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To cite this article: M Verawaty *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **248** 012006

IOP Conf. Series: Earth and Environmental Science **248** (2019) 012006 doi:10.1088/1755-1315/248/1/012006

Retention Ponds Pollution Level Monitoring in Palembang City for Achieving a Sustainable Urban Environmental Health and Ecosystem Service

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Abstract. Retention pond (RP) is part of green open space in the city. One of its functions is to provide ecosystem service to urban lives, thus its health should be protected. Measuring its pollution level is an important step for designing action plans for its protection and restoration. This study showed, based on Palmer Pollution Index scoring, both retention ponds located in PSCC and beside Siti Khodijah hospital showed possible high organic pollution levels (scores are 17 and 18) respectively, these are signals for priority treatment actions. The other seven RPs are at a medium level (the scores are 11 to 13), and the last four showed low organic level (the scores are 0-3). A further observation found that the PSSC retention pond was constantly dominated by *Planktotrhix agardhii.*, a cyanobacter under concerned due to its potential to release cyanotoxin. A preliminary study was done in this study showed it had an effect to *Cyprinus carpio L.*, gill and pathologic effects in the gill's lamella.

1. Introduction

People can enjoy a high quality of life in a liveable urban environment if the city environment provides a sustainable and good ecosystem service. Terms of eco-city and liveable city are currently getting attention; the city concept not only emphasized on ratios of buildings in the city, but more about the elements contributes to that such as amenity, transportations, water, and air quality, etc [1]. According to Fook and Gang [2], an eco-city must be economical, environmentally and socially sustainable; they reviewed on how important the application of green technologies, environmentally friendly and sustainable transportation, as well as heritage conservation for the eco-city.

A current survey was conducted by the Indonesian Association of Planners (IAP) released in 2014 on The Most Liveable City Index [3]; the survey included the seven most liveable cities in Indonesia. The result showed that Balikpapan topped the list as the most comfortable city to live in Indonesia, and then it was followed by cities such as Surakarta, Malang, Yogyakarta, Palembang, Makassar, and Bandung. Palembang, the capital city of South Sumatera has an area around 358,55 Km^2 with a population of 1.602.071 inhabitants [4] and a density of 3.945 inhabitants/km^2 [4]. It is located about 0-20 m above sea level; this city consists of 50% swamp areas. Musi River has divided the city into two regions (upstream and downstream) with 24 watersheds in total and canals. In history, living culture of the people in Palembang is largely inseparable from the water like the river, ponds, canals etc. Since the finding of the city, people had lived on the river banks or on the marshes. The needs of clean water continue to increase along with the increasing number of population. Source of clean water had been provided by water utilities, but some parts of the city still do not have access yet, there are still some of those have to use water from the river and artificial canals even though the condition is contaminated. The river pollution has been occurring for a long time either in the upstream or downstream areas. The water continuously contaminated physically, chemically and biologically due to the physical condition of the land deforestation and degradation in the upstream; the land cover and land used changes in the upstream such as mining, plantations, and housing expansion activities, as well as the establishment of factories along the river. Moreover, domestic solid and wastewater also significantly pollute the river and degrade the water quality. These are very detrimental to society both economically and socially in terms of poor sanitation and health. Therefore, the water resources of the city are needed to be protected and restored from contamination activities in order to make the city more liveable.

An inspiring statement from the world famous water leader Mr. Lee Kuan Yew (First Prime Minister of Singapore in period of 1959-1990) recognized water security as a priority that dominated every other policy; his famous remarks was "***it should be a way of life to keep the water clean, to keep every stream, every culvert, and every rivulet, free from unnecessary pollution***" [5]. This has brought Singapore into one of the countries that have the best water management system. Therefore, inspired by his spirit, this study aims to contribute on the keeping every source of water clean, and it includes the retention pond.

Indonesia has committed to participate in the implementation of sustainable development goals (SDGs). The Asian Water Development Outlook (AWDO), which was initiated by Asian Development Bank (ADB) and the Asia-Pacific Water Forum (APFW), had highlighted the importance of water management issues in Asia and the Pacific. AWDO 2013 presented the water security status of 49 economies in Asia and the Pacific. Based on National Water Security (NWS) Index Score which was assessed as the composite results of five key dimensions of household water security, economic water security, urban water security, environmental water security and resilience to water-related disaster, Indonesia was in the level 27th among the 49 countries, Indonesia's NWS stage was engaged (the range of score was 36 - 56), at this stage means in Indonesia more than half of the people have access to modest drinking water and sanitation facilities; water services still developed, water quality is needed to be improved, and first attempts for addressing water-related risks are being made; therefore hard jobs and big homework for the Indonesian policymakers to increase the scores [6].

Retention pond (RP) is part of green open space in the city. One of its functions is to provide ecosystem service to the urban lives that make its healthy should be protected. It is part of green storm water that is needed for flood reducing and prevention, surface water supplies augmentation, groundwater recharge, and water quality improvement [7]. This year, the 2018 world water day celebration brought the "Nature Based Solution (NBS)" as the year's theme of its celebration. Many studies showed that green stormwater infrastructure such as the retention ponds is not only controlled stormwater volume and timing but also promotes ecosystem services, which are the benefits that ecosystems provide to humans [7].

Studies showed retention ponds have a role to counter the urbanization impacts and also to increase the nature buffering capacity as well as to anticipate several climate change effects [8, 9, 10, 11]. Ecosystems benefits to human currently study intensely [12] and the benefits of retention ponds are generally categorized into four types which are provisioning, regulating, cultural, and supporting [13, 14, 15, 16]. Therefore, Measuring the retention ponds pollution level is an important step for designing action plans for its protection and restoration. One of the activities for the monitoring their health is by a regular water sampling and measuring its conditions; if there are any problems of concern, the public needs a quick notification of any potentially harmful effects, and also authorities needs to

obtain alternative sources for drinking water if the ponds are functioned as reservoir or connected to the source for drinking water supply.
Palmer Pollution Index (PPI), the index for the rating of organic pollution of a water body, used in this study to measure the organic pollution levels of retention ponds located in the city of Palembang. It was first compiled by C. Mervin Palmer [17] from Federal Water Pollution Control Administration, AWTRL, U.S. Dept of the Interior, Cincinnati, Ohio in the year 1969. PPI was compiled from reports made by 165 authors, and then the species/genera most often encountered in the water with high rates of organic pollution were ranked [17]. Organic pollutants in a water body can be used by algae, its level can alter algal species domination and sometimes it can shift the species types of algae and also may potentially cause toxic conditions. Therefore, monitoring its level and types of algal domination are important for water quality monitoring. According to Palmer [17] organic pollution tends to influence the algal flora more than other factors in the aquatic environment, such as water hardness, light intensity, pH, DO, flow rate, water body size, temperature, and often pollutants types.

2. Methods

2.1 Sample collection, environmental parameters measurement, and algae identification

Sample collections were conducted by using random sampling; water samples from the locations were collected for algae identification, the collected samples were stored with an addition of 4% formalin solution prior to being observed at Laboratory for classification and identification according to Mizuno [18] and web page [19] Quantification of individual algae species in the samples was done by using Sedgwick Rafter (SR) according to its manual instruction. Environmental parameters such as pH, DO, TDS, temperature, lux (brightness), COD, Ntot, Ptot and TSS were measured in every station during the sampling activities according to SNI methods.

2.2 Palmer Pollution Index Score

PPI scoring was done by adopting method as described by Palmer [17], water samples can be rating to measure its organic pollution by using the following table as it suggested by Palmer [17]. In the analyses according to Palmer [17], all of the 20 genera or species that present are recorded, The algae is called “present” if there are 50 or more individuals per mL. The pollution index factors of the algae present are then totaled, from the total score then the organic pollution level can be suggested.

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Table 1. Algae Genus Pollution Index based on Palmer [17].

Genus	Index Pollution	Genus	Index Pollution
Anacystis	1	*Micractinium*	1
Ankistrodesmus	2	*Navicula*	3
Chlamydomonas	4	*Nitzschia*	3
Chlorella	3	*Oscillatoria*	5
Closterium	1	*Pandorina*	1
Cyclotella	1	*Phacus*	2
Euglena	5	*Phormidium*	1
Gomphonema	1	*Scenedesmus*	4
Lepocinclis	1	*Stigeoclonium*	2
Melosira	1	*Synedra*	2

Following the values for the pollution index based on Palmer [17], in accordance with the algae genus it can be known:
0-10 = Less of organic pollution
10-15 = moderate pollution
15-20 = Possible high organic pollution

r more = Confirmed high organic pollution

2.3 Potential Toxic algae Planktothrix agardhii preliminary assay

2.3.1 Cyanobacter biomass preparation and potential toxic cyanobacter treatments assay to Cyprinus carpio L.. After identification of Planktothrix agardhii., the biomass was then collected by centrifugation (4000 rpm for 2 minutes). The collected biomass was counted by using Sedgwick Rafter according to its manual instruction then it was used for the study to observe its possible effect to fish (Cyprinus carpio L.). Prior to being exposed to Planktothrix agardhii., healthy fishes with sizes between 10-12 cm of length were subject to several days of adaptation; only healthy fishes were used for treatments assays. This preliminary study compared the exposed fishes with Planktothrix agardhii., with concentration 5 x 10^7 cells/mL with a negative control (without the addition of Planktothrix agardhii.,). Observations were conducted with video recorder, time zero to the time when the fishes were dead were recorded. The dead fishes were then dissected; its gills and organs were fixed in formalin solution (10% v/v) for 24 hours prior to be preparing for histopathology analysis.

2.3.2 Histopathology preparation for fish's gills and analysis. Organ especially gills of the dead fishes were subjected to these following steps for histopathology analyses, firstly, fixation where the dead fishes' gills were then fixed in formalin solution (10% v/v) for 24 hours. Then it was followed by cutting and dehydration by using alcohol solutions series of 70%, 80% alcohol, 96%, and 100%. Next, it was followed by clearing by xylol solutions, followed by Infiltration; the tissue was then immersed in paraffin 1 and paraffin 2. Then, embedding and slicing, the tissue’s block was sliced by using microtome (Shandon Finesse 325) followed by coloring by using Mayer’s haematoxylin and eosin dye. Finally mounting step, the slide was then dripped with Canada balsam and covered with cover glass and can be visualized with a microscope, this method based on Slaoui and Fiette with some modifications [20]

3. Results

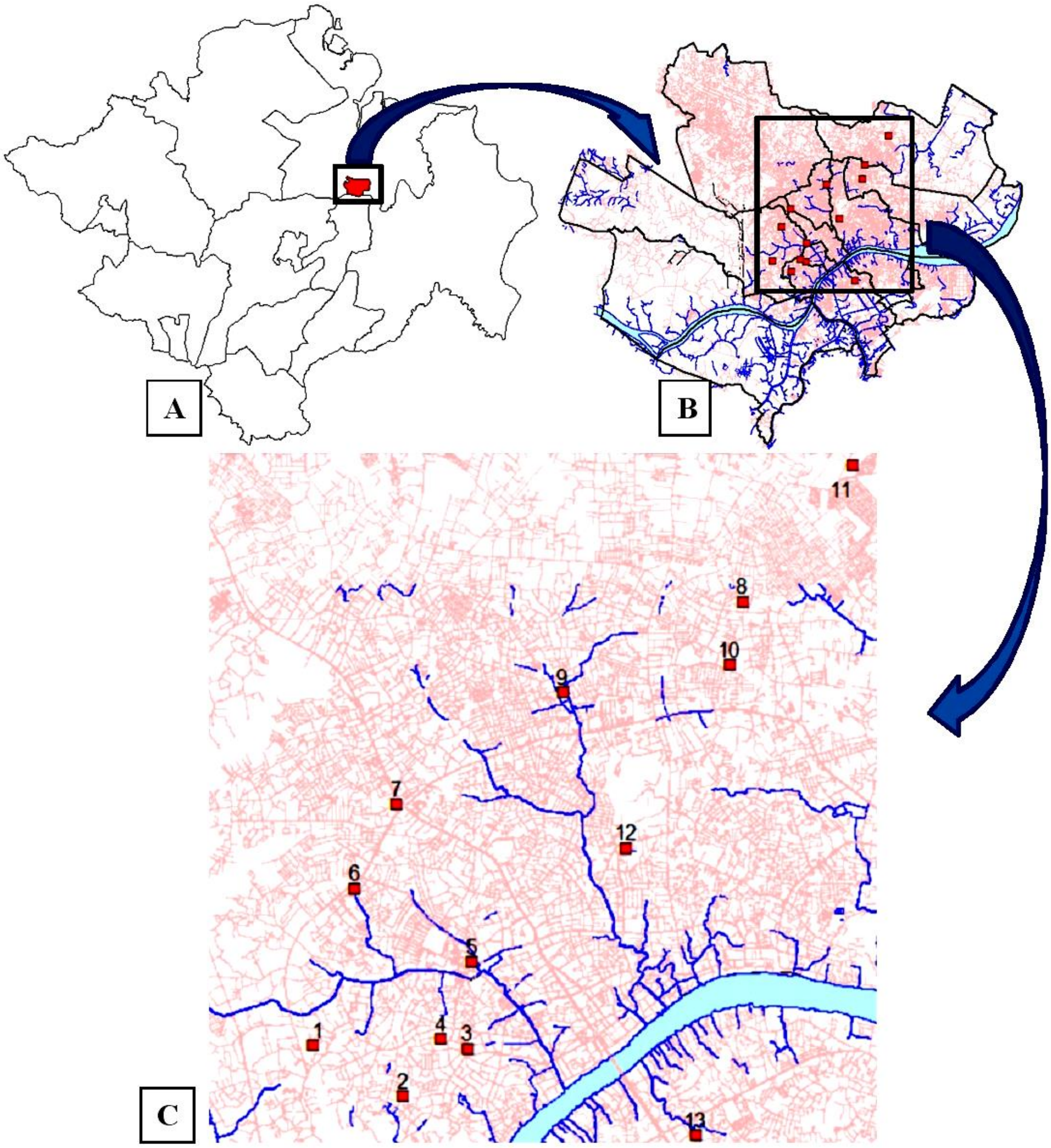
3.1 Sampling locations and its surrounding descriptions

In this study, thirteen retention ponds located in the city of Palembang were sampled and observed; sampling coordinates and map illustration of the sampling sites are presented in Figure 1. Samples were collected from thirteen retention ponds located in Palembang city, a map of the samplings sites include their sub-districts, coordinates, and the retention ponds area in Ha is presented in Figure 1. The total area of the retention ponds range from the smallest was 0,37 (PSCC/Palembang Icon) to the highest in this study was 2,19 (Seduduk Putih). Images of four of retention ponds are presented in Figure 2 (RP PSCC/Palembang Icon, RP Kambang Iwak Kecik, RP KI Besak, and RP Kemang Manis). Palembang in general has a tropical climate with moderate to high rainfall, even in the driest month. According to Köppen and Geiger [21], this climate is classified as Af. The average annual temperature is 26.9 °C and rainfall averages of 1727 mm.

Under this study, the surrounding coverage area of the sampling locations is presented in Table 2. The retention ponds under this study, ten of them are manmade (KI Besak, KI kecik, PSCC/ Palembang Icon, RP beside Siti Khodijah Hospital, RP Polda Junction, Seduduk Putih, Sapta Marga, Borang, Bangau and BKN) and three are natural retention ponds (Brimob, Kemang Manis and Tanjung Sari); these three are connected to marsh ecosystem. Two out of ten of the man-made retention ponds are connected to marsh ecosystem which is RP Seduduk Putih and RP Sapta Marga. Generally the retention ponds area are surrounded by dense population settlements, the only less dense populated is

Tanjung Sari but this retention pond is located near a tempeh industry (its water very smelled and black in color), one of them is located in the shopping mall (PSSCC/PI), some of them are located close to highway (Bangau, Brimob, PSCC/PI, Polda Junction, Siti Khodijah, KI Besak, and KI Kecik), some of them are used by the community for waste disposals (Brimob, K manis and BKN), some of them still have greenery coverage (KI Besak, KI Kecik, and Bangau) but some others have almost no tree coverage (BKN) and very less until very few trees, detail information of the retention ponds under this study can be seen in Table 2. These surrounding conditions affected the retention ponds aquatic ecosystem.

Characteristics of the thirteen retention ponds are presented in Table 3. The environmental parameters results from samples collected from the retention ponds showed several differences. Generally during the sampling periods temperature at the locations in the daylight were 27,2 - 34,10 ^{o}C, during the sampling periods Borang showed the higher water temperature. During the sampling periods, light intensity from 10 am to 3 pm were more than 500.000 lux, unless KI Besak and KI Kecik, during the sampling period the light intensity were lower (195.700 and 192.500 lux). The physical and chemical parameters of the water samples showed Retention Pond Borang had low pH 5,2 while other have pH above 7 (7,3 - 7,9); pH of Tanjung Sari was alkaline (7,9). Tanjung Sari showed a very low DO, high TDS and very low Ntot (<0,10 ppm). A detail on the environmental conditions of those sampling sites is presented in Table 3.



Sampling Sites Locations	Sub-districts	Easting/ X	Northing/ Y	Area* (Ha)
KR_Brimob	Bukit Lama	469718	9669568	1,82
KR_Kemang Manis	Kemang Manis	470899	9668904	0,82
KR_Kambang Iwak Besak	Talang semut	471752	9669524	1,92
KR_ Kambang Iwak Kecik	30 Ilir	471402	9669654	0,71
KR_ Palembang Icon/PSCC	Lorok Pakjo	471810	9670665	0,37
KR_Beside RS Siti Khodijah	Lorok Pakjo	470264	9671641	1,01
KR_Simpang Polda	20 Ilir Dalam I	470813	9672747	0,54
KR_Tanjung Sari	Bukit Sangkal	475381	9675425	0,61
KR_Seduduk Putih	Pipa Reja	473007	9674227	2,19
KR_Sapta Marga	Bukit Sangkal	475217	9674588	1,30
KR_Sematang Borang	Sako	476833	9677224	1,15
KR_Bangau	Sungai Ilir	473842	9672173	1,03
KR_BKN	Silaberanti	474765	9668380	0,83

Figure 1. Map of sampling locations located in the thirteen retentions in Palembang city.

Table 2. Surrounding coverage area description of sampling locations of retention ponds

Descriptions			**Sampling Locations**												
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Man-made					√	√	√	√	√				√	√	√
Man-made connected to marsh ecosystem											√	√			
Natural			√	√						√					
Natural connected to a marsh			√	√						√					
Surrounding coverage	Population	Dense	√	√	√	√		√						√	√
		Less Dense					√		√	√	√	√	√		
	Highway	Close	√		√	√	√	√	√						√
		Far		√						√	√	√	√	√	
	Lowland ecosystem	Connected	√	√						√	√	√	√		
		Not connected													
	Greeneries (trees)	many trees			√	√								√	
		Few trees	√	√			√	√	√	√	√	√	√		
	Domestic solid waste disposal	High													√
		Medium	√	√	√			√	√	√				√	
		Low				√					√	√	√		
	Recreation sites	Park			√	√									
		Mall					√								
		Hospital						√							
		Industry								√					
	Typical	Stagnant	√	√	√	√	√	√	√	√	√	√	√	√	√
		Aerated													
		Deep	√											√	√
		Shallow		√	√	√	√	√	√	√	√	√	√		

Codes: 1. Brimob; 2. K Manis; 3. KI Besak; 4. KI Kecik; 5. PI/ PSCC; 6. Near RS Skhod; 7. Polda; 8. T Sari; 9. S Putih; 10. S Marga; 11. Borang; 12. Bangau; 13. BKN.

Figure 2. Images of sampling locations of this study: (A) located in PSCC (B) Kambang Iwak Besak, (C) Kambang Iwak kecik and (D Kemang Manis.

Table 3. Characteristics of the water in retention ponds under this study

Sampling Locations	Parameters							
	PH	TDS	Temp	DO (%)	Ntot	Ptot	TSS	Lux
Near Siti Khodijah	7,4	196	30,13	10,6	3,77	0,29	48	>500000
Brimob	7,3	112	32,21	9,2	3,12	0,01	51	>500000
Kemang Manis	7,4	186	32,22	8,2	3,12	0,22	33	>500000
Borang	5,2	163	34,10	9,1	3,51	0,31	20	>500000
KI Besak	7,3	89	27,7	8,9	4,82	0,09	62	195700
KI Kecik	7,3	98	27,4	8,9	4,55	0,1	54	192500
PSCC	7,4	125	30,5	11,1	4,58	0,01	74	>500000
Polda	7,4	145	31,2	4,3	3,36	0,12	39	>500000
Seduduk Putih	7,9	113	28,5	3,4	2,52	0,02	32	>500000
Sapta Marga	7,7	91	28,8	13,8	1,5	0,01	23	>500000
Tanjung Sari	7,5	128	31,7	3,1	<0,10	0,12	47	>500000
Bangau	7,9	59	30,2	5,5	1,32	0,08	45	>500000
BKN	7,7	113	30	10,7	4,22	0,09	60	>500000

List of algae species identified from collected samples is presented in Table 4. There were 59 microalgae species were identified from the thirteen retention ponds located in Palembang. Based on this study, each of the retention ponds consisted of unique algae compositions. The interesting finding can be suggested that in Tanjung Sari retention pond, there were no algae species were identified (the water may not suitable for algae growth, a further study still in progressing for analyses). Some dominant and persistent algae species relate to the locations also observed in this study, such as *Planktothrix* group or *Oscillatoria* are two dominant groups that always dominated PSCC/PI retention pond (it reached more than 50% of the total species were identified in the sample). Other unique dominant group were *Euglena sp* that was identified to be dominated RP located near Siti

Khodijah hospital, and also *Pandorina sp* that always presence but still do not dominant in RP Brimob.

Table 4. Algal species identified from sampling sites in retention ponds located in Palembang city.

Species	Sampling Locations														
		1		2	3	4	5	6	7	8	9	10	11	12	13
Ankistrodesmus sp.	√							√							
Anabaena sp.	√	√	√												
Actinastrum sp						√									
Ankitrodesmus gracilis		√													
Asterionella sp.				√	√			√							
Actinastrum sp								√							
Bracteacoccus sp.		√							√						
Chlorella sp.	√													√	√
Chlamydomonas sp	√	√	√			√									
Chroococcus sp.			√												
Chlorococcum sp								√							
Closterium lineatum									√						
Coelastrum sp.	√														
Cyclotella sp								√						√	
Elliptochloris reniformis				√	√				√			√	√		
Eudorina sp							√							√	
Euglena acus	√													√	√
Euglena gracilis														√	√
Euglena oxyuris		√													
Euglena proxima													√		
Euglena sp.					√	√		√	√					√	√
Golenkinia sp.	√	√				√									
Gymnodinium uberrimum					√										
Lepocinclis fusiformis	√													√	√
Lepocinclis ovum								√							
Lepocinclis salina	√														
Lepocinclis sp.				√					√		√				
Mellosira sp.		√													
Micractinium sp.		√						√	√					√	
M. pusillum	√	√	√												
Monoraphidium sp.	√										√				
Navicula sp			√												
Nitzschia acicularis						√									
Nitzschia palea					√										
Nitzschia pungens	√	√	√												
Nitzschia sp.											√				
Nostoc punctiforme							√						√		
Oedogonium calliandrum															
Oocystis sp.			√												
Oscillatoria brevis	√		√												
Oscillatoria limosa			√		√	√									
Oscillatoria rubescens															
Oscillatoria sp.				√				√							
Oscillatoria princep	√	√	√			√									
Pandorina morum	√	√	√				√		√				√	√	√

Phacus acuminatus	√												
Phacus sp					√							√	
Phacus tortus			√		√								
Planktothrix agardhii					√								
Planktothrix rubescens					√					√			
Planktothrix isothrix													
Pleodorina sp.	√												
Pleurotaenium sp.							√						
Scenedesmus acuminatus		√		√			√	√				√	√
Scenedesmus quadricauda					√			√			√	√	√
Selenastrum gracile				√	√								
Staurastrum sp.								√					
Stephanodiscus hantzschii			√		√			√					
Stephanodiscus sp.				√							√		

*) √ The code represented is represented the presence of algae species which were observed in samples were taken from the sampling sites of this study.
Codes: 1. Near RS StKH; 2. KI Besak; 3. KI Kecik; 4. PSCC; 5. Polda; 6. S Putih; 7. S Marga; 8. T Sari; 9. S Borang; 10. Bangau; 11. BKN; 12. Brimob; 13. K Manis.

Tabel 5. Palmer Pollution Index (PPI) scores for the retention ponds located in Palembang city based on the Palmer's Algae Indicators scores.

Genus	Sampling Locations (Retention Ponds)													
	PPI Score	1	2	3	4	5	6	7	8	9	10	11	12	13
Anacystis	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Ankistrodesmus	2	2	-	-	-	-	2	-	-	-	2	2	-	-
Chlamydomonas	4	-	-	-	-	-	4	-	-	-	-	-	-	-
Chlorella	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Closterium	1	-	-	-	-	-	-	1	-	-	-	-	-	-
Cyclotella	1	-	-	-	-	-	-		-	-	-	-	1	-
Euglena	5	5	-	-	5	5	5	5	-	-	-	5	5	5
Ghomponema	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Lepocinclis	1	1	1	-	-	1	1	1	-	1	-	-	1	1
Melosira	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Micractinium	1	-	-	-	-	1	-	-	-	-	-	-	1	-
Navicula	3	3	-	-	-	-	-	-	-	-	-	-	-	-
Nitzschia	3	-		3	3	-	-	-	-	-	-	-	-	-
Oscillatoria	5	5	5	-	5	-	-	-	-	-	-	-	-	-
Pandorina	1	-	-	-	-	1	-	-	-	-	1	1	1	1
Phacus	2	2	2	-	-	-	-	-	-	-	-	-	-	2
Phormidium	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Scenedesmus	4	-	4	-	4	4	-	4	-	-	-	4	4	4
Stigeoclonium	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Synedra	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Tot Scores	-	18	12	3	17	12	12	11	0	1	3	12	13	13

*) – code is represented the presence of algae genus listed in Palmer's table for scoring located in the sampling sites of this study.
Codes: 1. Near RS StKH; 2. KI Besak; 3. KI Kecik; 4. PSCC; 5. Polda; 6. S Putih; 7. S Marga; 8. T Sari; 9. S Borang; 10. Bangau; 11. BKN; 12. Brimob; 13. K Manis.

The result of Palmer's Pollution Index scoring for the retention ponds can be seen in Table 5. The result suggested that two PPI highest scores in this study were St Khodijah and PSCC/PI retention ponds (scores are 18 and 17 respectively), based on Palmers [17], these scores suggested these two locations are possibly high organic pollution; seven other retention ponds have scores ranges of 11 to 13 (K Manis, Brimob, KI Besak, Polda, S Putih, S Marga, and BKN), these locations indicated moderate organic pollution level (scores range for this are 10-15), and the last four have scores 0 to 3 (Kambang Iwak Kecik, Tanjung Sari, S Borang, and Bangau) that indicated as less organic pollution (scores range for this are 0–10); in this case RP Tanjung Sari has zero score, this location may be polluted by other material (data not included) that needs a further study (in progress under this project), but from this result it was recorded that the water was unsuitable for algae to grow; this study observed only one type of unidentified organism was recorded (that was suspected as one type of fungi), it was suspected the tempeh industry that is located surround the retention pond affected this condition. The other two retention ponds (Bangau and S Borang) showed low scores (these two retention ponds recently were under cleaned up and re-renovated).

Table 6. Potential toxic and health risk cyanobacteria and Cyanophyta were identified in PSCC/PI and Beside Siti Khodijah Hospital Retention Ponds

Species	Beside RS S.Khodijah	PSCC	Potential Toxins	Health Risk	References
Anabaena sp.	√		Hepatotoxins, Anatoxin-a, Saxitoxins, Microcystins	Allergy, Dermatitis, Rhinitis	[22; 23]
Ankistrodesmus sp.	√		-	Allergy	[22; 24]
Micractinium pusillum	√		Hepatotoxin, Microcystin		[25]
Nitzschia acicularis		√	Domoic Acid		[26]
Nitzschia pungens	√		Domoic Acid		[27]
Oscillatoria brevis	√		Microcystin		[28]
Oscillatoria princeps	√	√	Microcystin		[29]
Planktothrix agardhii,		√	Microcystin		[30]
Planktothrix isothrix		√	Microcystin		[30]
Planktothrix rubescens		√	Microcystin		[31]

Among those 59 algae were identified, some species potentially produce toxins and become an animal and human potential cause of health problems (the list of these species is presented in Table 6). Species identified in RP besides Siti Khodijah Hospital such as *Anabaena sp.*, and *Ankistrodesmus sp.*, potentially cause allergy, dermatitis and rhinitis [22, 23, 24]. Other species such as *Nitzschia acicularis*, *Micractinium pusillum Nitzschia pungens*, *Oscillatoria brevis* and *Planktothrix agardhii*, that are identified and observed in samples collected from these two retention ponds are potentially produced hepatotoxin, microcystin and domoic acid. This study aims to record the potential toxic algae/*cyanobacteria* or *cyanophyta* in the retention ponds; in this study, the dominant potential toxic algae in the retention pond was *Planktothrix agardhii*. This study suggested the potential toxin producer such as *Plankthothrix agardhii.*, was identified to be dominated one of retention ponds located in the city (its domination was identified during sampling periods of April, Mei, June, July 2018, the domination of *Plankthothrix agardhii.*, during the months were 67,12 %; 72,43 %;77,19% and 70,55 % respectively.

3.2 Potential Toxic algae Planktothrix agardhii preliminary assay

A further study for assessing the potential toxicity effect of the cyanobacter *Planktothrix agardhii*., a preliminary assay was conducted to the *C. carpio L.*, In relation to that, Mowe et al., [32] suggested from their review on tropical cyanobacterial blooms that microcystis was the most prevalent bloom-causing genus in tropical Africa and Asia. *Planktothrix agardhii* blooms were currently reported occurring in Indonesia and Brazil [33, 34]. However, information about the possible toxic effects of this cyanobacterium isolated from Indonesia is still very limited [32]. Therefore, a preliminary study was conducted to investigate its potential toxic effect to fish (a more detail of this experiment is published in Wulandari et al., [35]. In this preliminary study, part of the histopathological changes of fish' gill (control) was compared to histopathology of fish that was exposed to potentially toxic algae (biomass of *Planktothrix agardhii*., was 5×10^7 cells/mL). The images of the cross sections of the gills are shown in figure 3 and 4. The pathological changes observed such as telangiectasis (a) and edema (b). The changes occurred may relate to the fishes reaction to oxygen stresses. According to Roberts [36] telangiectasis can be occurred by the normal process by which at low oxygen absorption, whereas normally the oxygen needs higher metabolism, these cause fish do homeostasis by accelerating the breakdown of pillar cells and expand their lacuna area at the end of secondary lamellae. In relation to that, according to Sudaryatma et al., [37] the closure lacuna by the epithelial cell of secondary lamellae can increase pressure in the lacuna and cause damage of pillar cells which its role is to serve in maintaining the stability of secondary lamellae.

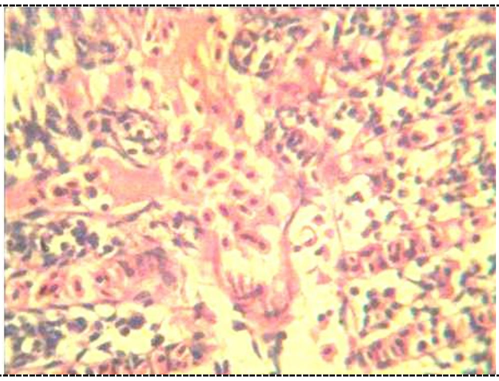


Figure 3. Cross section gill histology Cross section gill histology of C. carpio L. (A) normal condition (control) (40x, HE).

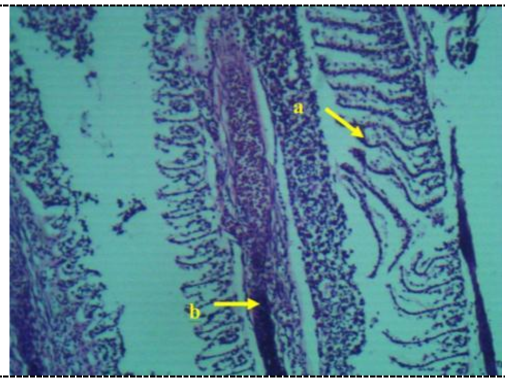


Figure 4. Cross section gill histology with *Plankthothrix agardhii* exposure concentration (B) exposed to *Plankthothrix agardhii* concentration of 5×10^7 a. Telangiectasis; b. Edema (10x, HE).

The damage of pillar cells can cause erythrocytes accumulation in blood vessels and also blood vessels dilatation, especially at the end of lamellae. Telangiectasis on secondary lamellae was observed after the fish was exposed to *Plankthothrix agardhii* with a concentration of 5 x 10^7 cells/mL (figure 4a), telangiectasis can also cause cellular degeneration and necrosis of gill epithelial tissues [38]. Beside the telangiectasis, another change is a lifting respiratory epithelium that normally occurred at the early stage of injuries. According to Santos et al. [39], the lifting respiratory epithelium occurred during the presence of toxin; it is characterized by a displacement of secondary lamellar layer or edema that is shown in Figure 4b. The toxic substances exposures to cells can cause edema; according to Alifia [40], edema is observed when there is an increasing amount of fluid in the intracellular compartment occurred, and also due to osmosis from the increase natrium concentration in the cell [41]. The presence of edema cause fragile and deformed erythrocytes, so they will degenerate and cause respiratory control difficulty (breath difficulty) in fish that can cause a further oxygen lacking and deadly effect.

4. Conclusion

This study showed both retention ponds located in PSCC and beside Siti Khodiajh hospital had high organic pollution levels (scores are 17 and 18) respectively, these are signals for a priority treatment and restoration actions. The other seven RPs are at a medium level (scores are between 11 to 13), and the last three showed low organic level (scores are between 0 to 3). A further observation in this study found that the PSSC retention pond was constantly dominated by *Planktotrhix agardhii*, a cyanobacter under concerned due to its potential to release cyanotoxin which can harmful the environment, aquatic animals, and public health. A preliminary study was done in this study showed it had an effect to *Cyprinus carpio* gill and pathologic effects in the gill's lamella such as edema, loss of secondary lamellar structure, epithelium released from the underlying tissue and secondary lamellar fusion.

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Acknowledgments
This study was supported by Directorate of Research and Community Service (DRPM), The Directorate General of Strengthening Research and Development of the Ministry of Technology and Higher Education Research through The Higher Education Basic Research Award Grants at Fiscal Year of 2018 granted to Dr. Marieska Verawaty.

This research/article's publication is partly supported by The United States Agency for International Development (USAID) through the Sustainable Higher Education Research Alliance (SHERA) Program for Universitas Indonesia's Scientific Modeling, Application, Research and Training for City-centered Innovation and Technology (SMART CITY) Project, grant #AID-497-A-1600004, Sub Grant #IIE00000078-UI-1.

This article is presented at the International Conference on Smart City Innovation 2018 that supported by the United States Agency for International Development (USAID) through the Sustainable Higher Education Research Alliance (SHERA) Program for Universitas Indonesia's Scientific Modeling, Application, Research and Training for City-centered Innovation and Technology (SMART CITY) Project, Grant #AID-497-A-1600004, Sub Grant #IIE-00000078-UI-1