

IOP Conference Series: Earth and Environmental Science

Country [United Kingdom](#) -  SIR Ranking of United Kingdom

Subject Area and Category [Earth and Planetary Sciences](#)
[Earth and Planetary Sciences \(miscellaneous\)](#)

[Environmental Science](#)
[Environmental Science \(miscellaneous\)](#)

Publisher [IOP Publishing Ltd.](#)

Publication type Conferences and Proceedings

ISSN 17551315, 17551307

Coverage 2010-2020

Scope The open access IOP Conference Series: Earth and Environmental Science (EES) provides a fast, versatile and cost-effective proceedings publication service.

 [Homepage](#)

[How to publish in this journal](#)

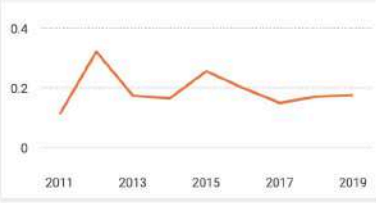
[Contact](#)

 [Join the conversation about this journal](#)

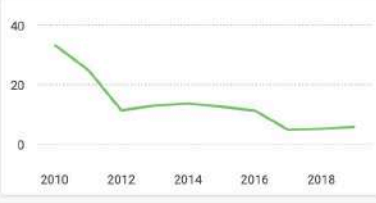
18

H Index

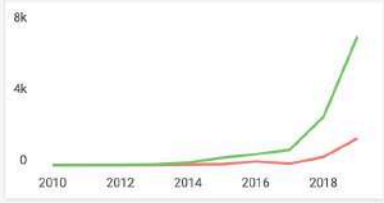
SJR



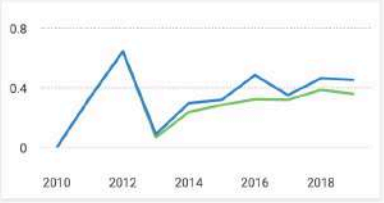
% International Collaboration



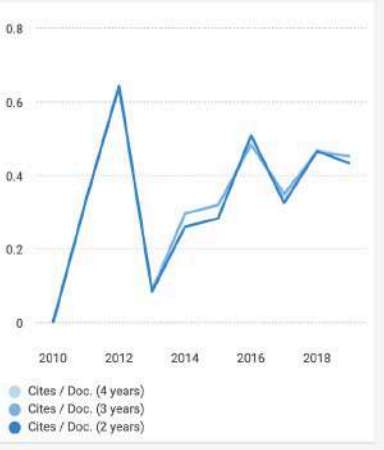
Total Cites Self-Cites



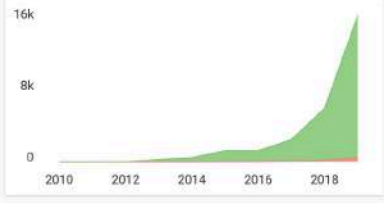
External Cites per Doc Cites per Doc



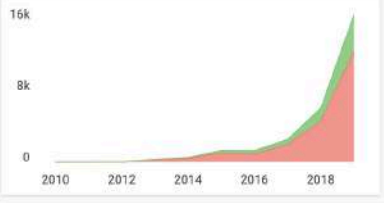
Citations per document



Citable documents Non-citable documents



Cited documents Uncited documents



IOP Conference Series: Earth and Environmental...

Not yet assigned quartile

SJR 2019: 0.18


powered by scimagojr.com

Show this widget in your own website

Just copy the code below and paste within your html code:

`<a href="https://www.scima`

Cover prosiding

 **NOTICE:** Ensuring subscriber access to content on IOPscience throughout the coronavirus outbreak - [see our remote access guidelines](#).

IOPscience

Journals ▾

Books

Publishing Support

Login ▾

Search IOPscience content

Journal of Physics: Conference Series

Issues

Volume 1402, 2019

4th Annual Applied Science and Engineering Conference 24 April 2019, Bali, Indonesia

Accepted papers received: 01 November 2019

Published online: 16 December 2019

Latest issues

(complete)

- [Number 1, December 2019](#)
- [Number 2, December 2019](#)
- [Number 3, December 2019](#)
- [Number 4, December 2019](#)
- [Number 5, December 2019](#)
- [Number 6, December 2019](#)
- [Number 7, December 2019](#)

AASEC 2019 - Bali, Indonesia

Welcome to the 4th Annual Applied Science and Engineering Conference (AASEC) 2019. Hosted by Technical and Vocational Education Study Program, School of Postgraduate Studies, Universitas Pendidikan Indonesia and UPI Publication Center, Universitas Pendidikan Indonesia, in collaboration with Universitas Warmadewa, Bali, Indonesia. This year's AASEC will take place on 24 April 2019 in Bali, Indonesia



Assoc.

Organized by:



Co-Host:



SAMPOERNA UNIVERSITY



Photos of Conference Day



([HTTP://AASEC.CONFERENCE](http://aasec.conference))

Committee

Advisory Board

- Prof. Dr. Wahyu Widada (Universitas Bengkulu)
Prof. Dr. Muhammad Ali Ramdhani, M.T. (UIN Sunan Gunung Djati Bandung)
Dr. Hadi Kuncoro, M. Farm., Apt. (Universitas Mulawarman)
Dr. Astri Rinanti, MT (Universitas Trisakti)
Dr. Hilmi Aulawi, M.T. (Sekolah Tinggi Teknologi Garut)
Dr. Juniastel Rajagukguk, M.Si (Universitas Negeri Medan)
Dr. Ir. Herman S., MBA. (Universitas Komputer Indonesia)
Dr. Endarto Y Wardhono, (Universitas Sultan Ageng Tirtayasa, Banten)
Dr. Niken Subekti, MSi (Universitas Negeri Semarang)
Dr. Sudi Dul Aji (Universitas Kanjuruhan Malang)
Dr. July Hidayat, M.Sn. (Universitas Pelita Harapan)
Dr. Jarman Arroisi, M.A. (Universitas Darussalam Gontor Ponorogo Jatim)
Dr. Ir. Suharsono. (UPN Veteran Yogyakarta)
Dr. Setia Budi, M.Sc (universitas Negeri Jakarta)
Dr. Ade Yeti Nuryantini, S.Pd., M.Pd., M.Si. (UIN Sunan Gunung Djati Bandung)
Dr. Bebeh Wahid Nuryadin (UIN Sunan Gunung Djati Bandung)
Dr. Melati Ferianita Fachrul, MS. (Universitas Trisakti)
Dr. rer. nat. I Gusti Ngurah Agung Suryaputra, S.T., M.Sc. (Universitas Pendidikan Ganesha)
Daniel Sutopo Pamungkas, PhD (Politeknik Negeri Batam)
Cynthia Wuisang, ST, MURbHabMgt., PhD (Universitas Sam Ratulangi)
Ir. Isri Ronald Mangangka, M.Eng., Ph.D. (Universitas Sam Ratulangi)

Scientific Committee

Prof. Dr. Asep Kadarohman, Universitas Pendidikan Indonesia, Indonesia

Prof. Dr. Didi Sukyadi, M. A., Universitas Pendidikan Indonesia, Indonesia

Prof. Dr. Anna Permanasari, Universitas Pendidikan Indonesia, Indonesia

Prof. Dr. Sumarto, Universitas Pendidikan Indonesia, Indonesia

Prof. Dr. M. Syaom Barliana, Universitas Pendidikan Indonesia, Indonesia

Prof. Dr. Ratih Hurriyati, Universitas Pendidikan Indonesia, Indonesia

Dr. Ir. Taufiq Saidi, M. Eng., Universitas Syiah Kuala, Indonesia

Dr. Erfan Handoko, M.Si., Universitas Negeri Jakarta, Indonesia

Dr. Hilmi Aulawi, MT., Sekolah Tinggi Teknologi Garut, Indonesia

Dr. Astri Rinanti, MT., Universitas Trisakti, Indonesia

Dr. Prantasi H. Tjahjanti, Universitas Muhammadiyah Sidoarjo, Indonesia

Dr. Rositayanti Hadisoebroto, ST., MT., Universitas Trisakti, Indonesia

Erfan Rohadi, ST., M.Eng., PhD. b., Politeknik Negeri Malang, Indonesia

Indrazno Siradjuddin, ST, MT, PhD., Politeknik Negeri Malang, Indonesia

Irwan Alnarus Kautsar, Ph.D., Universitas Muhammadiyah Sidoarjo, Indonesia

Muhammad Nur Hudha, M.Pd., Universitas Kanjuruhan Malang, Indonesia

Organizing Committee

Conference Chair:

Dr. Ade Gafar Abdullah, M.Si. – Universitas Pendidikan Indonesia

Co- Conference Chair:

Ari Arifin Danuwijaya, M.Ed. – Universitas Pendidikan Indonesia

Members:

Dr. Eng. Asep Bayu DaniNandiyanto – Universitas Pendidikan Indonesia

Dr. Isma Widiaty, M.Pd. – Universitas Pendidikan Indonesia

Cep Ubad Abdullah, M.Pd. – Universitas Pendidikan Indonesia

Dr. Dadang Lukman Hakim – Universitas Pendidikan Indonesia

Table of contents

Volume 1402

2019

[◀ Previous issue](#) [Next issue ▶](#)

Accepted papers received: 01 November 2019

Published online: 16 December 2019

[Open all abstracts](#)

Issue 2

OPEN ACCESS 022001

[Modular panel house design with prefabricated production technology](#)

E S Soegoto, R Subarjat and T Valentina

[+Open abstract](#) [View article](#) [PDF](#)

OPEN ACCESS 022002

[Safety factor analysis of landslides hazard as a result of rain condition infiltration on Buyan-Beratan Ancient Mountain](#)

I N Sinartha and I W A Basoka

[+Open abstract](#) [View article](#) [PDF](#)

OPEN ACCESS 022100

[Pollutant load capacity of Situ Parigi, Banten Province](#)

A Zharifa, M F Fachrul and D I Hendrawan

[+Open abstract](#) [View article](#) [PDF](#)

OPEN ACCESS 022101

[The study on the self-purification based on BOD parameter, Situ Gede Tangerang City, Banten Province](#)

H Purwati, M F Fachrul and D I Hendrawan

[+Open abstract](#) [View article](#) [PDF](#)

OPEN ACCESS 022102

[Removal of heavy metal \(Cu²⁺\) by *Thiobacillus* sp. and *Clostridium* sp. at various temperatures and concentration of pollutant in liquid media](#)

A K R Vernans, B Iswanto and A Rinanti

[+Open abstract](#) [View article](#) [PDF](#)

PAPER • OPEN ACCESS

The study on the self-purification based on BOD parameter, Situ Gede Tangerang City, Banten Province

To cite this article: H Purwati *et al* 2019 *J. Phys.: Conf. Ser.* **1402** 022101

View the [article online](#) for updates and enhancements.

The advertisement banner features a collage of colorful book covers on the left, including titles like 'Infrared Imaging' and 'Science and Mathematics Physics'. On the right, the text reads: 'IOP ebooks™ Bringing together innovative digital publishing with leading authors from the global scientific community. Start exploring the collection—download the first chapter of every title for free.'

The study on the self-purification based on BOD parameter, Situ Gede Tangerang City, Banten Province

H Purwati, M F Fachrul and D I Hendrawan*

Department of Environmental Engineering, Faculty of Landscape Architecture and Environmental Technology, Universitas Trisakti, Jakarta, Indonesia

*dianahendrawan@trisakti.ac.id

Abstract. Situ Gede is a natural small lake located in Kelapa Indah, Tangerang District, Tangerang City, which has an area of 5.07 hectares. The decreasing in water quality is characterized by the number of pollutants such as BOD (Biochemical Oxygen Demand), which are closely related to human activities such as the disposal by organic waste from domestic activities surrounding. The purpose of this study is to analyse the self-purification of water body in degrading of organic matter. The average of retention time of Situ Gede is 3.05 hours and a mixed concentration is 16.12 mg/l. The calculation results, the degradation rate at Situ Gede is 0.19/day. These results are stated as the composition of BOD in the Situ Gede situation not degraded perfectly. Alternative strategies for water pollution control can conduct by aeration to increase the oxygen for aerobic microorganism's growth to process the organic matter degradation.

1. Introduction

Situ (small lake) have a very important role in the environment. The role there is as groundwater recharge areas, helping to improve surface water, irrigation, recreation, fisheries and supporting marine biodiversity. Situations in the Tangerang City generally experience pollution problems, decreasing the quality of water there, decreasing water discharge especially during the dry season and silting up there.

Increased community activities tend to cause pollution and disrupt the sustainability of the waters there. Domestic waste comes from the surrounding community settlements which carry out various activities, such as bathing, washing, urinating and disposing of garbage on the banks of Situ Gede. Nature actually has the ability to overcome pollution problems that occur. This mechanism, called self-purification. Self-Purification is efforts to purify water from pollutants contained in it by natural processes without the influence of human activities [1].

To achieve or maintain the quality of Situ Gede water so that it can be used continuously in accordance with the expected water quality standards, it is necessary to control and or preserve water there. One of the management steps taken is to calculate the degradation rate in Situ Gede waters.

2. Literature review

Lakes, ponds and reservoirs are used for domestic and irrigation purposes, providing ecosystems for aquatic life, especially fish. Which has important social and economic benefits as a result of tourism and recreation. In addition, it has an equally important role in flood control [2]. At present, lakes and reservoirs are in various levels of environmental degradation, due to encroachment, eutrophication (from



domestic and industrial waste) and sludge deposits [3]. Disposal of garbage and other waste around it occurs, which not only pollutes it but also damages its beauty. There are a number of layouts (residential areas) around it, which can affect water both quantitatively and qualitatively [4].

Self-Purification capability occurs in conditions where pollution does not exceed the threshold or carrying capacity of nature. The mechanism of purification naturally is limited to organic parameters which can be degraded under aerobic conditions by microorganisms. The ability of water bodies to purify themselves is the ability to remove organic matter, or other pollutants from a lake by biological activity. Self-purification is often related to the oxidation of organic matter by aerobic organisms. The oxidation process causes deoxygenation from water and the deoxygenation level depends on the strength of the wastewater, the level of dilution given by the mixture with water and the flow rate [5]. Situ conditions that are relatively flat show a relatively calm and no-flow pattern (turbulence) which causes the air reeration process to be reduced so that the self-purification capacity of the Situ is not optimal [6]. The concentration of pollutants entering the waters has three types, namely dilution (dilution), spread (dispersion), and decomposition reactions (decay or reaction) [7].

3. Research methods

3.1. Location and time of research

This research was conducted during 3 months, from May to July 2018 in Situ Gede waters, which is located in Kelapa Indah Village, Tangerang District, Tangerang City, Banten Province. This location is a natural site with an area of 5.07 Ha.

3.2. Determination of sampling points

Situ Gede is research determined 8 sampling points as locations for taking water samples. The point of water sampling is divided based on the characteristics of the waters that are affected by the presence of activities or activities to use the surrounding area. The method of water sampling which is carried out directly using the grab sampling method is the method of instantaneous sampling in accordance with SNI 6989.57: 2008. Sampling from the water surface at a depth of 1/2-2/3 from water depth. Sampling was conducted the morning at 07. 00a.m - 13.00 p.m.

Table 1. Water sampling coordinate.

Sampling Point	Coordinate Point	Information
1	6°11'57.80"LS; 06°38'15.82"BT	Inlet originating from a pool of shelter, runoff flow, apartment and domestic activities
2	6°12'0.60"LS; 106°38'14.76"BT	The point that receives water input comes from food / beverage businesses and sports recreation centres
3	6°11'56.59"LS 106°38'11.98"BT	The middle part is the mixing point (point 1 and point 2)
4	6°11'53.13"LS 106°38'9.14"BT	The middle part is the continuation of point 3
5	6°11'47.68"LS 106°38'8.37"BT	The point that receives water input from shopping centres, runoff flow and domestic activities
6	6°11'47.27"LS 106°38'4.62"BT	The middle part is the mixing point of point 5
7	6°11'44.33"LS 106°38'2.02"BT	The point that receives water input from the education centre, runoff flow and domestic activities
8	6°11'44.40"LS 106°38'0.86"BT	The Outlet section which is the last area of Situ Gede waters towards the Cisadane River

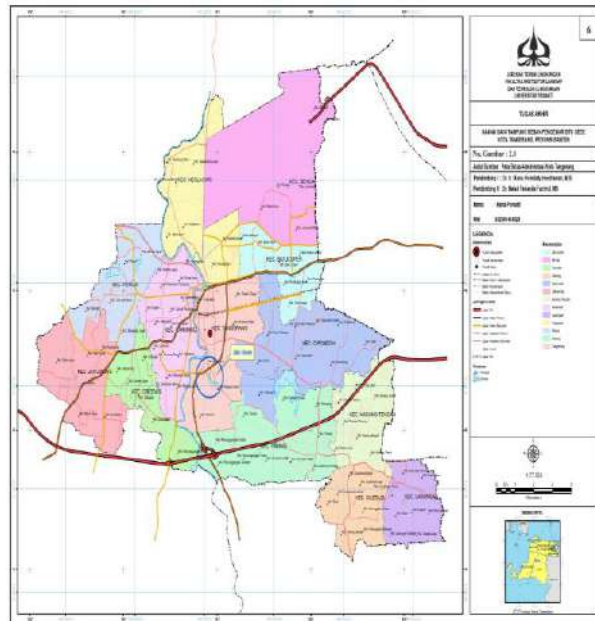


Figure 1. Sampling point of Situ Gede.

3.3. Data analysis

Measured water quality results are then compared with environmental quality standards based on Government Regulation No. 82 of 2001 on Management of Water Quality and Water Pollution Control in accordance with its designation applies the Standard Criteria for Class II Water Quality, in accordance with the water criteria set by the City Government of Tangerang City for Situ Gede which is for recreation [8].

The rate of degradation is the speed of removal of pollutants in the water. The rate of degradation in Situ Gede Waters, Tangerang City, is done by calculating the water residence time and the division of Situ Gede segment. The parameters measured are only BOD parameters, BOD (Biochemical Oxygen Demand) is a characteristic that shows the amount of dissolved oxygen needed by microorganisms (usually bacteria) to decompose or decompose organic matter in aerobic conditions. BOD is important to know the amount of oxygen that will be needed to stabilize organic matter. Then a BOD value will be obtained which will give an idea of the ability of the waters to degrade organic matter. In addition, it can be seen that the ability of the waters to degrade organic matter is still quite good or low. If it is low, it means that the ability to recover water has decreased.

The degradation rate is influenced by residence time (t_d), mixture concentration and microorganism. The residence time of pollutants in water is one of the factors that can affect the value of the degradation rate. The hydraulic residence time can show the average time or speed of degradation of organic matter. While the waters with stagnant flow, have a faster degradation rate, due to a decrease in oxygen levels. And the speed of decomposition will occur more slowly.

To calculate the hydraulic residence time of each sampling point using a formula Davis and Cornwell, [9]:

$$t_d = V / Q \quad (1)$$

Where:

t_d = Hydraulic residence time (seconds); V = Volume (m^3); Q = Debit (m^3 /second)

Whereas to calculate the degradation rate Situ Gede uses formulas Davis and Cornwell [9]:

$$C_t = C_o \cdot e^{-kt} \quad (2)$$

Where:

C_t : Final concentration (mg/l) t : Hydraulic residence time (seconds)

C_o : Initial concentration (mg/l) k : The degradation rate coefficient (days)

The concentration of the mixture aims to calculate the concentration of pollutant load at each point. The following formula is used to calculate mixed concentrations [9]:

$$C_{\text{camp}} = \frac{(C_1Q_1)+(C_2Q_2)+C_3Q_3+\dots+(C_nQ_n)}{Q_{\text{total}}} \quad (3)$$

Where:

C_{camp} : Mixture concentration (mg/l) Q_1 : Water discharge at point 1 (m³/second)

C_1 : Concentration at point 1 (mg/l) Q_n : Water discharge at point n (m³/second)

C_n : Concentration at point n (mg/l) Q_{total} : Overall debit (m³/second)

In general, situ and other water reservoirs are described as bodies of water which are perfect mixing sites horizontally and vertically. Where this is based on wind pressure above the water surface which helps mixing in water. The concentration of various materials will remain in situ waters.

4. Results and discussion

4.1. Pollutant source in Situ Gede

Activities around Situ Gede are settlements, food and beverage businesses, laundry, salons, apartments, educational facilities, hospitals, recreation areas and shopping places. These activities have the potential to be sources of pollution. For inorganic waste, the surrounding population does not throw it into Situ Gede. As for the garbage around it comes from food wrap and drinks brought by anglers who are dumped around Situ Gede while fishing. The flow that goes into Situ Gede waters through 4 inlets.

4.2. Water quality of Situ Gede

The following results of BOD concentration for 3 sampling times can be seen in Table 2 below:

Table 2. Results of BOD concentration in Situ Gede waters.

Sampling	BOD (mg/l)							
	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8
1	32,98	35,79	34,10	25,15	8,42	4,30	11,46	20,76
2	7,02	9,82	7,02	9,82	5,61	8,42	5,61	9,82
3	18,24	15,44	15,44	8,42	7,02	7,02	14,03	19,64
Average	19,41	20,35	18,85	14,46	7,02	6,58	10,37	16,74

One indicator of pollution in the waters can be based on the BOD value, where the higher the BOD value the more polluted waters [10]. BOD is a parameter that can be used to describe the presence of organic matter in the waters. The BOD value in Situ Gede waters ranges from 4 mg / l-36 mg / l. The lowest value of 4 mg / l is at point 6 (middle situ), the lower concentration in the middle part describes the occurrence of dilution and degradation in accordance with the residence time there. While the highest value is 36 mg / l measured at point 2 (near restaurants and swimming pools). In sampling 2 the BOD value is relatively smaller than sampling 1 and sampling 3, this is due to the presence of rain so that dilution occurs and causes the BOD level to decrease. Based on the water quality standard the required BOD value is ≤ 3 mg / l. Thus it is concluded that Situ Gede waters have been polluted by easily decomposed organic matter, which is caused by the density of domestic settlement activities, food and beverage businesses, apartments located around Situ Gede waters so that as seen during monitoring that Situ Gede's physical condition looks cloudy and smell.

4.3. Water degradation rate of Situ Gede

Table 3 shows the results of the Situ Gede Aquatic Degradation Rate calculation. From the table it can be seen that, the average residence time of Situ Gede is 3.05 hours and the mixture concentration is 16.12 mg / l. The calculation results, the degradation rate in Situ Gede is 0.19 / day.

Table 3. Results of pollutant degradation rate in Situ Gede Waters.

Segment	Mixed concentration (mg/l)	Outlet concentration (mg/l)	Td (second)	degradation constant (/days)
A (Inlet)	18,88	19,54	11.264	-0,26
B (Middle)	15,93	13,67	10.755	1,23
C (outlet)	13,56	11,84	10.915	1,07

In accordance with the results of the calculation of the mixture concentration, it can be seen that the concentration of BOD getting closer to the outlet will decrease its concentration. This shows the degradation process of BOD compounds in Situ Gede waters. To find out the residence time in segment Gede, you must first know the volume and debit volume. Hydraulic residence time is influenced by the amount of discharge. The bigger the discharge, the smaller the hydraulic residence time.

A situation with a small outlet flow can have a long detention time. While the larger the outlet discharge, the hydraulic residence time will be smaller. And hydraulic residence time can show the speed of degradation of organic matter that occurs in the waters. In segment A, the constant degradation rate is -0.26 / day with mixed concentrations of 18.88 mg / l, outlet concentration of 19.54 mg / l and residence time of segment A is 11.264 / sec. Segment B, has a degradation rate constant value of 1.23 / day with a mixture concentration of 15.93 mg / l, outlet concentration of 13.67 mg / l and residence time of segment B is 10.755 / sec. Furthermore, segment C, has a degradation rate constant value of 1.07 / day with a mixture concentration of 13.56 mg / l, outlet concentration of 11.84 mg / l and residence time of C segment is 10.915 / sec.

However, in segment A, the constant value of the degradation rate is -0.26 / day, because there is no complete degradation in Situ Gede. In addition, it can be influenced by a short hydraulic residence, so that the process of degradation of organic materials has not run perfectly. The longer the hydraulic residence time in the waters, the greater the allowance for organic materials. This happened because of the addition of waste water in each inlet to the direction of the outlet originating from the activities around Situ Gede.

Situ is inundated waters, then the speed of the waters will occur more slowly and the decomposition process is very dependent on the wind which is strong enough to be able to make waves in the waters, thus helping the degradation process. With the entry of oxygen in the waters will help the growth of aerobic microorganisms that will help the process of reforming organic matter.

5. Conclusion

The conclusions obtained from the study at Situ Gede were that the average residence time of Situ Gede was 3.05 hours and the mixture concentration was 16.12 mg/l. The results of the calculation, the degradation rate at Situ Gede is 0.19/day.

References

- [1] Hendrasarie N and Cahyarani 2008 Kemampuan Self Purification Kali Surabaya, ditinjau dari Parameter Organik berdasarkan Model Matematis Kualitas Air *Jurnal Ilmiah Teknik Lingkungan* **2**(1)
- [2] Moslem S, Zohreh R, Javid I, Abbas M and Tahsin R 2013 Water Quality Assessment of the Zarivar Lake using Physico-chemical Parameters and NSF- WQI Indicator, Kurdistan Province-Iran *Int J Adv Biol Biom Res.* **1**(3) 302-312
- [3] Joyanta P, Manish P, Pankaj K R and Asis M 2016 Water Quality Index for Assessment of Rudrasagar Lake Ecosystem *India. Int. Journal of Engineering Research and Applications* **6**

- (1) 98-101
- [4] Puri P J, Yenkie M K N, Rana D B and Meshram S U 2015. Application of Water Quality Index (WQI) for the Assessment of Surface Water Quality (Ambazari Lake) Pelagia Research Library *European Journal of Experimental Biology* **5**(2) 37-52
- [5] Arbie R R, Nugraha W D and Sudarno S 2015 Studi Kemampuan Self Purification Pada Sungai Progo Ditinjau Dari Parameter Organik DO Dan BOD (Point Source: Limbah Sentra Tahu Desa Tuksono, Kecamatan Sentolo, Kabupaten Kulon Progo, Provinsi DI Yogyakarta) *Jurnal Teknik Lingkungan* **4**(3) 1-15
- [6] Agustiniingsih D, Budi S S and Sudarno 2012 Analisis Kualitas Air dan Strategi Pengendalian Pencemaran Air Sungai Blukar Kabupaten Kendal *Jurnal Presipitasi* **9**(2)
- [7] Walukow A F 2010 Kajian Parameter Kimia Posfat di Perairan Danau Sentani Berwawasan Lingkungan *Forum Geografi* **24**(2)
- [8] Peraturan Pemerintah Republik Indonesia 2001 Peraturan Pemerintah Nomor 82 Tahun 2001 Tentang Pengelolaan Kualitas air dan Pengendalian Pencemaran Air (Jakarta: Peraturan Pemerintah Republik Indonesia)
- [9] Davis M L and Cornwell D A 2013 *Introduction to Environmental Engineering Fifth Edition* (New York: McGraw Hill, Inc.)
- [10] Hindriani H, Asep S, Suprihatin and Machfud 2013 Pengendalian Pencemaran Sungai Ciujung berdasarkan Analisis Daya Tampung Beban Pencemaran *Jurnal sumber daya air* **9**(2) 169-184

The study on the self-purification based on BOD parameter, Situ Gede Tangerang City, Banten Province

by Perpustakaan Falit

Submission date: 13-Apr-2023 02:39PM (UTC+0700)

Submission ID: 2063302775

File name: File_12.pdf (209.48K)

Word count: 2954

Character count: 14973

The study on the self-purification based on BOD parameter, Situ Gede Tangerang City, Banten Province

6
H Purwati, M F Fachrul and D I Hendrawan*

Department of Environmental Engineering, Faculty of Landscape Architecture and Environmental Technology, Universitas Trisakti, Jakarta, Indonesia

*dianahendrawan@trisakti.ac.id

10
Abstract. Situ Gede is a natural small lake located in Kelapa Indah, Tangerang District, Tangerang City, which has an area of 5.07 hectares. The decreasing in water quality is characterized by the number of pollutants such as BOD (Biochemical Oxygen Demand), which are closely related to human activities such as the disposal by organic waste from domestic activities surrounding. The purpose of this study is to analyse the self-purification of water body in degrading of organic matter. The average of retention time of Situ Gede is 3.05 hours and a mixed concentration is 16.12 mg/l. The calculation results, the degradation rate at Situ Gede is 0.19/day. These results are stated as the composition of BOD in the Situ Gede situation not degraded perfectly. Alternative strategies for water pollution control can conduct by aeration to increase the oxygen for aerobic microorganism's growth to process the organic matter degradation.

1. Introduction

Situ (small lake) have a very important role in the environment. The role there is as groundwater recharge areas, helping to improve surface water, irrigation, recreation, fisheries and supporting marine biodiversity. Situations in the Tangerang City generally experience pollution problems, decreasing the quality of water there, decreasing water discharge especially during the dry season and silting up there.

Increased community activities tend to cause pollution and disrupt the sustainability of the waters there. Domestic waste comes from the surrounding community settlements which carry out various activities, such as bathing, washing, urinating and disposing of garbage on the banks of Situ Gede. Nature actually has the ability to overcome pollution problems that occur. This mechanism, called self-purification. Self-Purification is efforts to purify water from pollutants contained in it by natural processes without the influence of human activities [1].

9
To achieve or maintain the quality of Situ Gede water so that it can be used continuously in accordance with the expected water quality standards, it is necessary to control and or preserve water there. One of the management steps taken is to calculate the degradation rate in Situ Gede waters.

2. Literature review

3
Lakes, ponds and reservoirs are used for domestic and irrigation purposes, providing ecosystems for aquatic life, especially fish. Which has important social and economic benefits as a result of tourism and recreation. In addition, it has an equally important role in flood control [2]. At present, lakes and reservoirs are in various levels of environmental degradation, due to encroachment, eutrophication (from



2
Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.

domestic and industrial waste) and sludge deposits [3]. Disposal of garbage and other waste around it occurs, which not only pollutes it but also damages its beauty. There are a number of layouts (residential are ⁵) around it, which can affect water both quantitatively and qualitatively [4].

Self-Purification capability occurs in conditions where pollution does not exceed the threshold or carrying capacity of nature. The mechanism of purification naturally is limited to organic parameters which can be degraded under aerobic conditions by microorganisms. The ability of water bodies to purify themselves is the ability to remove organic matter, or other pollutants from a lake by biological activity. Self-purification is often related to the oxidation of organic matter by aerobic organisms. The oxidation process causes deoxygenation from water and the deoxygenation level depends on the strength of the wastewater, the level of dilution given by the mixture with water and the flow rate [5]. Situ conditions that are relatively flat show a relatively calm and no-flow pattern (turbulence) which causes the air reaeration process to be reduced so that the self-purification capacity of the Situ is not optimal [6]. The concentration of pollutants entering the waters has three types, namely dilution (dilution), spread (dispersion), and decomposition reactions (decay or reaction) [7].

3. Research methods

3.1. Location and time of research

This research ¹⁰ was conducted during 3 months, from May to July 2018 in Situ Gede waters, which is located in Kelapa Indah Village, Tangerang District, Tangerang City, Banten Province. This location is a natural site with an area of 5.07 Ha.

3.2. Determination of sampling points

Situ Gede is research determined 8 sampling points as locations for taking water samples. The point of water sampling is divided based on the characteristics of the waters that are affected by the presence of activities or activities to use the surrounding area. The method of water sampling which is carried out directly using the grab sampling method is the method of instantaneous sampling in accordance with SNI 6989.57: 2008. Sampling from the water surface at a depth of 1/2-2/3 from water depth. Sampling was conducted the morning at 07.00a.m - 13.00 p.m.

Table 1. Water sampling coordinate.

Sampling Point	Coordinate Point	Information
1	6°11'57.80"LS; 06°38'15.82"BT	Inlet originating from a pool of shelter, runoff flow, apartment and domestic activities
2	6°12'0.60"LS; 106°38'14.76"BT	The point that receives water input comes from food / beverage businesses and sports recreation centres
3	6°11'56.59"LS 106°38'11.98"BT	The middle part is the mixing point (point 1 and point 2)
4	6°11'23.13"LS 106°38'9.14"BT	The middle part is the continuation of point 3
5	6°11'47.68"LS 106°38'8.37"BT	The point that receives water input from shopping centres, runoff flow and domestic activities
6	6°11'47.27"LS 106°38'4.62"BT	The middle part is the mixing point of point 5
7	6°11'44.33"LS 106°38'2.02"BT	The point that receives water input from the education centre, runoff flow and domestic activities
8	6°11'44.40"LS 106°38'0.86"BT	The Outlet section which is the last area of Situ Gede waters towards the Cisadane River

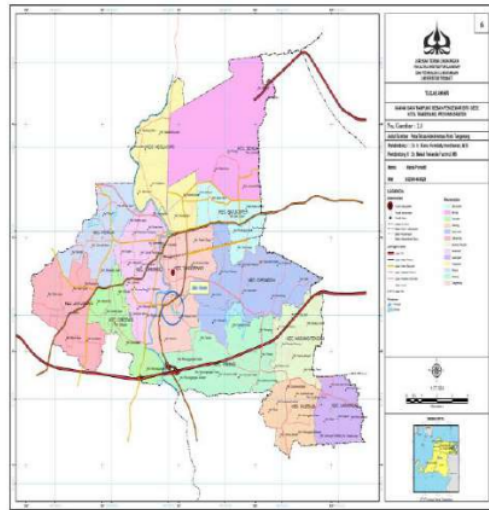


Figure 1. Sampling point of Situ Gede.

3.3. Data analysis

Measured water quality results are then compared with environmental quality standards based on Government Regulation No. 82 of 2001 on Management of Water Quality and Water Pollution Control in accordance with its designation applies the Standard Criteria for Class II Water Quality, in accordance with the water criteria set by the City Government of Tangerang City for Situ Gede which is for recreation [8].

The rate of degradation is the speed of removal of pollutants in the water. The rate of degradation in Situ Gede Waters, Tangerang City, is done by calculating the water residence time and the division of Situ Gede segment. The parameters measured are only BOD parameters, BOD (Biochemical Oxygen Demand) is a characteristic that shows the amount of dissolved oxygen needed by microorganisms (usually bacteria) to decompose or decompose organic matter in aerobic conditions. BOD is important to know the amount of oxygen that will be needed to stabilize organic matter. Then a BOD value will be obtained which will give an idea of the ability of the waters to degrade organic matter. In addition, it can be seen that the ability of the waters to degrade organic matter is still quite good or low. If it is low, it means that the ability to recover water has decreased.

The degradation rate is influenced by residence time (td), mixture concentration and microorganism. The residence time of pollutants in water is one of the factors that can affect the value of the degradation rate. The hydraulic residence time can show the average time or speed of degradation of organic matter. While the waters with stagnant flow, have a faster degradation rate, due to a decrease in oxygen levels. And the speed of decomposition will occur more slowly.

To calculate the hydraulic residence time of each sampling point using a formula Davis and Cornwell [9]:

$$td = V / Q \quad (1)$$

Where:

td = Hydraulic residence time (seconds); V = Volume (m³); Q = Debit (m³/second)

Whereas to calculate the degradation rate Situ Gede uses formulas Davis and Cornwell [9]:

$$Ct = Co. e^{-kt} \quad (2)$$

Where:

C_t : Final concentration (mg/l)

t : Hydraulic residence time (seconds)

C_o : Initial concentration (mg/l)

k : The degradation rate coefficient (days)

The concentration of the mixture aims to calculate the concentration of pollutant load at each point. The following formula is used to calculate mixed concentrations [9]:

$$C_{\text{camp}} = \frac{(C_1Q_1) + (C_2Q_2) + C_3Q_3 + \dots + (C_nQ_n)}{Q_{\text{total}}} \quad (3)$$

Where:

C_{camp} : Mixture concentration (mg/l)

Q₁ : Water discharge at point 1 (m³/second)

C₁ : Concentration at point 1 (mg/l)

Q_n : Water discharge at point n (m³/second)

C_n : Concentration at point n (mg/l)

Q_{total} : Overall debit (m³/second)

In general, situ and other water reservoirs are described as bodies of water which are perfect mixing sites horizontally and vertically. Where this is based on wind pressure above the water surface which helps mixing in water. The concentration of various materials will remain in situ waters.

4. Results and discussion

4.1. Pollutant source in Situ Gede

Activities around Situ Gede are settlements, food and beverage businesses, laundry, salons, apartments, educational facilities, hospitals, recreation areas and shopping places. These activities have the potential to be sources of pollution. For inorganic waste, the surrounding population does not throw it into Situ Gede. As for the garbage around it comes from food wrap and drinks brought by anglers who are dumped around Situ Gede while fishing. The flow that goes into Situ Gede waters through 4 inlets.

4.2. Water quality of Situ Gede

The following results of BOD concentration for 3 sampling times can be seen in Table 2 below:

Table 2. Results of BOD concentration in Situ Gede waters.

Sampling	BOD (mg/l)							
	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8
1	32,98	35,79	34,10	25,15	8,42	4,30	11,46	20,76
2	7,02	9,82	7,02	9,82	5,61	8,42	5,61	9,82
3	18,24	15,44	15,44	8,42	7,02	7,02	14,03	19,64
Average	19,41	20,35	18,85	14,46	7,02	6,58	10,37	16,74

One indicator of pollution in the waters can be based on the BOD value, where the higher the BOD value the more polluted waters [10]. BOD is a parameter that can be used to describe the presence of organic matter in the waters. The BOD value in Situ Gede waters ranges from 4 mg / l-36 mg / l. The lowest value of 4 mg / l is at point 6 (middle situ), the lower concentration in the middle part describes the occurrence of dilution and degradation in accordance with the residence time there. While the highest value is 36 mg / l measured at point 2 (near restaurants and swimming pools). In sampling 2 the BOD value is relatively smaller than sampling 1 and sampling 3, this is due to the presence of rain so that precipitation occurs and causes the BOD level to decrease. Based on the water quality standard the required BOD value is ≤ 3 mg / l. Thus it is concluded that Situ Gede waters have been polluted by easily decomposed organic matter, which is caused by the density of domestic settlement activities, food and beverage businesses, apartments located around Situ Gede waters so that as seen during monitoring that Situ Gede's physical condition looks cloudy and smell.

4.3. Water degradation rate of Situ Gede

Table 3 shows the results of the Situ Gede Aquatic Degradation Rate calculation. From the table it can be seen that, the average residence time of Situ Gede is 3.05 hours and the mixture concentration is 16.12 mg / l. The calculation results, the degradation rate in Situ Gede is 0.19 / day.

Table 3. Results of pollutant degradation rate in Situ Gede Waters.

Segment	Mixed concentration (mg/l)	Outlet concentration (mg/l)	Td (second)	degradation constant (/days)
A (Inlet)	18,88	19,54	11,264	-0,26
B (Middle)	15,93	13,67	10,755	1,23
C (outlet)	13,56	11,84	10,915	1,07

In accordance with the results of the calculation of the mixture concentration, it can be seen that the concentration of BOD getting closer to the outlet will decrease its concentration. This shows the degradation process of BOD compounds in Situ Gede waters. To find out the residence time in segment Gede, you must first know the volume and debit volume. Hydraulic residence time is influenced by the amount of discharge. The bigger the discharge, the smaller the hydraulic residence time.

A situation with a small outlet flow can have a long detention time. While the larger the outlet discharge, the hydraulic residence time will be smaller. And hydraulic residence time can show the speed of degradation of organic matter that occurs in the waters. In segment A, the constant degradation rate is -0.26 / day with mixed concentrations of 18.88 mg / l, outlet concentration of 19.54 mg / l and residence time of segment A is 11.264 / sec. Segment B, has a degradation rate constant value of 1.23 / day with a mixture concentration of 15.93 mg / l, outlet concentration of 13.67 mg / l and residence time of segment B is 10.755 / sec. Furthermore, segment C, has a degradation rate constant value of 1.07 / day with a mixture concentration of 13.56 mg / l, outlet concentration of 11.84 mg / l and residence time of C segment is 10.915 / sec.

However, in segment A, the constant value of the degradation rate is -0.26 / day, because there is no complete degradation in Situ Gede. In addition, it can be influenced by a short hydraulic residence, so that the process of degradation of organic materials has not run perfectly. The longer the hydraulic residence time in the waters, the greater the allowance for organic materials. This happened because of the addition of waste water in each inlet to the direction of the outlet originating from the activities around Situ Gede.

Situ is inundated waters, then the speed of the waters will occur more slowly and the decomposition process is very dependent on the wind which is strong enough to be able to make waves in the waters, thus helping the degradation process. With the entry of oxygen in the waters will help the growth of aerobic microorganisms that will help the process of reforming organic matter.

5. Conclusion

The conclusions obtained from the study at Situ Gede were that the average residence time of Situ Gede was 3.05 hours and the mixture concentration was 16.12 mg/l. The results of the calculation, the degradation rate at Situ Gede is 0.19/day.

References

- [1] Hendrasarie N and Cahyarani 2008 Kemampuan Self Purification Kali Surabaya, ditinjau dari Parameter Organik berdasarkan Model Matematis Kualitas Air *Jurnal Ilmiah Teknik Lingkungan* **2**(1)
- [2] Moslem S, Zohreh R, Javid I, Abbas M and Tahsin R 2013 Water Quality Assessment of the Zarivar Lake using Physico-chemical Parameters and NSF- WQI Indicator, Kurdistan Province-Iran *Int J Adv Biol Biom Res.* **1**(3) 302-312
- [3] Joyanta P, Manish P, Pankaj K R and Asis M 2016 Water Quality Index for Assessment of Rudrasagar Lake Ecosystem *India. Int. Journal of Engineering Research and Applications* **6**

- (1) 98-101
- [4] Puri P J, Yenkie M K N, Rana D B and Meshram S U 2015. Application of Water Quality Index (WQI) for the Assessment of Surface Water Quality (Ambazari Lake) Pelagia Research Library *European Journal of Experimental Biology* **5**(2) 37-52
- [5] Arbie R R, Nugraha W D and Sudarno S 2015 Studi Kemampuan Self Purification Pada Sungai Progo Ditinjau Dari Parameter Organik DO Dan BOD (Point Source: Limbah Sentra Tahu Desa Tuksono, Kecamatan Sentolo, Kabupaten Kulon Progo, Provinsi DI Yogyakarta) *Jurnal Teknik Lingkungan* **4**(3) 1-15
- [6] Agustiningih D, Budi S S and Sudarno 2012 Analisis Kualitas Air dan Strategi Pengendalian Pencemaran Air Sungai Blukar Kabupaten Kendal *Jurnal Presipitasi* **9**(2)
- [7] Walukow A F 2010 Kajian Parameter Kimia Posfat di Perairan Danau Sentani Berwawasan Lingkungan *Forum Geografi* **24**(2)
- [8] Peraturan Pemerintah Republik Indonesia 2001 Peraturan Pemerintah Nomor 82 Tahun 2001 Tentang Pengelolaan Kualitas air dan Pengendalian Pencemaran Air (Jakarta: Peraturan Pemerintah Republik Indonesia)
- [9] Davis M L and Cornwell D A 2013 *Introduction to Environmental Engineering Fifth Edition* (New York: McGraw Hill, Inc.)
- [10] Hindriani H, Asep S, Suprihatin and Machfud 2013 Pengendalian Pencemaran Sungai Ciujung berdasarkan Analisis Daya Tampung Beban Pencemaran *Jurnal sumber daya air* **9**(2) 169-184

The study on the self-purification based on BOD parameter, Situ Gede Tangerang City, Banten Province

ORIGINALITY REPORT

15%

SIMILARITY INDEX

10%

INTERNET SOURCES

9%

PUBLICATIONS

11%

STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Universitas Negeri Jakarta Student Paper	4%
2	core.ac.uk Internet Source	2%
3	"River Odra Estuary (North-West Poland): Assessment of Physical and Chemical Parameters of Water on Basis of European Union Water Framework Directive", Asian Journal of Chemistry, 2014. Publication	1%
4	midwifery.iocspublisher.org Internet Source	1%
5	Submitted to Udayana University Student Paper	1%
6	M F Fachrul, D I Hendrawan, A Rinanti. "The study of N:P ratio for estimating nutrient limitation at shallow lakes waters in Depok City West Java, Indonesia", IOP Conference Series: Earth and Environmental Science, 2021 Publication	1%

7	resources-boschsecurity-cdn.azureedge.net	1 %
Internet Source		
8	worldwidescience.org	1 %
Internet Source		
9	journal.walisongo.ac.id	1 %
Internet Source		
10	R B Budiyantri, S Ardila. "Mapping the green open spaces system in the sub-district of Tangerang, Tangerang City of Banten", IOP Conference Series: Earth and Environmental Science, 2021	1 %
Publication		
11	Susilowati Susilowati, Joko Sutrisno, Muhammad Masykuri, Maridi Maridi. "Dynamics and factors that affects DO-BOD concentrations of Madiun River", AIP Publishing, 2018	1 %
Publication		
12	trijurnal.lemlit.trisakti.ac.id	1 %
Internet Source		

Exclude quotes

Off

Exclude matches

< 15 words

Exclude bibliography

On

The study on the self-purification based on BOD parameter, Situ Gede Tangerang City, Banten Province

GRADEMARK REPORT

FINAL GRADE

/0

GENERAL COMMENTS

Instructor

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6
