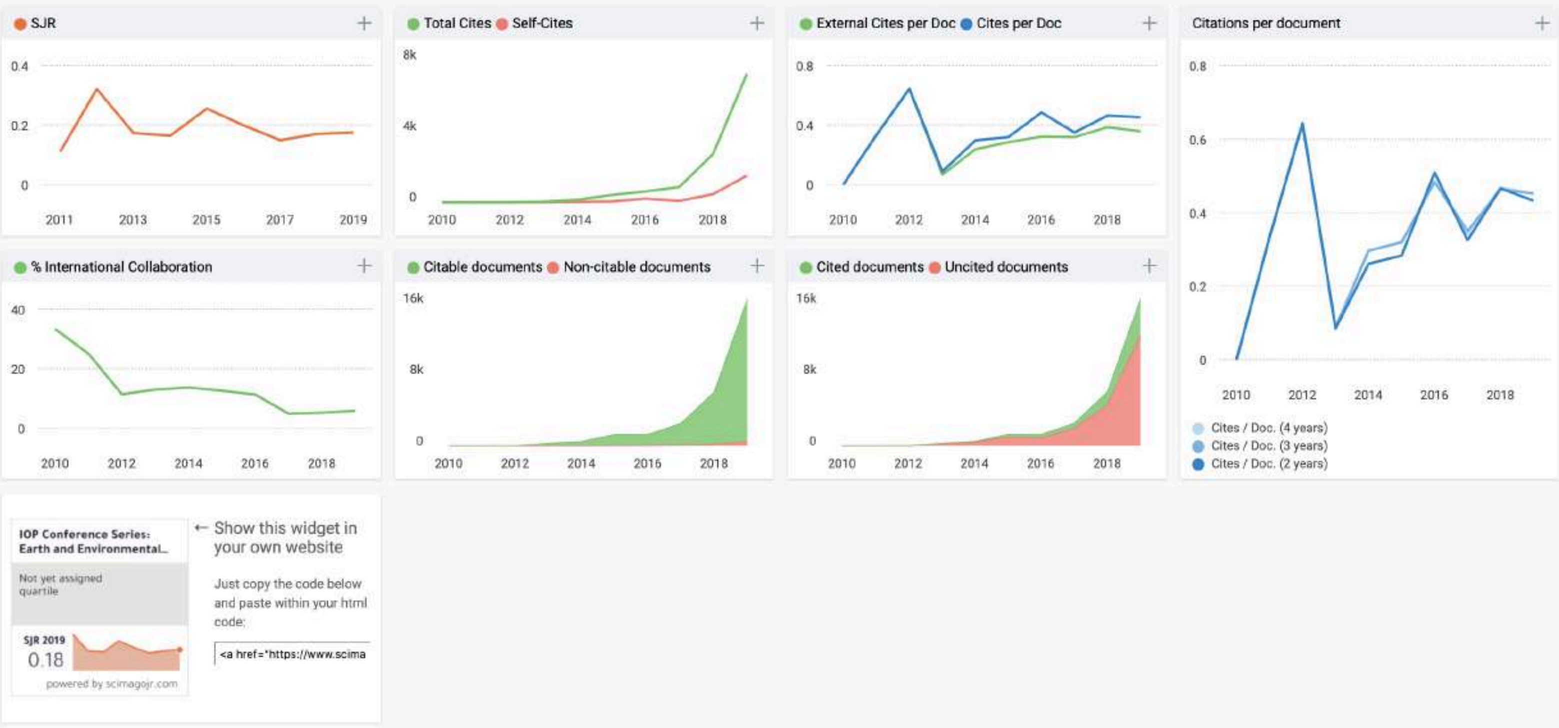
IOP Conference Series: Earth and Environmental Science

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
0.4
0.2
0
2011
2013
2015
2017
2019
Total Cites Self-Cites
8k
4k
0
2010
2012
2014
2016
2018
External Cites per Doc Cites per Doc
0.8
0.4
0
2010
2012
2014
2016
2018
Citations per document
0.8
0.6
0.4
0.2
0
2010
2012
2014
2016
2018
Cites / Doc. (4 years)
Cites / Doc. (3 years)
Cites / Doc. (2 years)
% International Collaboration
40
20
0
2010
2012
2014
2016
2018
Citable documents Non-citable documents
16k
8k
0
2010
2012
2014
2016
2018
Cited documents Uncited documents
16k
8k
0
2010
2012
2014
2016
2018
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

http://aasec.conference.upi.edu/2019/

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

http://aasec.conference.upi.edu/2019/calendar/

Organized by:

Co-Host:

Photos of Conference Day

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

Journal of Physics: Conference Series

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 3

Journal of Physics: Conference Series

PAPER • OPEN ACCESS

Efficiency of constructed wetland using vetiver plant *(Vetiveria sp)* to reduced BOD and COD Concentration in greywater

To cite this article: D H Wasita *et al* 2019 *J. Phys.: Conf. Ser.* **1402** 033007

Journal of Physics: Conference Series **1402** (2019) 033007 doi:10.1088/1742-6596/1402/3/033007

Efficiency of constructed wetland using vetiver plant *(Vetiveria sp)* to reduced BOD and COD Concentration in greywater

D H Wasita, R Hadisoebroto and M F Fachrul*

Department of Environmental Engineering, Universitas Trisakti, Jakarta, Indonesia

*melati@trisakti.ac.id

Abstract. Constructed wetland is engineered, man-made ecosystems as a wastewater treatment unit to reduce water pollution by using plants. The purpose of this study to know the efficiency of Sub-Surface Flow constructed wetland with Vetiveria sp. in domestic wastewater treatment and to reveal the effect of aeration and detention time to reducing BOD concentrations in domestic wastewater. The research has been conducted in a constructed wetland located in Srengseng Sawah Village of continuing aerated reactor and without aeration as a control reactor. Detention time (days) 2 and 3 ware setup, then the sample was taken for BOD concentration. The results indicated that constructed wetland with aeration and detention time 4 days had a higher performance to remove BOD up to 90% than without aeration and less than 4 days' process. These results fulfil the requirement of the quality standards of the Decree of DKI Jakarta Governor No. 122 of 2005 and Decree of the Minister of Environment No. 112 of 2003.

1. Introduction

Population growth will increase domestic activities and domestic wastewater, which will cause environmental pollution later. Naturally, the environment has the ability to degrade pollutants, if the pollution load can still be tolerated. The increase in the volume of untreated wastewater will certainly cause problems in the environment if not-balanced with an increase in the capacity and quality of the receiving water body [1].

This domestic wastewater resulted by daily waste from human activities such as residential activities, restaurants, offices, commercial centers, apartments, and dormitories. Around (60-70) % of the water used by urban people will be wasted into wastewater which will be discharged directly into water bodies without prior treatment which causes this wastewater to be a major contributor to water pollution [2,3]. In addition, wastewater is discharged directly into water bodies due to the limited Wastewater Treatment Plant (WWTP) in Indonesia due to various problems such as the number of costs that will be used to treat the wastewater and the difficulty in operating it so that WWTP becomes ineffective [4].

Therefore, waste treatment is needed which applies low-cost processing, easy operation by producing water quality that achieves existing environmental quality standards. The choice of waste treatment must also be based on the characteristics of the waste where domestic waste contains high organic matter so that to reduce it can use biological treatment. Based on these considerations, alternatives in wastewater treatment especially biological processing to minimize wastewater can use a constructed wetland system [5].

Constructed wetlands can effectively eliminate suspended solids, organic pollutants, and nutrients from wastewater [3]. Constructed wetland systems can save energy, cheaper development, and operational costs, and can form new ecosystems, and provide aesthetic value somewhere [6]. The constructed wetland system has two types, namely the type of flow above the surface (Free Water Surface Flow) and subsurface flow (Sub-Surface Flow) [7]. However, because the Constructed wetland system in a conventional way requires large land, frequent blockages, slow mass transfer, and poor root penetration into layered soil columns, new technology is needed to overcome this problem.

There is a new approach in constructed wetland systems in increasing efficiency in wastewater treatment by combining the benefits of phytoremediation and attached growth systems based on engineering procedures (bio-rack technique) [8]. Using this bio-rack technique provides better conditions for plant root growth, efficient oxygen diffusion, the increased surface area for microbial growth in this system.

2. Materials and method

2.1. Location

The study was conducted in RW 8 Srengseng Sawah Village, Jagakarsa District, South Jakarta. The area of Srengseng Sawah Village is 674.70 Ha with a population of more or less 51,565 people spread in 19 districts with a population density of 6,954 people/ km2 [9].

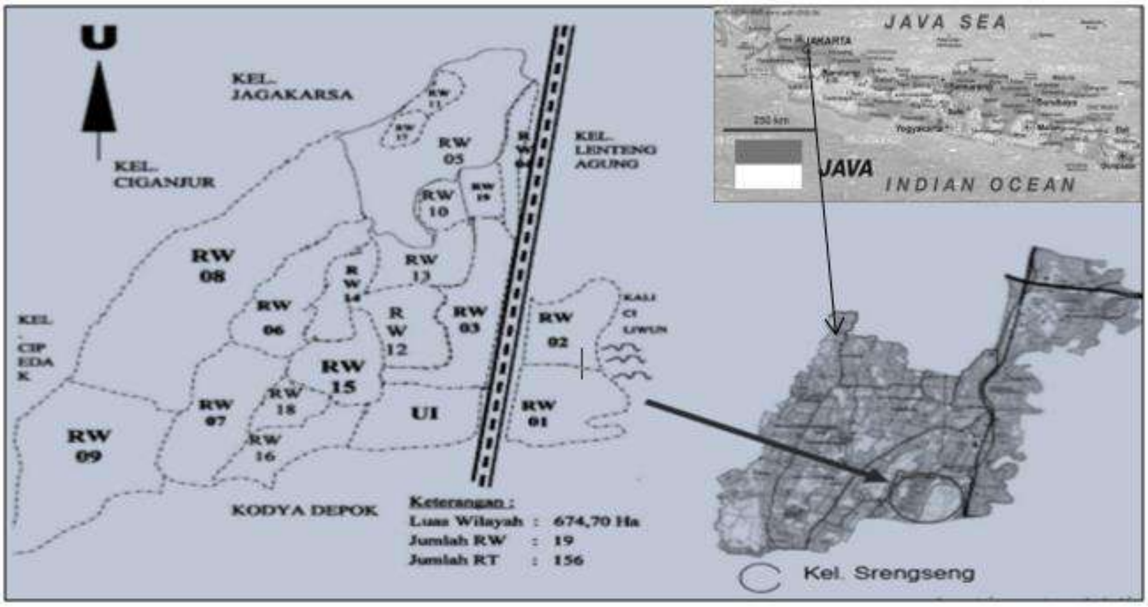


Figure 1. Location of constructed wetland.

2.2. Domestic wastewater

The wastewater used is greywater from settlements in Srengseng Sawah, South Jakarta. Greywater was directly discharged through residential sewers and before flowing into the river.

2.3. The constructed wetland

This research was conducted in a Constructed Wetland located in Srengseng Sawah Village, Jakarta. This Constructed Wetland construction measures 300cm x 200cm x100cm. The constructed wetland system has two types, namely the type of flow above the surface (Free Water Surface Flow) and subsurface flow (Sub-Surface Flow) [10]. However, because the constructed wetland system in a conventional way requires large land, frequent blockages, slow mass transfer, and poor root penetration into layered soil columns, new technology is needed to overcome this problem. [11].

2.4. Media and plant
Media consisting of gravel, sand, topsoil mixed with compost, sand, and mud. The plant used *Vetiveria* sp. that is able to absorption pollutants as nutrients needed [12].

2.5. Data analysis
Calculation of effectiveness of pollutant removal in constructed wetlands using formulas:

$$Efficiency\ (\%) = \frac{Co - Ct}{Co} x\ 100\%$$

where :

Co: Value of domestic wastewater parameters before treatment
Ct: Value of parameters for domestic wastewater after treatment

2.6. Quality standard
The wastewater used in this study was greywater that quality is not complying with the quality standard requirements to disposed of into the environment. The characteristics of wastewater before processing show in table 1.

Table 1. Characteristics of residential wastewater RW 8 Srengseng Sawah.

No.	Parameter	Unit	Quality of wastewater	Quality Standard*
1.	pH	-	6.9 – 7.2	-
2.	TSS	mg/l	23.00 – 50.33	50
3.	BOD	mg/l	151.85 – 286.04	50
4.	COD	mg/l	210.07 – 320.70	80
5.	Detergent	mg/l	4.09 – 11.92	2
6.	T-N	mg/l	12.38 – 25.87	-
7.	T-P	mg/l	0.96 – 3.89	-

*Quality Standards: Gov. Reg .of DKI Jakarta No. 122/2005

3. Results and discussion
In figure 2 show that the highest COD concentration is 342 mg/l and the lowest is 67 mg/L. The highest level occurs on day 4 with temperature of around 35 ^{o}C while the lowest concentration occurs on day 4 with temperature 30 ^{o}C. The ability to decrease COD content increases after the 12th day due to the efficiency of removal of wastewater content depending on concentration and the length of time of detention in constructed wetland.

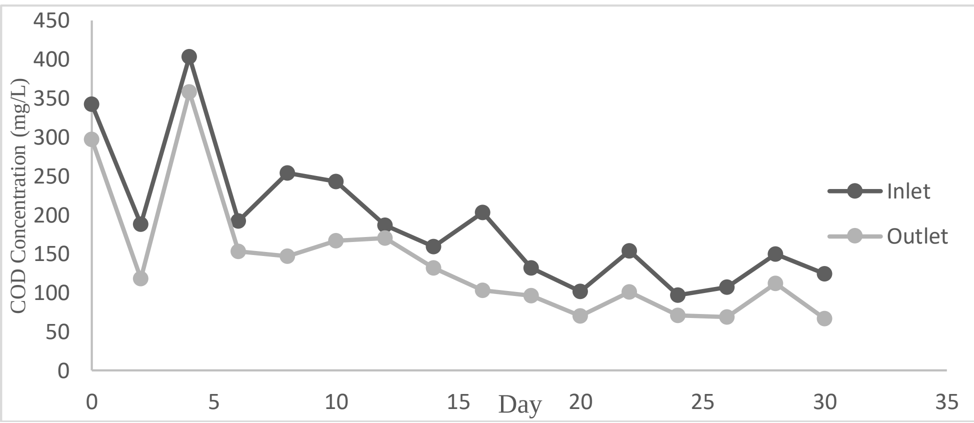


Figure 2. COD concentration in inlet and outlet.

Journal of Physics: Conference Series **1402** (2019) 033007 doi:10.1088/1742-6596/1402/3/033007

The hydraulic permeability and productivity level of the media greatly influences the detention time of wastewater, sufficient detention time will provide an opportunity for contact between microorganisms and wastewater [5] Organic material contained in wastewater will be overhauled by microorganisms into compounds simpler and will be used by plants as nutrients, while the root system of aquatic plants will produce oxygen which can be used as a source of energy/catalyst for a series of metabolic processes for microorganism life [13].

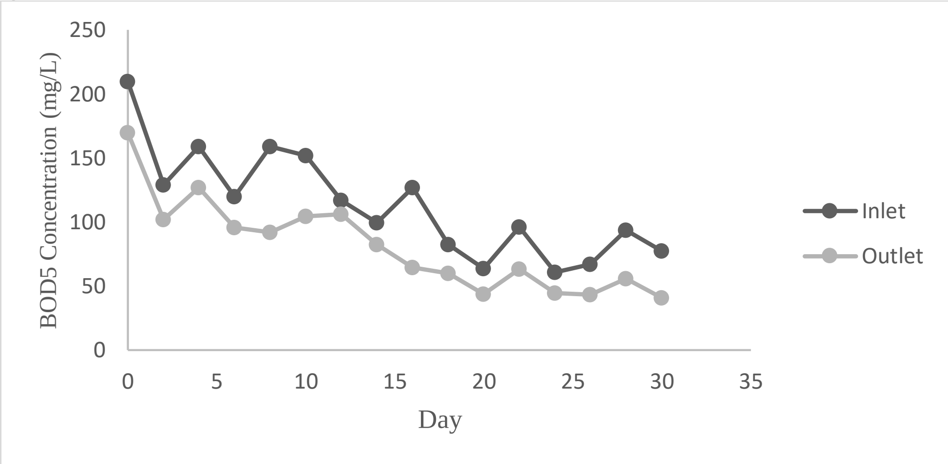


Figure 3. BOD_5 concentration in Inlet and outlet.

Figure 3 show that the highest BOD_5 level occurred on the 8^{th} day while the lowest concentration occurred on day 30. The effect of retentione time also played a role in the process of decreasing waste content. A decrease in the concentration of organic matter in the wetland system occurs because of the mechanism of microorganism and plant activity, through the oxidation process of aerobic bacteria that grow around the plant's rhizosphere [14]. The mechanism of biological decline occurs due to microbiological activity at the root [15].

Plant roots increase the density and microbial activity provided by the root surface for microbial growth [16]. One factor is the availability of oxygen for biological processes. if oxygen in the roots is sufficient, the microorganisms that play a role in decomposing the waste are also getting bigger [17]. When wastewater passes through soil particles at a certain detention time, it gives the chance of settling solid particles. With this deposition process, it will reduce the oxygen demand for subsequent biological treatment. The more and in the root tissue in the soil, the wider the rhizosphere zone is created, so that the swamp's ability to support microorganisms is increasing [18].

Decreasing the BOD content in Constructed wetland processes requires considerable availability which will pass through the side-lines of the soil to be sent to plant roots for microorganisms to decompose the waste content. Soil air occupies part of the macrospores between the secondary aggregates of the soil [19]. The soil air is very important for the respiration of plant roots and the activities of living bodies in the soil. Especially living bodies in aerobic soil desperately need oxygen to support their activities to decompose organic matter. In general, the effectiveness of wastewater treatment with a Constructed wetland system equipped with plant growth proved to be quite high.

4. Conclusion

Based on the results analysis of domestic wastewater treatment with constructed wetlands by *Vetiteria* sp. plant has a good performance in domestic wastewater treatment in Constructed Wetland system. The COD removal of 91.8% with 20 cm plant distance plant and a retention time of 2 days and the BOD_5 removal is 91.6%.

References

[1] Supradata 2005 *Domestic Waste Treatment Using Ornamental Plants Cyperus alternifolius, L In the Wetland System of Artificial Flow* (SSF-Wetlands) (Jakarta)
[2] Hernandez M E and Mitsch W J 2007 Denitrification potential and organic matter for the affected community, wetland age, and plant introduction in Created Wetlands *Journal Environmental Quality* **36** 333-342
[3] Va V, Setiyawan A S, Soewondo P, Putri D W 2018 The Characteristics of Domestic Wastewater From Office Buildings In Bandung, West Java, Indonesia. *indones.j.urban.environ.technol.* **1**(2) 199 – 214
[4] Pidou M F A, Stephhenson T, Jeffersen B and Jeffrey P 2017 Greywater recycling: treatment options and applications *Procurement of the Institution of Civil Engineering Sustainability* **160** 119-131
[5] Sa'adah, Nur R and Winarti P 2011 Domestic Liquid Waste Processing Using Anaerobic Process Active Mud *Essay* Semarang: Chemical Engineering Department, Faculty of Engineering, Diponegoro University
[6] Khiatuddin M 2003 *Preserving Water Resources with Constructed Swamp Technology* (Yogyakarta: Gadjah Mada University Press)
[7] Prawira J 2015 Effectiveness of Constructed Wetland Systems as an Alternative for Domestic Waste Processing Using Iris Pseudoacorus Ornamental Plants. Tanjungpinang: Department of Aquatic Resource Management Faculty of Marine and Fisheries, Maritime University Raja Ali Haji
[8] Vymazal J and Kropfelova L 2008 Removal of organics in constructed wetlands with the horizontal sub-surface flow: A review of the field experience *Science Direct* **12**
[9] Hendrawan D 2007 Ciliwung River Water Quality Judging From Oil And Fat Parameters *Journal. Environmental Engineering Department*
[10] Witthar S R 1993 *Wetland Water Treatment Systems Dalam Constructed Wetlands for Water Quality Improvement, ed. G. A. Moshiri* (Boca Raton, FL: Lewis Publishers) pp 147-155
[11] Qomariah S 2017 Constructed Wetlands as Liquid Waste Processing and Non-Consumption Water Providers *Journal of Civil Engineering Research* 25-32
[12] Vymazal J 2010 *Constructed Wetlands for Wastewater Treatment* (Prague: Department of Landscape Ecology)
[13] Kling S 2007 *Determination of Wastewater Characteristics And Its Relation To The Type And Size Of Developments* (Malaysia: Faculty Of Civil Engineering, Universiti Teknologi Malaysia)
[14] Hoffman H, Platzer M, Winker M and Muench E 2011 Technology review of constructed wetlands *Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ) GmbH*
[15] Vacca 2005 Effect of Plant Filter Materials on Bacteria Removal in Pilot-Scale Constructed Wetlands (Germany: Department of Bioremediation)
[16] Vymazal J 2008 Constructed wetlands for wastewater treatment: a review *In Proceedings of Taal2007 The 12th World Lake Conference* **965** 980
[17] Wood W A 1995 *Dampak Pencemaran Lingkungan, Andi Offset,* (Yogyakarta)
[18] Rizka 2005 Study of Decreasing the COD and BOD Contents of Domestic Wastewater Using Kana (Canna Sp) Plants in a Sub-Surface Flow Constructed Wetland System (Surabaya: ITS Environmental Engineering Department)
[19] Morel A and Diener S 2006 *Greywater Management in Low and Middle-Income Countries: A review of different treatment systems for households and neighborhoods. Sandec Report No 14/6 Swiss Federal Institute of Aquatic Science and Technology* (Switzerland: Dubendorf)