The study of Phosphorus distribution at Putrajaya Wetland

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Abstract. This study is concerning phosphorus distribution in Putrajaya Wetland. Phosphorus is one of the important component in nutrients for living things be it aquatic or non – aquatic organisms. Total phosphorus (TP) results will give some information on the trophic status of surface water in water bodies. The focus of this study is to determine the total phosphorus concentration in Putrajaya Wetland which is in the inlet of the wetland then outlet of the wetland (Central Wetland Lake). The water sample is taken from Putrajaya Wetland and the test was conducted in the laboratory. The result from this study shows the results for total phosphorus according to month, sampling station and cells. Lowest total phosphate at the Central Wetland compare with all the wetland arms cells.

1. Introduction

Phosphorus is one of the important component in nutrients for living things whether aquatic or non – aquatic organisms. Phosphorus is a significant element because it is crucial for nucleotides and ATP (adenosine triphosphate) which are fundamental energy sources for living beings. However, excessive phosphorus content in ecosystem could lead to negative impact. Putrajaya Wetland is one of the tourist attractions in Klang Valley area. High concentration of phosphorus in the wetland could cause negative impacts to the aquatic and non-aquatic organisms in the wetland. This can be a contributing factor to ecosystem problem.

Phosphorus is a fundamental component in all living beings. Genetic materials such as DNA as well as energy producing ATP (adenosine triphosphate) and general compounds such as phospholipids are essential in living cells as a constituent [1]. Phosphorus plays an important role in the ecosystem. It has a predominant function in cellular energetics as ATP and is an important part of many structural and biochemically functional components for the cell growth in plants [2]. Various pollutants including phosphorus (P) May 2017 be absorbed in the sediments that have accumulated at the bottoms of wetlands as well as lakes and rivers. These sediments May 2017 accumulate over long periods of time and the pollutants can be released into the water and being utilized by the plants. Phosphorus concentrations generally are low in seawater and can restrict organic efficiency in some marine biological systems [3,4].

Kalff et. al [5]. stated that P is often the limiting nutrients in freshwater and brackish system. Variation in soil's P content influences the biogeochemical cycle of elements including nitrogen and carbon. Pote et. al [6] found that P is the most often element that limits eutrophication because of too many blue-green algae that are able to utilize atmospheric gases. Sims et. al [7] stated that loss of P from agricultural production systems are known to contribute to acceleration of eutrophication in natural waters. Stewart et. al [8] found that plants primarily acquire the P needed for their development from soil P reserves. Soil P content is mainly affected by factors such as organisms and biogeochemical processes in soil, climate and parent material whereby its distribution has a large spatial heterogeneity.

1.1. Phosphorus distribution

Phosphorus is the main and basic nutrient for marine biological system. Its biogeochemical cycle plays an important role in limiting the primary production process in marine environment. Marine sediment is regarded as a crucial carrier for phosphorus cycling. When the external loading of P becomes higher, the sediments can absorb it as a pool. When the water loading is reduced, the sediments would release the absorbed phosphorus to the aquatic surroundings as a pollution source. Total phosphorus (TP) evaluation May 2017 give some information on the trophic status of sediments in marine biological system. However, not all of the phosphorus fractions can be released from sediment into the overlying water, and the released phosphorus fractions can barely have a similar mobility and bioavailability.

To study phosphorus behavior in sediments in assessing the trophic status, it is more efficient to evaluate based on the phosphorus fractions. Amid sorption process, considering phosphorus portions is additionally beneficial to heighten the phosphorus sorption on dregs, taking the holding method of phosphorus and residue into account. Thus, it May 2017 be useful to assess the portability and bioavailability of the absorbed phosphorus. Phosphorus sorption/desorption in the sediment– water interface is an essential procedure influencing the phosphorus cycling in any marine eco-frameworks. Other than temperature, saltiness and pH of the media, properties of residue particles, for example, molecule measure, particular surface territory, surface charge thickness, can likewise be of noteworthy significance for phosphorus sorption process. Considering the phosphorus sorption kinetic characteristics and phosphorus form changes during sorption process, the sorption could be considered as an important physical process. Increase in temperature benefits the sorption of phosphorus. Sorption was a spontaneous, endothermic and entropy increasing process. It has a dominating function in cell energetic as ATP and is a vital part of numerous auxiliary and biochemical utilitarian parts for cell development in plants. Different contaminations including P might be caught up in the silt accumulated at the bottom of waterways and lakes or being used up by plants. Internal loading in the sediments plays an important role in wetlands. Hence, it is important to evaluate the potential of P release and its utilization. However, not all types of P are available for plants. Therefore, it is necessary to investigate the fractions and bioavailability of P in sediments. Knowledge in P speciation is important to observe environmental changes and P bio availability. Some studied shows P bioavailability in the sediments from the middle and lower reaches of the Yangtze River region using different chemical extraction methods. The results showed that the bioavailable P concentrations can be evaluated by measuring the concentrations of TP, IP and NAIP in the heavily polluted sediments and that bioavailable P can only be evaluated using different chemical extracting methods in slightly polluted sediments [9]. The main objective of this study is to investigate the total phosphorus (TP) distribution in surface water at Putrajaya Wetland.

2. Methodology

2.1. Putrajaya Wetland

The Putrajaya's constructed wetland system comprises of five arms (refer to one main stream with total 23 cell) will discharge to the Central Wetland which make the 24 cells in all before flows into the Putrajaya Lake. They straddle the water courses of Sungai Chuau, Sungai Bisa and three tributaries. A rock filled weirs was constructed along the five arms of the wetland to divide all cells in wetland. Although all the five arms are connected, they differ in size, depths, plant communities and pollutant loads that each is designed to handle. Putrajaya Wetland is designed with features a multi-cell of multi-stage system with flood mitigation capability to make best use of the space available for colonization by water plants. All plants inside wetland function to intercept any pollutants. These plants act as to facilitate filtering and removing water pollutants where bacteria and microorganisms can flourish [10].

Figure 1. Location of sampling site in The Putrajaya Wetland.

Table 1. Sampling coordinate at Putrajaya Wetland.

POINT	NAME	LATITUDE	LONGITUDE
UW7	Upper West 7	2.972827°	101.692815°
UW8	Upper West 8	2.961730°	101.690493°
UW1	Upper West 1	2.958223°	101.695829°
UN6	Upper North 6	2.975433°	101.701737°
UN1	Upper North 1	2.959439°	101.698333°
UE3	Upper East 3	2.962103°	101.713427°
UE1	Upper East 1	2.960403°	101.704643°
LE2	Lower East 2	2.951822°	101.707165°
LE1	Lower East 1	2.952581°	101.702536°
CW	Central Wetland	2.949129°	101.694874°

2.2. Sample Collection and Laboratory Test

All water samples were taken from Putrajaya Wetland. Samples were collected from 10 points within 5 months for this study starting from January 2017 to May 2017. Table 1 shows the coordinate of each sampling location at Putrajaya Wetland. Each sample is taken from individual point for every end of the month. The water samples were collected at three points which are at the inlet, middle and outlet. The raw sample were then being tested immediately within 48 hours. Then, all data is tabulated and interpreted in graphical format. The data is tabulated according to month, station and arm. These total phosphorus values were recorded in mg/l unit. HACH method 8190 is used to determine the total phosphorus. The water samples was collected and kept in a bottle before transport to the lab.

3. Results

3.1. Distribution of phosphorus at each cell by month

Figure 2 shows the total phosphorus results by cells from January 2017 – May 2017. The total phosphorus for cell CW shows the decreasing trend compare with other cells from January 2017 to May 2017. The total phosphorus concentration reading for January 2017 and February 2017 is 0.10 mg/l while in March 2017, April 2017 and May 2017 is 0.11 mg/l. There is a slightly increasing amount of total phosphorus concentration from February 2017 to March 2017 which is 0.01 mg/l. Central Wetland has the lowest concentration of total phosphorus among all 12 cells because possible pollutant already treated at wetland arm.

Both LE1 and LE2 are located at the Lower East sector. LE1 is at the middle while LE2 is the inlet and the water will eventually flow to CW. Generally, LE1 concentration of total phosphorus for January 2017 is 0.12 mg/l, and increased rapidly in February 2017 2017 (0.18 mg/l), decreased from 0.04 mg/l to 0.14 mg/l in March 2017 and slightly increase to 0.15 mg/l in April 2017 and May 2017. LE2 in January 2017 is 0.15 mg/l and increased to 0.23 mg/l in February 2017, then decreased to 0.15 mg/l in March 2017 but increased to 0.21 mg/l in April 2017 and then decreased back to 0.18 mg/l in May 2017. The phosphorus concentration pattern in LE2 and LE1 seems fluttered probably due to the inlet water sources at the Lower East sector which is in precinct 12, whereby from observation, currently there is construction project going on. Contaminants in forms of sediment and floatable types are those commonly found in storm water from construction activities.

At Upper East sector there are UE1 and UE3 cells. UE1 is the middle and UE3 is the inlet. From Figure 2, UE3 total phosphorus concentration bar is slightly higher than UE1. As for UE1, total phosphorus concentration in January 2017 and February 2017 is consistent at 0.18mg/l with no changes, then a slight decrease to 0.16 mg/l in March 2017 and gradually increased to 0.17 mg/l and 0.21 mg/l respectively in April 2017 and May 2017. On the other hand, UE3 concentration in January 2017 is 0.21 mg/l and increased by 0.04 mg/l to 0.25 mg/l in February 2017. In March 2017 the concentration further decreased to 0.18 mg/l and 0.14 mg/l in April 2017. However, it further increased by 0.0 mg/l to 0.16 mg/l in May 2017. The main inlet source of Upper East sector is from shopping complex which is the commercial area and other sources are for instance, the ongoing construction sites there. Possible contaminants such as pesticides, herbicides and organic materials can be found from commercial area.

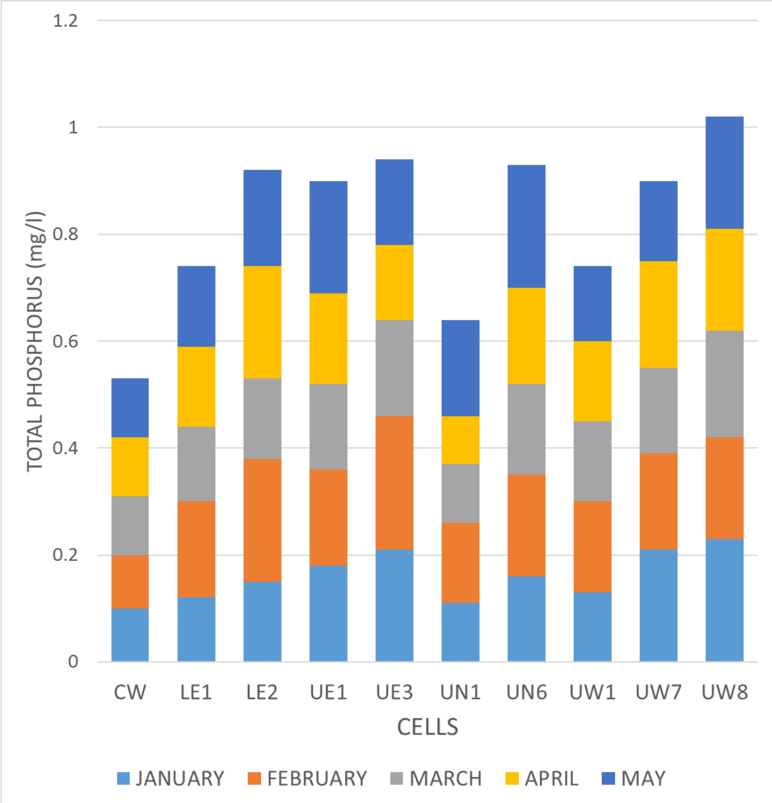

Figure 2. The Total Phosphorus Results by Cells from January 2017 – May 2017

As for the Upper North sector, there are middle cells UN1 and UN6 serves as inlet of the sector. According to Figure 2, UN1 has the lowest bar of concentration while UN6 have equal level of concentration. UN1 concentration in January 2017 is 0.11 mg/l, 0.15 mg/l in February 2017 and decreased to 0.11 mg/l and 0.09 mg/l in March 2017 and April 2017 respectively, then rapidly increased to 0.18 mg/l in May 2017. For UN6 cell, the concentration of total phosphorus in January 2017 is 0.16 mg/l, increased by 0.03 mg/l to 0.19 mg/l in February 2017 and decrease to 0.17 mg/l in March 2017. It increased gradually to 0.18 mg/l and 0.23 mg/l in April 2017 and May 2017 respectively.

At Upper West sector, there are UW1 which serves as the middle, as well as UW7 and UW8 are the inlets. The bar for UW1 is the lowest among the cells in Upper West structure followed by cells UW7 and UW8. In January 2017, total phosphorus concentration for UW1 is 0.13 mg/l and increased by 0.04 mg/l to 0.17 mg/l in February 2017 which then decreased gradually to 0.15 mg/l in March 2017 and April 2017, and 0.14 mg/l in May 2017. For inlet UW7, the concentration in January 2017 is 0.21 mg/l, gradually decreased by 0.02 mg/l in February 2017 to March 2017 with 0.18 mg/l and 0.16 mg/l respectively. In April 2017, the concentration increased by 0.04 mg/l to 0.20 mg/l and decrease to 0.15 mg/l in May 2017. For inlet UW8, the phosphorus in January 2017 is 0.23 mg/l and decreased to 0.19 mg/l in February 2017. In March 2017 it increased by 0.01 mg/l to 0.20 mg/l and decreased back by 0.01 mg/l to 0.19 mg/l in April 2017, but in May 2017 it increased to 0.21 mg/l. The sources of storm water entering from UN6 is from Serdang which is the farm area. It serves as a centre for agro-based events and activities. For UW6, the source of inlet is from Presint 11 which residential area.

4. Conclusion

The first objective is to investigate the phosphorus (P) distribution in Putrajaya Wetland. The P distribution of all data were determined and fulfill an objective. This research determines the distribution of phosphorus in Putrajaya Wetland according to month, sampling station and flow arm. The objective is to determine the phosphorus (P) content in inlet, middle and outlet of Putrajaya Wetland was successfully using method HACH 8190.

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