TIDAL EFFECTS ON WATER QUALITY AT THE PAHANG RIVER

SYAZWANA BINTI MUHAMAD

B. ENG (HONS.) CIVIL ENGINEERING

UNIVERSITI MALAYSIA PAHANG

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I/We* hereby declare that I/We* have checked this thesis/project* and in my/our* opinion, this thesis/project* is adequate in terms of scope and quality for the award of the Bachelor Degree of Civil Engineering

_____

(Supervisor's Signature)

Full Name : WAFTY BINTI ABD RAHMAN

Position : SUPERVISOR

Date : MAY 2019

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I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

_____

(Student's Signature)

Full Name : SYAZWANA BINTI MUHAMAD

ID Number : AA15204

Date : MAY 2019

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SYAZWANA BINTI MUHAMAD

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ABSTRAK

Kualiti air dari permukaan air seperti sungai dan tasik adalah isu biasa yang dibincangkan di Malaysia. Disebabkan populasi manusia yang semakin berkembang dan proses pembangunan yang pesat, kualiti air sungai termasuk Sungai Pahang telah merosot. Ini mengakibatkan kemudahan untuk mendapatkan sumber air yang bersih menjadi lebih mencabar. Putaran bumi dan daya graviti yang dikenakan oleh bulan juga boleh mempengaruhi kualiti air. Kajian ini memberi tumpuan kepada analisis kesan air pasang surut terhadap kualiti air di Sungai Pahang. Objektif kajian ini adalah untuk menentukan kualiti air Sungai Pahang berdasarkan enam parameter (BOD, COD, DO, AN, SS dan pH) dan untuk mengklasifikasikan Sungai Pahang mengikut Indeks Kualiti Air (WQI) semasa air surut dan air pasang dari tahun 2008 hingga 2017. Dua stesen, 4PH01 dan 4PH17, telah dipilih berdasarkan jarak dari muara sungai untuk mengkaji kesan air pasang surut keatas kualiti air. Hasil dari analisis ini, kualiti air (WQI) Sungai Pahang untuk sepuluh tahun kebanyakannya berada dalam Kelas II. Menurut Jabatan Alam Sekitar, DOE (2016), Kelas II sungai sesuai untuk perikanan II, bekalan air II dan untuk rekreasi menggunakan hubungan badan. Analisis enam parameter menunjukkan tiada trend khusus untuk kesemua parameter di kedua-dua stesen. Sebagai kesimpulan, tidak ada kesan yang signifikan dari pasang surut terhadap WQI di kedua-dua stesen kerana jarak stesen tersebut adalah 12.56 km dan 56.71 km dari muara sungai. Kajian ini menyediakan dan memperluas pengetahuan komuniti mengenai pencemaran Sungai Pahang dan keadaan semasa berdasarkan WQI dan diharapkan dapat meningkatkan kesedaran dalam kalangan masyarakat sama ada pihak berkuasa awam, pemain industri atau komuniti yang tinggal di dalam lembangan mengenai sebab-sebab dan sumber yang menyumbang kepada pencemaran air di Sungai Pahang dan boleh mencari penyelesaian yang terbaik untuk mengelakkan kemerosotan kualiti sungai pada masa akan datang.

ABSTRACT

Water quality of surface water such as rivers and lakes are the common issues discussed in Malaysia. Due to hasty growing human population and development process, water quality of rivers including Pahang River was deteriorated. Consequently, human access to clean and safe water become a tremendous challenge. Earth rotation and gravitational force exerted by the moon may also influence the water quality. This study was focused on analysis of tidal effect on water quality at the Pahang River. The objectives were to determine the water quality of the Pahang River based on six parameters (BOD, COD,DO, AN, SS and pH) and to classify the Pahang River accordance to the Water Quality Index (WQI) during low tide and high tide from 2008 to 2017. Two stations, 4PH01 and 4PH17 were chosen due to their proximity the river mouth in order to observe the influence of tidal to the water quality at the Pahang River. The results of water quality trends shows the WQI of the Pahang River for the ten years sampling data mostly was in Class II. According to Department of Environment, DOE (2016), Class II of river were suitable for fishery II, water supply II and for recreational use with body contact. Analysis of six parameters shows there was no specific trend for all of them at both stations. The study concluded that there was no significant effects of the tidal to the WQI at both stations due to the distance of these stations are 12.56 km and 56.71 km from the river mouth. This study provides and widen the community knowledge on the pollution of the Pahang River and its current situation based on WQI and expected to raise awareness among society either the public authorities, industrial players or community who lives within the basin about the causes and sources that contribute to water pollution in the Pahang River and can figure out the best solution to prevent further deterioration of the river in future.

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LIST OF SYMBOLS

Ag_2SO_4	Silver Sulphate
BOD_3	Biochemical Oxygen Demand for Three Days
BOD_5	Biochemical Oxygen Demand for Five Days
Cr^{+3}	Chromium (III)
Cr^{+5}	Chromium (V)
$Cr_2O_7^{2-}$	Dichromate
e^-	Electron
H^+	Hydrogen atom
H_2O	Water
$K_2Cr_2O_2$	Potassium Dichromate
NH_3	Ammonia
NH_4^+	Ammonium Ion
OH^-	Hydroxide Ion

LIST OF ABBREVIATIONS

AN	Ammonia Nitrate
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
DID	Department of Irrigation and Drainage
DO	Dissolved Oxygen
DOE	Department of Environmental
EQA	Environmental Quality Act
EQR	Environmental Quality Report
FAS	Ferrous Ammonium Sulphate
GEC	Global Environment Centre
INWQS	Interim National Water Quality Standard
ISLW	Indian Spring Low Water
JUPEM	Jabatan Ukur dan Pemetaan Malaysia
LAT	Lowest Astronomical Tide
NASA	National Aeronautics and Space Administration
NHC	National Hydrographic Centre
NOAA	National Oceanic and Atmospheric Administration
NH_3-N	Ammoniacal Nitrogen
PAIP	Pengurusan Air Pahang
pH	Acidity and Alkalinity
PHN	Pusat Hidrografi Nasional
PSMSL	Permanent Service for Mean Sea Level
RMN	Royal Malaysian Navy
RoL	River of Life
RoL-POP	River of Life Outreach Programme
SIAN	Sub Index Ammoniacal Nitrogen
SIBOD	Sub Index Biochemical Oxygen Demand
SICOD	Sub Index Chemical Oxygen Demand
SIDO	Sub Index Dissolved Oxygen
SIpH	Sub Index pH
SISS	Sub Index Suspended Solid
SS	Suspended Solid
TSS	Total Suspended Solid
US	United State

UTM	Universiti Teknologi Malaysia
WHO	World Health Organization
WQI	Water Quality Index

CHAPTER 1

INTRODUCTION

1.1 Introduction

Water is the basis of all forms of life in this earth and living organisms can withstand only for a short period without water. It is admittedly that water is an essential resource that needed for the very survival of all creatures and for ecological balance. However, the increases rate of worldwide urbanization make the availability of clean water will be worse in the future. Hydrology is the science that encompasses the study of water on the earth's surface and beneath the surface of the earth, occurrence and movement of water, the physical and chemical properties of water, and its relationships with the living and material components of environment (Bales, 2015)

From time to time, surface water resources are being more significant in daily life. 97% of water on the Earth is salty, leaving only 3% as fresh water, of which slightly over two thirds (68.9%) is frozen in glaciers and polar ice caps. The remaining unfrozen fresh water mainly found as groundwater (29.9%) with only a small friction present above ground (0.3%) or in the air (Cassardo and Jones, 2011). Since the fresh water on the earth are finite, surface sources like rivers, lakes, and canals are fully utilised for drinking, public supply, agriculture, irrigation, domestic use, industrial purposes and also for thermoelectric supply. Unfortunately, these important sources seem to be the typical place for discharge of domestic wastes and agriculture's pollutants.

Water pollution sources can be classified as point sources and non-point sources. Point sources of pollution is referring to the waste that are discharged from known sources at an identifiable point to the water body such as industrial wastes, and sewage treatment plants wastes. Non- point sources are defined by multiple discharge point. This

pollution is mainly caused by agricultural runoff, urban stormwater and atmospheric deposition (Zhang, et al., 2016).

1.2 Problem Statement

Water quality of rivers and lakes can be said as common issues discussed in Malaysia. Government and public authorities seems to be alert about the future of the natural water resources. Recognizing this, they intensify their effort to awaken the citizens about the importance of protecting the water resources as water is basic need for humans, ecological balance, and also for national development. The Pahang River has been chosen for the study of water quality by reason of its importance and function to the communities. The Pahang River was acknowledged as the longest river in Peninsula Malaysia and plays a very important role not only for the people living around the area but also for all nearly state in Peninsula Malaysia. People use this river as source of water supply. Due to the hasty growing human population and development process, water quality of rivers in Malaysia, including Pahang River was deteriorated. Consequently, human access to get clean and safe water become a tremendous challenge (Huang, et al., 2015).

Hence, it is necessary to study the level of pollution in our rivers and find out the causes of the pollution in order to find out suitable and better solutions for the problem encountered. This research would serve as a guideline study that is required prior to the future development along the Pahang riverbank. Furthermore, the data collection and data analysis in this research also can serve as reference to do comparisons of water quality in the future. This collected data would be useful to improve the protection of river as the natural water sources.

1.3 Objectives

The objectives of this study are:

i. To determine the water quality of the Pahang River based on six parameters which are Dissolved Oxygen (DO), Biochemical Oxygen

Demand (BOD), Chemical Oxygen Demand (COD), Ammonia Nitrate (AN), pH and Suspended Solids (SS) in order to classify the river.

ii. To classify the Pahang River in accordance to the Water Quality Index (WQI) during high and low tide of water quality profile.

iii. To identify the relationship between WQI and tidal.

1.4 Scope of Study

The scope of study area was at the Pahang River, Pahang, Malaysia. The purpose of this study was to analyse the tidal effect on water quality of the Pahang River. The condition of tidal observation was during low and high tides. Besides, this study was carried out to investigate whether the water quality of Pahang River give the negative impact to the users. The six parameters of water quality were chosen based on the Water Quality Index (WQI) implemented by Department of Environment (DOE) and Interim National Water Quality Standard for Malaysia (INWQS). The six parameters were DO, BOD, COD, AN, pH, and SS. The river was classified based on DOE-WQI.

In this study, sampling points were predetermined for field and laboratory testing. Two parameters involve in in-situ measurement were DO and pH while the other four parameters which are BOD, COD, AN and SS were determined by laboratory testing. The sampling points choosen were based on the distance to the sea in order to see the tidal effect to the water quality. Ten years record (2008 to 2017) obtained from DOE were used for analysis. Besides, classification of the level of pollution in river and identifying types of pollution that exists in the river can be established based on water quality profile of Pahang River. This scope of study portrays an analysis that was implemented to figure out the factors that contributes to the pollution in Pahang River in order to save our natural resources from future degradation.

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