and life of lake aquatic biota is strongly influenced by temperature, pH and water DO. The optimal temperature range for fish life in tropical waters is a natural water temperature between 28 ° C - and 32 ° C, so it can be said that the temperature of Situ Cilodong waters is classified as normal. This is by research from Kiara and Yamin (2022) who conducted research on Lake Taliwang with a temperature range of 28°C – 30°C. In contrast to the results of Nizar et al.'s (2022) research conducted in Lake Teloko, the observed temperature is 30°C – 31°C.

Transparency is very influential for the development and growth of phytoplankton because the deeper sunlight that penetrates the water, the morelight phytoplankton can use to carry out photosynthesis (Barus and Widhiastuti, 2008). Transparency values below 100 cm are classified as low brightness levels (Akrimi, 2002). The transparency value obtained during observations at the sampling point obtained numbers between 0.40 – 1.10 m, so it can be said that the transparency of Situ Cilodong waters is normal. Water transparency values range from 0.5 - 3.35 meters in Lake Lindu of Central Sulawesi Province. This brightness level is still relatively high and qualifies for aquatic organisms (Hartina and Trianto 2020).

The chemical parameters measured include pH and DO. pH (pH meter) and DO (Winkler titration) data collection is done directly on Situ water bodies.

Dissolved oxygen (DO) is oxygen that dissolves in water. On the water's surface, dissolved oxygen levels will be higher due to the active process of photosynthesis and high oxygen air that diffuses into water bodies. If DO levels decrease, this can result in death in aerobic organisms. The value of the degree of acidity (pH) of a body of water characterizes the balance between acids and bases in water and is a measurement of the concentration of hydrogen ions in solution. Domestic wastewater and waste materials from industrial activities discharged into waters will change the pH of the water.

The measurement results show that the DO value fluctuates at each station because dissolved oxygen levels will fluctuate daily or seasonally depending on water temperature, salinity and also the movement of water masses. The higher the temperature of water and salinity, the lower the dissolved oxygen level, while the higher the movement of water mass and the lower the temperature, the higher the dissolved oxygen level. The need for oxygen in water required by organisms varies relatively depending on the type, stage, and activity factors. According to Said and Yudo (2021), the minimum DO content is 2 ppm under normal circumstances and is not contaminated by toxic compounds. Judging from the 6 mg / L quality standard value, the DO measurement value exceeds the quality standard value in class II. This indicates that the DO levels in Situ Cilodong are lightly polluted.

The pH measurement results show that the pH measurement value is still within safe limits by water quality standards, namely pH 6-9 (PP, 2021). The pH value obtained in this study ranged from 6.0-7.8. The pH value obtained is that acids tend to be neutral. Based on the explanation from Astuti and Hendra (2009), for phytoplankton growth pH ranges from 6-8. This is reinforced by the explanation of Miswan et al (2022), that phytoplankton will photosynthetize well at a neutral pH of around 6-8 and decrease if it is too acidic or alkaline.

This type of phytoplankton is more often found allegedly because the collection is carried out in a shallow place. The sampling time is carried out in the morning, so the sunlight intensity is optimal for phytoplankton to carry out photosynthesis. Phytoplankton contains chlorophyll which can photosynthesize, which taps solar energy to convert inorganic matter into organic matter (Nontji, 2006). Phytoplankton in photosynthesis requires sunlight. The irradiation of sunlight will decrease rapidly with higher depth. The results of research in the inland waters of Surabaya and Malang by Desmawati et al. (2020) showed that phytoplankton abundance is higher in the morning due to optimal sunlight for photosynthesis, while environmental conditions and food availability influence zooplankton abundance. Changes in the environment and food availability in a body of water will affect the abundance of zooplankton. Zooplankton like other organisms can only live and develop well in suitable aquatic conditions such as ocean waters, rivers and lakes. If environmental conditions are to zooplankton needs, there will be a process of phytoplankton predation by zooplankton. According to Thoha (2013), if environmental conditions and phytoplankton availability do not meet zooplankton needs, zooplankton cannot survive and will look for suitable environmental conditions (Ruga, et al., 2014).

CONCLUSION

The conclusion from this study can be inferred that the water quality in Situ Cilodong, Depok, West Java, is classified as moderately polluted due to human activities and wastewater. The study used the Storet Method to determine the water quality, which involved comparing data on water quality with adjusted data to identify the status of the water. Base on physical parameters (temperature and brightness) and chemical parameters (pH and DO) showed that the water at Situ Cilodong was classified as a lightly polluted lake based on Storett's method scores for the inlet (-10), center (-8), and outlet (-10). The most frequently identified type of plankton species was from the phytoplankton group.

ACKNOWLEDGMENT

In carrying out this research, the research team would like to thank the management of Situ Cilodong for allowing us to collect data. Thank you to the Laboratory of Chemistry, Universitas Nasional which has been willing to provide research materials.

REFERENCES

Akrimi S. (2002). Teknik Pengamatan Kualitas Air dan Plankton direservat danau Arang- Arang Jambi. Buletin teknik pertanian 7: 02

Barus TA, Widhiastuti R. (2008). Keanekaragaman Plankton dan Keterkaitannya dengan Kualitas Air di Parapat Danau Toba.

Dinas Kebersihan dan Lingkungan Hidup Kota Depok. (2007). Laporan Status Lingkungan Hidup Daerah Kota Depok. Depok: Pemerintah Kota Depok.

Desmawati, I., Ameivia, A., & Ardayanti, L. B. (2020). Studi Pendahuluan Kelimpahan Plankton di Perairan Darat Surabaya dan Malang. Rekayasa, 13(1), 61-66.

Hutabarat, S dan S.M. Evans. (1986). Kunci Identifikasi Zooplankton Daerah Tropik. UI Press. Jakarta

Hartina, S., & Trianto, M. (2020). Diversity of Zooplankton in Lindu Lake Waters Central Sulawesi Province. BIO-EDU: Jurnal Pendidikan Biologi, 5(3), 129-139.

Karliansyah, (2016). Atlas Status Mutu Air Indonesia. Direktur Jenderal Pengendalian Pencemaran dan Kerusakan Lingkungan. Kementerian Lingkungan Hidup dan Kehutanan, Republik Indonesia.

KepmenLH (Kementerian Lingkungan Hidup). (2003). Keputusan Menteri Negara Lingkungan Hidup Nomor 115 tahun 2003 tentang Pedoman Penentuan Status Mutu air. Jakarta, 2003.

Kirana, G. C., Khairuddin, K., & Yamin, M. (2022). Analyss of Heavy Metal Content of Copper (Cu) in Cork Fish From Rawa Taliwang Lake, West Sumbawa Regency 2021. Jurnal Biologi Tropis, 22(3), 1033-1039.

Kulla, O. L. S., Yuliana, E., & Supriyono, E. (2020). Analisis kualitas air dan kualitas lingkungan untuk budidaya ikan di Danau Laimadat, Nusa Tenggara Timur. Pelagicus, 1(3), 135-144.

Mahajarifar, R.Z., H. Bakri, E.N. Aulia, S. Wicaksono, & M. Indrawati. (2021). Editor: A. Zulfa, T.M. Setia, & S. Handayani. Buku Pedoman Analisis

Perairan - Panduan Lapangan dan Analisis Laboratorium. Lembaga Penerbitan Universitas Nasional (LPU-UNAS). Jakarta.

Miswan, M., Ranga, S. I. S., Shaleh, M. F. R. M., & Umrah, U. (2022). Phytoplankton Diversity in The Waters of Lake Sibili Palu City Central Sulawesi. Biocelebes, 16(1), 30-37.

Nizar, M., Catharica, A., & Sunoki, B. R. (2022). Inventarisasi Jenis Ikan Di Danau Teloko Kecamatan Kayuagung, Kabupaten Ogan Komering Ilir. Jurnal Perikanan Perairan Umum, 1(1), 24-34.

Nontji. (2006). Tiada Kehidupan di Bumi Tanpa Keberadaan Plankton. Lembaga Ilmu Pengetahuan Indonesia. Jakarta.

Pardamean, S. (2015). Teknologi Pengolahan Air Kotor dan Payau Menjadi Air Bersih dan Layak Minum. Lembaga Ilmu Pengetahuan Indonesia (LIPI).

Peraturan Pemerintah Republik Indonesia Nomor 22 Tahun 2021. (2021) tentang Penyelenggaraan Perlindungan dan Pengelolaan Lingkungan Hidup Jakarta,

Pratiwi, R. H. 2015. Distribusi Bakteri Coliform di SITU Cilodong Depok Jawa Barat. Faktor Exacta, 6(4), 290-297.

Purwoto, S. (2023). Peningkatan mutu air sungai surabaya berbasis treatment koagulasi, absorbsi, dan ion exchange. Waktu: Jurnal Teknik UNIPA, 21(02).

Ruga, L., Langoy, M., Papu, A. dan Kolondam. 2014. Identikasi Zooplankton di Perairan Pulau Bunaken Manado. Jurnal MIPA UN-SRAT Online. Vol 3(2): 84-86.

Said, N. I., & Yudo, S. (2021). Status kualitas air di kolam bekas tambang batubara di Tambang Satui, Kabupaten Tanah Laut, Kalimantan Selatan. Jurnal Teknologi Lingkungan, 22(1), 048-057.

Thoha, H. dan A. Rachman. (2013). Kelimpahan dan distribusi spasial komu- nitas plankton di perairan Kepulauan Banggai. J. Ilmu dan Teknologi Kelautan Tropis 5(1):145-161.

Yohannes, B. Y., Utomo, S. W., & Agustina, H. (2019). Kajian Kualitas Air Sungai dan Upaya Pengendalian Pencemaran Air. IJEEM-Indonesian Journal of Environmental Education and Management, 4(2), 136-155.