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The Second International Conference on Sustainable Infrastructure and Built Environment

Faculty of Civil and Environmental Engineering
Institut Teknologi Bandung

PROCEEDING BOOK

VOLUME IV

"Accelerating Sustainable Infrastructure Developement - Challenges, Opportunities, and Policy Direction"

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PROCEEDING BOOK

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Volume IV

Topic 4.Water & Waste EngineeringManagement
Topic 8.Enviromental Protection & Management

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The Second International Conference on Sustainable Infrastructure and Built Environment.

Accelerating Sustainable Infrastructure Development – Challenges, Opportunities, and Policy Direction

BANDUNG - INDONESIA
NOVEMBER 19TH - 20TH, 2013

International Conference and Exhibition

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PREFACE

Infrastructure provides the basic needs of human beings, and sustainable infrastructure systems are essential for the survival, health, and well-being of a society. The civil, environmental, and ocean engineers are at the epicenter in seeking the means to enhance human life through modernization of infrastructure as evidenced by provision of shelter, water, and transport, amongst others.

The current fast rate of urbanization and industrialization has caused a rise in environmental issues, involving environmental mismanagement, which has been associated with unforeseen global catastrophes. The problems are further aggravated by the impacts of environmental degradation such as soil erosion, hurricanes, sea-level rise, depletion of water resources, etc. These issues have become the current focus of attention and studies of the world's academicians and professionals in infrastructure development. Relevant researches include not only hard infrastructure but also soft infrastructure aspects such as regulation, institution, and policy development framework.

To support economic activities and to offer a better quality of life, developing countries need to accelerate sustainable infrastructure provision. In many developing countries, including Indonesia, lack of infrastructure has been the main obstacle of investment and development activities. Besides limited available fund, the acceleration of sustainable infrastructure development still has to face the challenges of, among others, knowledge, human resources management, best practices, and capacity development. On the other hand, developing countries generally possesses abundant local natural resources, sufficient carrying capacity, and local wisdom.

In order to meet these multifaceted challenges, not only proper planning, design, implementation and verification exercises, but also clear policy and strategy direction of sustainable infrastructure development are required, via an integrated, multidisciplinary and holistic approach.

The global momentum for sustainable development must now lead to practical applications of the engineering and science of sustainability – an optimization – which allows an accelerated infrastructure provision with maximum attention on sustainability aspects.

The conference will provide an opportunity for professionals and researchers to learn, share and exchange the latest development and research in civil engineering and environmental engineering. The scope of the conference will be broad, covering all aspects of civil and environmental engineering practices.

Participants of the conference include researches, academic staffs, students, industries, public and local governments. The keynote presentations during the conference are as follows:

Keynote speakers:

- **Ir. Djoko Kirmanto**
  Minister of Public Works, Indonesia
- **Prof. Tamon Ueda**
  Head of International Committee of Faculty of Engineering, Hokkaido University, Japan
- **Dr. Ir. Bambang Susantono, MSCE., MCP**
  Vice Minister of Communication, Indonesia
- **Prof. Shyh-Jian Hwang**
  National Taiwan University, Taiwan
- **Prof. Ir.Suprihanto Notodarmojo, Ph.D.**
  Dean of the Faculty of Civil and Environment Engineering,InstitutTeknologi Bandung, Indonesia
- **Dr. Ir. Achmad Hermanto Dardak, MSc.**
  Vice Minister of Public Works, Indonesia
- **Dr. Ir. Dedy Supriadi Priatna, M.Sc.**
  Deputy Infrastructure of BAPPENAS
- **Dr. Ir. Lucky Eko Wuryanto, M.Sc.**
  Deputy Infrastructure of Coordinator Ministry for Economic Affair

The objectives of the conference are:

1. To provide a platform for exchange of ideas and information among academics, researchers, consultants, engineers, manufacturers and post graduate scholars in civil and environmental engineering
2. To discuss and evaluate the latest approaches, innovative technologies, policies and new directions in infrastructure development, pollution prevention and eco-friendly technologies adapted to developing countries
3. To promote cooperation and networking amongst practitioners and researchers involved in addressing infrastructure and built environment issues

The oral presentations are subdivided into 8 major sctions as following:

1. Structure and materials
2. Transportation system and engineering
3. Water resources engineering and management
4. Water & waste engineering and management
5. Ocean engineering
6. Construction management
7. Geotechnical engineering
8. Environmental protection and management

There are 131contributors in oral presentation.

Finally, the organizing committee wishes that the conference is able to provide beneficial scientific information to the participants and other concerned readers

Bandung, November 2013

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Contents

TOPIC 8.Enviromental Protection And Management

The Analysis of Relationship of Physico-chemical Properties of Wastewater and the Microalgae Diversity and Abundance in Bojongsoang Wastewater Treatment Plant

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Abstract. Bojongsoang Wastewater Treatment Plant (WWTP) serves to treat domestic wastewater originated from Bandung City, West Java, Indonesia. Bojongsoang WWTP is managed by the Regional Water Company which is called PDAM Kota Bandung. Domestic wastewater contains complex organic materials which derived from human activities such as urine and feces. Abundant amount of nutrients as the results of waste decomposition will increase the number of microalgae populations present in the pond of the wastewater treatment plant, thereby causing a population explosion of microalgae or algal blooming. In terms of wastewater treatment pond system, the presence of algal blooming is not desirable because it can decrease the performance of wastewater treatment. The existence of algae blooming is related with the nutrient in the water itself. The need of information on relationship of those nutrients concentration and algae blooming conditions such as their microalgae diversity is needed for controlling the water quality in a wastewater treatment plant. Therefore, this study was conducted to reveal the diversity of microalgae in the stabilization pond and its relationship with the water characteristics in the pond. The results showed that the water quality in the stabilization pond of Bojongsoang WWTP supported the rapid growth of microalgae where the most rapid microbial growth occurred in the anaerobic pond. The diversity of microalgae in stabilization pond was very high with various morphologies and probably to be affiliated with Blue Green Algae, Green Algae, Cryptophytes, Dinoflagellates, and Diatom. This study has successfully provided information on the availability of microbial diversity and abundance profiles in wastewater treatment system.

Keywords: *domestic wastewater, microalgae,nutrients, stabilization pond.*

1. Introduction

Bojongsoang Waste Water Treatment Plant (WWTP) is a domestic wastewater treatment facility managed by the Regional Water Company (PDAM) in Bandung, to handle part of wastewater originated from Bandung city. The treatment processes occurred in this Bojongsoang WWTP consists of the physical or mechanical processes and 3 stages of biological processes of the stabilization pond (anaerobic, facultative, and maturation pond). Wastewater is treated by the Bojongsoang WWTP come from various sources of domestic waste. Domestic waste typically consists of protein, carbohydrates, oils and fats. Decomposition products of these compounds on the anaerobic pond become nutrient sources for microorganisms inside such as microalgae. The abundant amount of nutrients will increase the number of existing microalgae population in the treatment ponds then initiate population explosion of microalgae or also known as algal blooming.

In terms of pond system, algal blooming can reduce the efficiency of wastewater treatment. On the other hand, if it is conducted simple modification, for example: inactivation and immobilization, the microalgae consortium biomass can be utilized as competitive and environmentally friendly biomaterials for heavy metals absorbing. Heavy metal biosorption technology is potential to be applied in Indonesia because of availability of local various types of biomass, cheaper and easier to develop. Investigation of the sorption capacity of microalgae consortium from Bojongsoang WWTP has been done in previous studies and has been obtained an interesting results in the form of competitive sorption character profile of the biomass from algal blooming [1]. However, the huge potential of the microalgae consortium utilization was still constrained by the unavailability of information on its diversity and abundance profiles.

Therefore, further studies are needed to obtain a profile of the abundance and diversity of microalgae consortium in Bojongsoang WWTP's stabilization ponds and optimize their use as biomaterial of heavy metal. This study provided information of the abundance and diversity profile of growing microalgae and physical chemical conditions of water as limiting factor for microalgae growth. Not only morphologically, identification of microalgae could be performed with molecular approaches by using the Fluorescent in situ hybridization (FISH). This technique may allow us to determine the physical location of the DNA sequences in the chromosomes properly by using probes, without having to perform DNA isolation prior to cell damage [2]. When these probes are coupled with a fluorescent marker, the target organism can be easily identified by a technique known as Fluorescence in situ Hybridisation (FISH). Fluorescence in situ hybridisation enables the rapid detection of different species or strains [3]. This technique has been successfully applied for the detection of harmful algae, algal classes [4] and other taxonomic hierarchies. The results of molecular biological in this study are reported in another paper.

2. Materials and Methods

Sampling points were located at Bojongsoang WWTP's stabilization pond set 1B, which consists of Anaerobic 1B (AN 1B), Facultative 1B (F 1B), and Maturation 1B (M 1B) ponds as shown in **Figure 1**. Laboratory sample testing was conducted at Industrial Hygiene and Toxicology Laboratory and Water Quality Laboratory, Environmental Engineering ITB, and Microbiology Laboratory, Indonesian Institute of Sciences (LIPI) Cibinong, as well.

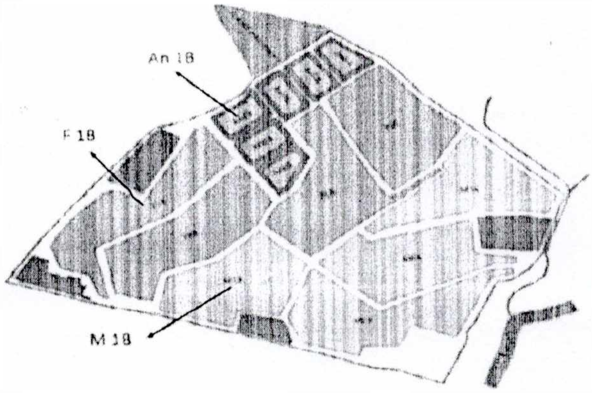


Figure 1. Research Area Plan

2.1 Sampling and Insitu Water Quality Measurement

Water quality measurements were carried out either in situ or in the laboratory. Sampling was performed using La motte water sampler. Three sampling points were established in each study. There were the inlet (In), the middle (M), and the outlet (Out), with the composited vertical variation for water quality analysis and without composited for microalgae observation. Water quality parameters that measured, the location of the measurement, and the methods are presented in **Table 1.**

Table 1. Water quality parameter, location measurement and methods used.

Water Quality Parameter	Analysis Location	Equipment/ Method
Water transparency	Insitu	*Secchie* disc
pH	Insitu	pH meter
Dissolved Oxygen (DO)	Insitu	DO meter
Conductivity	Insitu	Conductivitymeter
Ammonia	Laboratory	Spectrofotometric [5]
Nitrite	Laboratory	Spectrofotometric [5]
Nitrate	Laboratory	Spectrofotometric [5]
Total Phosphate (Total P)	Laboratory	Spectrofotometric [5]

2.2 Morphologicaly Analysis of Microalgae Abundance and Diversity

Samples were precipitated using Lugol with 10: 1 ratio. Precipitated samples were identified using a binocular microscope and identification guide book. Abundance of microalgae was counted using Improved NeubauerHaemocytometer counting chamber [6]. Subsequently, the critical value, diversity index [7], and similarity index using the Sorensen Index [8] were determined.

3. Results and Discussion

3.1 Insitu Water Quality Analysis

Water transparency values in all ponds were very low ranged from 1.5 ± 1.03 cm to 4 ± 1.07 cm. According to [9], a turbid water has the water transparency value of 0.25 to 1 m. AN 1B pond had the highest turbidity levels. Turbidity occurred because microalgae biomass increased rapidly as long as the availability of growth factors such as nutrients derived from the treated wastewater and sufficient sunlight. Temperatures in all ponds ranged from 28.13 ± 1.22 °C to 31.05 ± 4.89 °C, depended on the weather condition and location of ponds. Overall, the values were in normal temperature range for microalgae growth. According to Reynolds (1982) in [10], the optimal temperature range for microalgae growth is 25 °C – 40 °C.

Based on the results of pH values measurements, it was found that AN 1B pond had a lower pH range than F 1B and M 1B ponds, which ranged from 5.33 ± 1.47 to 6.11 ± 1.96. While F 1B and M 1B ponds had pH values ranged from 6.81 ± 1.9 to 8.02 ± 1.94. Based on the statistical analysis results using t-test, there were no significant difference of pH values between F 1B and M 1B ponds (p value> 0.05), but either F 1B or M 1B ponds had pH values higher than AN 1B pond (p value <0.05). Anaerobic pond had non-methanogenic phase, which the dissolved organic material degraded to organic acids, alcohols, ammonia, sulfide, hydrogen, CO_2 and water by acid-forming bacteria that reduced the pH values. Meanwhile, in F 1B and M 1B, pH values increased, due to the process of microalgae photosynthesis that absorbed dissolved CO_2 in water. Decreasing of CO_2 concentration will increase the pH values in water [11].

The concentration of dissolved oxygen (DO) ranged from 2.36 ± 1.69 mg/l in AN 1B to 10.91 ± 2.16 mg/l in F 1B. DO value in F 1B and M 1B were relatively higher than DO levels in AN 1B pond, due to the process of photosynthesis by photosynthetic organisms which produced oxygen and reduced organic loading that required oxygen for its biochemical reaction in both ponds. Based on the results of statistical analysis using t-test, DO levels in F 1B and M 1B were not significantly different (p value> 0.05), but both ponds had greater values than DO levels in AN 1B (p value <0.05).

Conductivity value showed the ability of water to transport electrical current as a result of dissolved minerals in the ionized water. Based on the results of statistical analysis using t-test, the conductivity in all ponds were significantly different (p value <0.05), where AN 1B has a maximum conductivity (520.65 ± 77.07 µS/cm), and the minimum conductivity was shown in M 1B (346.7 ± 27.66 µS/cm).

3.2 Nutrient Load Factor Analysis

N-organic compounds in domestic waste are decomposed by microorganisms to form ammonia compounds (NH_3). At low pH (acid condition) ammonia compounds turned into ammonium (NH_4^+). As shown in **Figure 2**, the concentration of ammonia compounds tended to decline started from AN 1B inlet point to M 1B outlet point, due to more acidic condition in AN 1B. Statistically, ammonia concentrations in all ponds were significantly different (p value <0.05).

This proved that there were significant ammonia concentrations declining from AN 1B to M 1B.

Nitrification which is a process of oxidation of ammonia to nitrite and nitrate is the most important process in the nitrogen cycle and takes place in aerobic condition [12]. In **Figure 2,** nitrite compounds tend to increase started from AN 1B inlet point to M 1B outlet point, due to the nitrification process in an aerobic condition, while there were DO increase in F 1B and M 1B ponds. It showed that AN 1B and F 1B had similar nitrite concentrations (p value> 0.05), but M 1B had significantly different concentrations or higher when compared with A 1B and F 1B (p value <0.05).

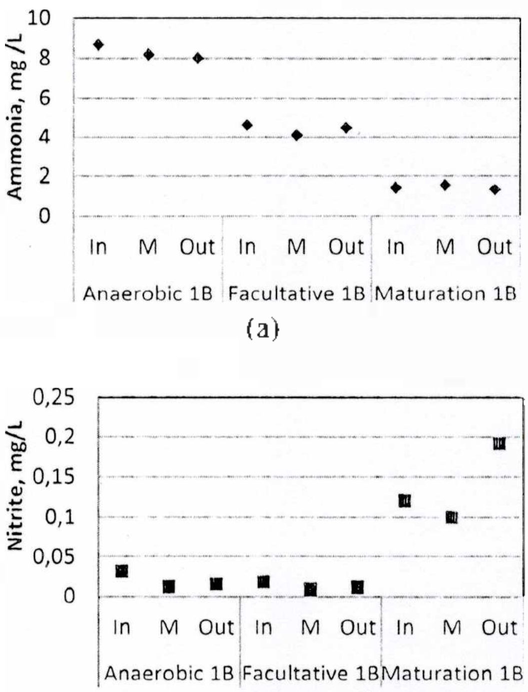
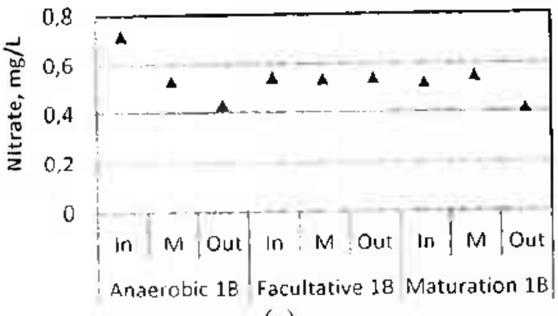


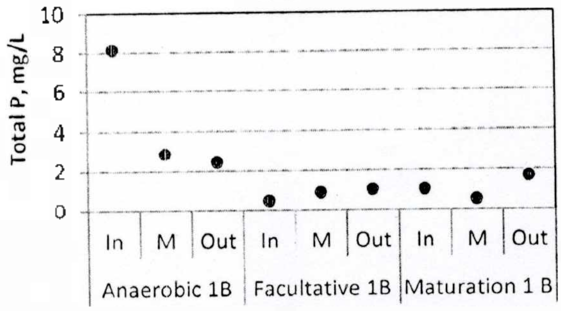
Figure 2. Profile of (a) ammonia and (b) nitrite concentrations of stabilization ponds set 1B Bojongsoang WWTP

Nitrate (NO_3) is the main form of nitrogen in natural waters and the nutrient for the aquatic plants and algae growth. Based on the measurement results, nitrate compounds tend to be stable and there were no impairment or significant improvement **(Figure 3).** This result was consistent with the statistical tests, the comparison of all ponds showed *p values*> 0.05, which mean that the nitrate concentrations in all ponds were similar or were not significantly different.

As shown in **Figure 3,** the maximum total P concentration based on insitu measurement was in AN 1B (8.17 ± 0.08 mg/l) and minimum was in pond F 1B (0.49 ± 0.13 mg/l). Based on statistical analysis using test-t, total P concentrations in AN 1B ponds were significantly different with F 1B and M 1B ponds (*p value*<0.05) which indicated a significant increasing. However, total P concentrations in F 1B pond were almost similar with M 1B pond (*p value*> 0.05). Absorption of ortho-phosphorousis also correlated directly with the presence of microalgae, a number of ion in water, the existence macronutrient and organic compounds (Wetzel, 2001 in [13]).



(a)

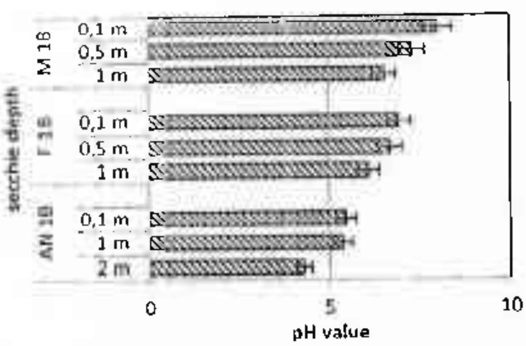


(b)

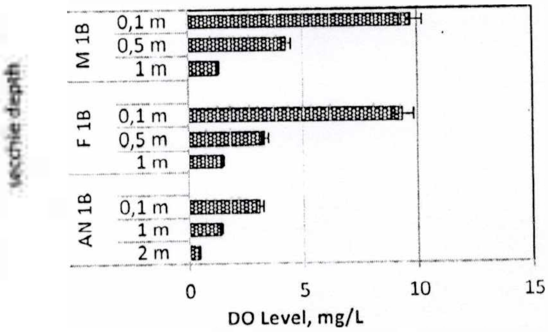
Figure 3. Profiles of (a) nitrate and(b) totalphosphate concentrations of stabilization ponds set 1B Bojongsoang WWTP

3.3 Effect of Depth Variation for Physical Chemical Factors of Water and Abundance of Microalgae

According to [12], the vertical stratification of the water column in the standing waters depends on the intensity of light entering the waters. The decrease of light intensity caused water temperature decline, so that the dissolved oxygen and the pH value also decreased. H_2S production by sulfate reducing bacteria also created low pH value condition in the bottom of pond. In contrast, the conductivity value which illustrates the concentration of dissolved particles in water increased due to death cells of bacteria and algae and other solid particles settled to the bottom of the pond in anaerobic decomposition process **(Figure 4)**.



(a)



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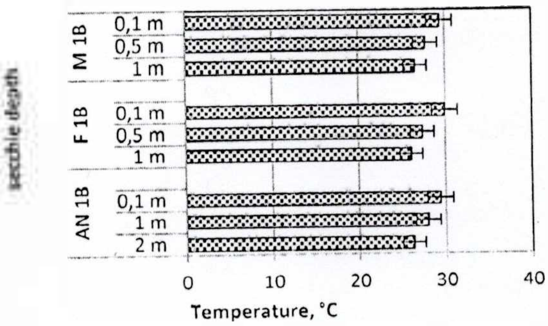

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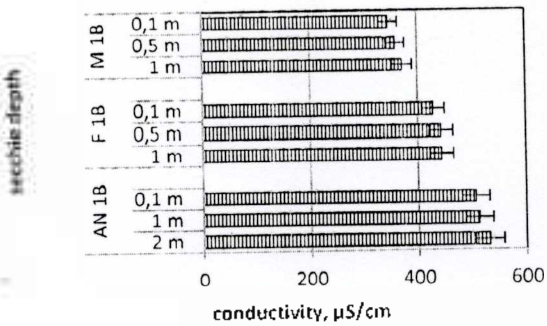

(d)

Figure 4. Profiles of water quality parameters (a) pH, (b) Dissolved Oxygen, (c) temperature and (d) conductivity by depth variation of stabilization ponds set 1B Bojongsoang WWTP

Based on linear regression using Pearson Correlation statistical analysis, the variations of depth had no influence on water quality and the number of cells, indicated by negative values (-) as the test results. However, some water quality parameters had influence or positive correlation on cells growth, indicated by positive values (+) as the test results. Correlation of each parameter was different in each pond. Matrix of linear regression results for each parameter relationship was shown in **Table 2.**

Table 2. Matrix correlations among parameters based on linear regression test (Pearson Correlation)

Pond	Parameter	Total Cells	Depth	pH	DO	Temperature	Conductivity
Anaerobic 1B	Total Cells		-	+	-	+	+
	Depth	-		-	-	-	+
	pH	+	-		+	-	-
	DO	-	-	+		+	-
	Temperature	+	-	-	+		-
	Conductivity	+	+	-	-	-	
Facultative 1B	Total Cells		-	-			+
	Depth	-		-	-	-	+
	pH	+	-		+	+	-
	DO	+	-	+		+	-
	Temperature	+	-	+	+		+
	Conductivity	+	+	-	-	+	
Maturation 1B	Total Cells		-	+	+	-	+
	Depth	-		-	-	-	+
	pH	+	-		+	-	-
	DO	+	-	+		+	-
	Temperature	-	-	-	+		+
	Conductivity	+	+	-	-	+	

Notes:

(-) :no correlation

(+) :positive correlation

Based on **Table 2,** pH and conductivity had positive correlation to the abundance of microalgae in each pond. According to [14], the conductivity also gave positive correlation to the density of phytoplankton, especially during the wet season. As a result of vertical stratification and differences in water quality parameters, the abundance of microalgae tended to decrease in line with depth increasing **(Figure 5).**

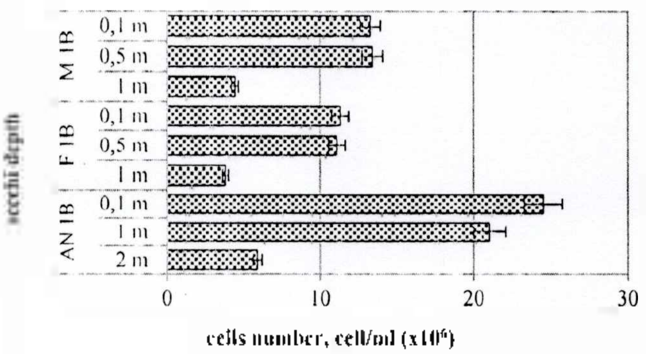

Figure 5. Profile of abundance of microalgae by depth variation of stabilization ponds set 1B Bojongsoang WWTP

3.4 MorphologicalAnalysis of the Abundance and Diversity of Microalgae

The morphological microalgae identification process was only conducted at the genus level. The diversities of microalgae in stabilization pond set 1B Bojongsoang

WWTP were dominated by Cyanobacteria and Chlorophyta division (**Figure 6**). Both division were found in every pond because of its genera were quite common in some types of aquatic habitats [15]. The dominant algae species was determined by the load of organic compounds, where the algae had capability to tolerate anaerobic conditions [11]. Therefore,AN 1B pond had the highest microalgae abundance.

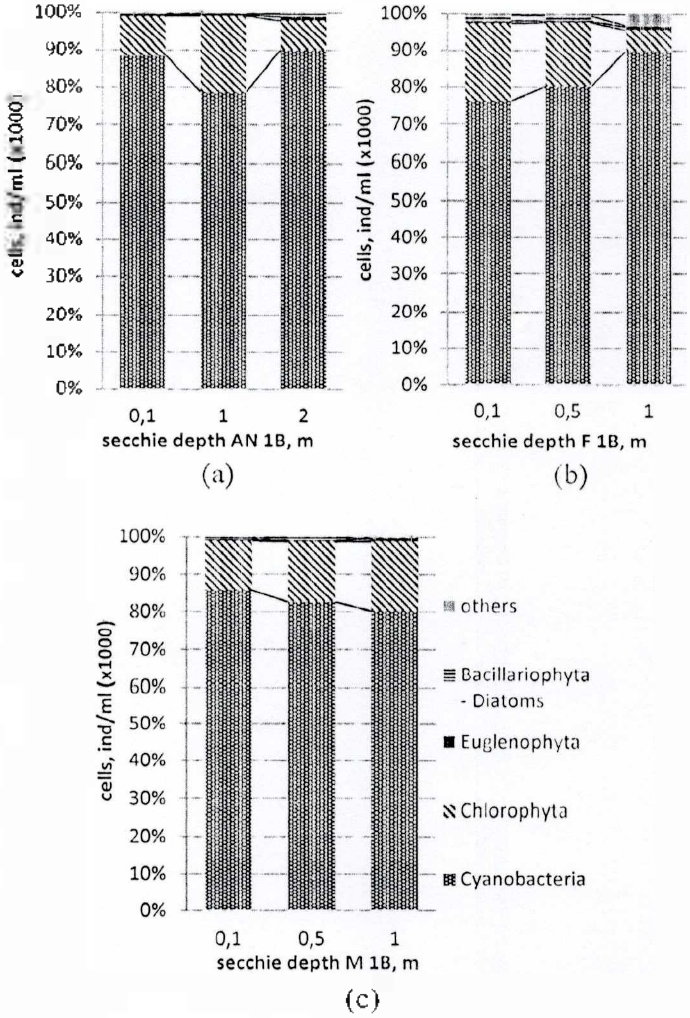

Figure 6. Profiles of microalgae diversity in (a) anaerobic, (b) facultative, and (c) maturation pond of stabilization ponds set 1B Bojongsoang WWTP

Based on the calculation of diversity index (H ') at all points, it showed that diversity index was in the range of 1 to 3, which means moderate level of diversity. Based on test of similarity index (S), three community ponds in this study (AN 1B, F 1B, and M 1B) had similarity index above 50%, which indicated that the microalgae communities were similar. Critical value calculation results indicated that the stabilization ponds set 1B were dominated by the genera *Synechococcus*, *Chroococcus*, *Mycrocystis*, and *Chlorella*, which were distributed across the three ponds. According Mezrioui *et al.* (1994) in [15],some Cyanobacteria such as

Synechococcus in wastewater treatment pond were able to produce toxic compounds that inhibited *E. coli* and other bacteria growth. In addition, there were other genera that only found in F 1B and M 1B ponds, such as *Spirulina* (**Figure 7**).

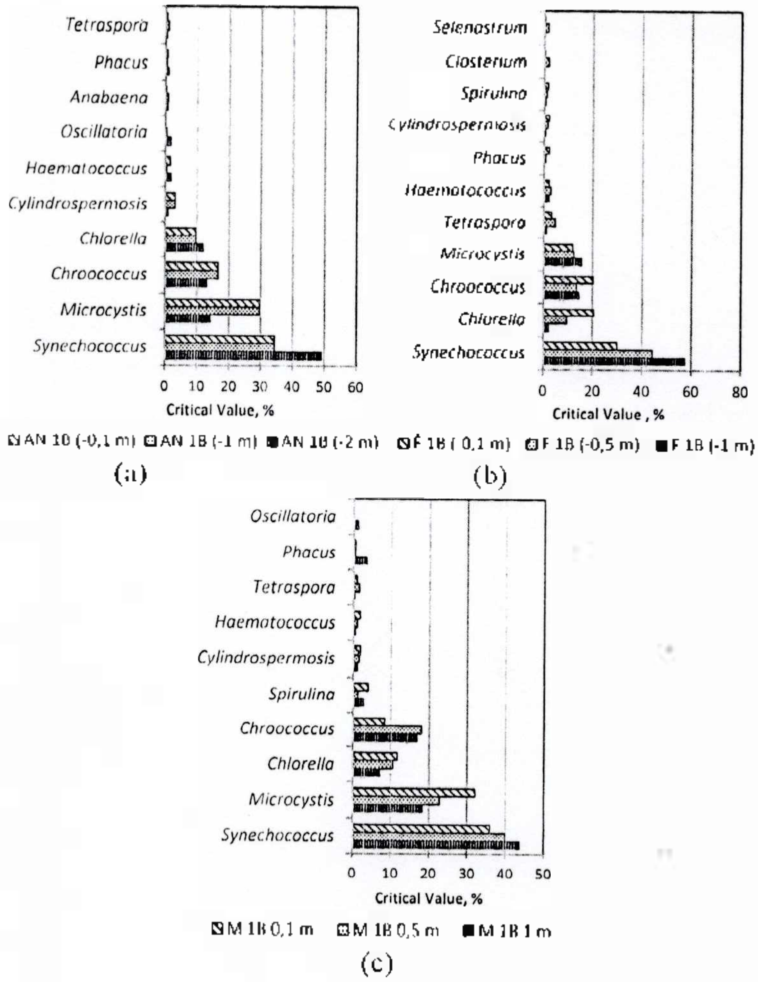

Figure 7. Profiles of critical values microalgae genera diversity in (a) anaerobic, (b) facultative, and (c) maturation pond of stabilization ponds set 1B Bojongsoang WWTP

4. Conclusions

Anaerobic 1B (AN 1B), Facultative 1B (F 1B), and Maturation 1B (M 1B) ponds in WWTP Bojongsoang had certain characteristics based on physical factors (water transparency, pH, dissolved oxygen concentration, temperature, conductivity) and chemical factors (ammonia, nitrate, nitrite, total phosphate concentration). Differences in the characteristics of water vertically affected the total abundance of microalgae, but had little influence on its diversity, due to the shallow water depth. Microalgae in stabilization ponds set 1B Bojongsoang WWTP were dominated by the genus *Synechococcus*, *Chroococcus*, *Mycrocystis*, and *Chlorella* with a fairly uniform distribution in each pond, with moderate diversity index and similarity index that showed similar microalgae communities.

5. Acknowledgement

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6. References

[1] Kurniasih, Kardena, E., Sulaeman, A., &Ariesyady, H.D., *Preliminary Characterization of Sorptive Properties of Phytoplanktonic Consortium in Tropical Environment*. Proceedings of the 5th SEATUC Symposium. Hanoi, 24-25th February, 2011.

[2] Devi, J., Ko, J. M., &Seo. B. B., *FISH and GISH: Modern Cytogenetic Techniques*. Indian Journal of Biotechnology, 4, pp. 307-315, 2005.

[3] Amann, RI. *In Situ Identification of Microorganisms by Whole Cell Hybridisation with rRNA-Targeted Nucleic Acid Probes*, In: Akkermans A.D.L., van Elsas J.D., de Bruijn F.J. (eds) Molecular microbial ecology manual, 336, pp. 1-15, 1995.

[4] Eller, G., Töbe, K., & Medlin, L.K., A Set of Hierarchical FISH Probes for the Haptophyta and a Division Level Probe for The Heterokonta. Journal of Plankton Research, 29, pp. 629-640, 2007.

[5] AWWA, *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, American Public Health Association. New York, 1998.

[6] Isnansetyo, A. &Kurniastuty, *Teknik Kultur Phytoplankton dan Zooplankton*, Penerbit Kanisius, Yogyakarta, 1995.

[7] Magurran, A.E., *Ecological Diversity and Its Measurement*. Princeton, New Jersey, 1987.

[8] Odum, E.P., *Dasar-Dasar Ekologi*. Edisi ketiga, Gajah mada University Press, Yogjakarta, 1993.

[9] Arthington, A.H., Bunn, S.E., Poff, N.L., & Naiman, R.J., *The Challenge of Providing Environmental Flow Rules to Sustain River Ecosystems*. EcolAppl, 16, pp. 1311–1318, 2006.

[10] Kawaroe, M., Prartono, T., &Wulan Sari, A., *Fatty Acid Content of Indonesian Aquatic Microalgae*, HAYATI Journal of Biosciences, 17 (4), pp. 196-200, 2010.

[11] Amengual-Morro, C., MoyàNiell, G. &Martinez-Taberner, A., *Phytoplankton as Bioindicator for Waste Stabilization Ponds*. Journal of Environmental Management, 30, pp. 1-6, 2011.

[12] Effendi, H. *Telaah Kualitas Air Bagi Pengelolaan Sumber Daya dan Lingkungan Perairan*, Penerbit Kanisius, Yogyakarta, 2003.

[13] Annisa. *Respon Chlorella pyrenoidosa terhadap Senyawa Klorporifos*. Tesis, Departemen Biologi, Institut Teknologi Bandung, Bandung, 2005.

[14] Senapati, T., Ghosh, S. &Mandal, T., *Variation in Phytoplankton Diversity and Its Relation With Physico Chemical Parameters of A Semi Lentic Water Body of Golaphag, West Bengal, India*, International Journal of Current Research, 3(7), pp. 053-055, 2011.

[15] Kantachote, D., Dangtago, K., &Siriwong, C., *Treatment Efficiency in Wastewater Treatment Plant of Hat Yai Municipality by Quantitative Removal of Microbial Indicators*, Songklanakarin J. Sci. Technol, **31** (5), pp. 567-576, 2009.