

STUDY ON WATER QUALITY OF THE SUNGAI BALOK,
GEBENG, KUANTAN, MALAYSIA

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BACHELOR ENGINEERING (HONS.) CIVIL ENGINEERING
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MOHD AZZREN BIN SHAM MOHD NASIR

Report submitted in partial fulfilment of the requirements
for the award of the degree of
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SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Bachelor (Hons.) of Civil Engineering.

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STUDENT'S DECLARATION

I hereby declare that the work in this thesis is my own except for quotations and summaries which have been duly acknowledged. The thesis has not been accepted for any degree and is not concurrently submitted for award of other degree

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NOMENCLARATURE

Symbol	Meaning
INWQS	Interim National Water Quality Standard
WQI-DOE	Water Quality Index Department of Environment
pH	Acidity and alkalinity
DO	Dissolve Oxygen
TDS	Total Suspended Solid
TSS	Total Suspended Solid
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
E-coli	Escherichia coli
AN	Ammonia Nitrogen
H ₂ O	Water molecules
NTU	Nephelometric Turbidity Units
O ₂	Oxygen
mg/l or mg/L	milligram per litre
DOE	Department of Environment
ppm	parts per million
mm	millimeter
BOD 5	BOD value of day five
DO 1	DO value of day 1
DO 5	DO value of day 5
P	Coefficient of dilute factor
CO ₂	Carbon dioxide

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ABSTRACT

The Sungai Balok is one of the rivers in Pahang that has been affected by the human activities around the river vicinity mainly by the industrial estate in Gebeng and indirectly affected by the bauxite mining in Bukit Goh, Kuantan. A study was conducted in order to assess the level of pollution in river water samples based on National Water Quality Standard (NWQS) for Malaysia and Quality Index (WQI) at spatial variation along the river. Four stations were selected from the river and standard method was used for analysis. Water samples were collected at four sampling stations along the Sungai Balok. Water quality was assessed based on physical and chemical parameters. These parameters were pH, dissolved oxygen (DO), temperature, turbidity, total suspended solids (TSS), biochemical oxygen demand (BOD), chemical oxygen demand (COD), ammonical nitrogen and selected heavy metals test. The in-situ parameter were DO, temperature, electrical conductivity, turbidity and while the rest of the parameters were analysed in the laboratory. From the results, all parameters were compared to NWQS. The highest average pH value (6.92) was recorded at station 4 in Sungai Balok categorised as class IIB. The DO level showed an average of 5.06 mg/L categorised as class IIB. The BOD values obtained from experiments was ranging between 11 mg/L to 13 mg/L and COD values also high ranging from 14 mg/L to 36 mg/L. Meanwhile the TSS values show a range from 50 mg/L to 62 mg/L which categorised as class III water. The calculation of WQI revealed that the water quality index in Sungai Balok was 57.59 and categorised as class IV. According to NWQS, class IV water can be used as irrigation water. It is proposed that a better regulation needed to be imposed on the surrounding industrial area to prevent a more severe water quality decline in the Sungai Balok. A monthly water quality checks should be performed in the river to monitor the river quality index continuously.

ABSTRAK

Sungai Balok merupakan sebatang sungai di Negeri Pahang yang telah mengalami impak daripada aktiviti manusia terutamanya dari kawasan perindustrian di Gebeng dan juga secara tidak langsung dari aktiviti perlombongan bauksit di Bukit Goh, Kuantan. Kajian ini dijalankan bagi mengukur tahap pencemaran air sungai berdasarkan National Water Quality Standard (NWQS) for Malaysia dan Department of Environment Water Quality Index (DOE WQI) menurut perbezaan ruang sepanjang sungai tersebut. Empat stesyen telah dipilih dari sepanjang sungai dan kaedah standart digunakan untuk analisis. Sampel air diambil di empat stesyen disepanjang Sungai Balok. Kualiti air dikaji berdasarkan parameter fizikal dan kimia. Antara parameter tersebut ialah pH, oksigen terlarut, suhu, kekeruhan, jumlah rampaian tergantung, BOD, COD, ammonia nitrogen dan logam berat terpilih. Oksigen terlarut, suhu, konduktif elektrik, kekeruhan dan pH dianalisa secara in-situ manakala parameter lain diuji secara ex-situ di makmal. Keputusan analisis kemudiannya dianalisis dan dibandingkan dengan NWQS. Berdasarkan keputusan analisis, semua parameter dibandingkan dengan NWQS. Tahap pH dalam Sungai Balok berpurata pada 6.81 dan berada didalam kelas IIB. Tahap DO menunjukkan purata 5.06 mg/L dan termasuk didalam kelas IIB. Nilai BOD yang diperolehi daripada eksperimen adalah dari 11 mg/L hingga 13 mg/L dan nilai COD yang diperolehi adalah dari 14 mg/L hingga 36 mg/L. Sementara itu, nilai TSS menunjukkan bacaan dari 50 mg/L hingga 62 mg/L yang merupakan kelas III. Pengiraan WQI mendedahkan indeks kualiti air di Sungai Balok berada di bawah kelas IV. Mengikut NWQS, untuk kelas IV, air boleh digunakan sebagai sumber pertanian sahaja. Pemantauan dan penguatkuasaan undang undang yang lebih ketat perlu dilaksanakan ke atas pihak industri di kawasan sekitar Gebeng untuk mencegah penurunan yang lebih teruk dalam kualiti air Sungai Balok. Pemantauan secara bulanan perlu dilaksanakan bagi memantau kualiti air di Sungai Balok.

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Water is an essential solvent that has been used for daily activities for millenniums. Water is an important aspect of life not only for human but also other living things. Water quality is the measurement of the suitability of a water source according to the water condition to be used for certain activities such as for personal consumption, industrial uses and also recreational activities. There are two standards that classify the water quality in Malaysia which is National Water Quality Standards for Malaysia and DOE Water Quality Index Classification. There are three types of water quality parameter namely physical, chemical and biological parameter. Parameters such as dissolve oxygen(DO), biochemical oxygen demand(BOD), chemical oxygen demand(COD), total suspended solid(TSS), suspended solid(SS), Ammonical nitrogen(AN) , turbidity, heavy metal, total coliform and temperature are essential in classifying water quality.

Human activities, such as domestic activities, industrial activities and recreational activities are the main concern when dealing with water quality. The industrialization in Malaysia increases the need for factories to be built. With lax in enforcement and preventative effort by authority, most rivers in Malaysia are affected by chemical,

biological and physical waste. Low exposure to environmental issues saw an increase in physical waste being dump into rivers during recreational activities.

According to the Environmental Quality Report 2014, 48% of rivers in Malaysia were polluted which was higher than the previous year. Clean rivers are essential as 97% of our water supply come from rivers and lake. The trend from the report shows the decrease in total number of clean rivers. More of our river systems are being contaminated by agriculture activities and industrial effluents, which are some of the source of pollution to river. Residential area also contributed to river pollution but most of the pollution comes from rural area where there is no centralize waste management system implemented.

Sungai Balok is one of the rivers in Pahang located in Gebeng. Along this river, there are residential and industrial areas. The vicinity of this river to the local industrial area had impacted the river severely. The physical changes to the river such as colouration and smell are a sign of the severity of the pollution in Sungai Balok.

This research is prepared to study on water pollution due to industrial activities and Water Quality Index (WQI) especially in Sungai Balok, Pahang. Water Quality Index (WQI) is a water pollution indicator that used to determine the physic-chemical parameters of surface water.

1.2 Problem Statement

Due to the worldwide concern that good quality freshwater may become a scarce resource in the near future, developing countries and countries with transition economies have increased their interest in water quality monitoring programs during the past decades (Pesce and Wunderlin, 2000). Water consumption for agriculture, industry and domestic activities are essential but the effect of these activities cause river system to become polluted by the after effects of the activities. The demand of clean water is ever increasing due to population growth in Malaysia. River as one of the main source of clean water needed to be classified for specific use and purpose. The quality of water is classified in

term of physical, biological and chemical parameters. There is a level of heterogeneous in temporal and spatial variation of river characterization. Therefore, there is problem in finding out the water quality of a river. Pinpointing the source of river pollution is necessary to effectively curb pollutant from being dump into the river to minimize the chance of pollution from happening again.

Anthropogenic activities have been one of the causes for the damage to watershed system. Anthropogenic activities such as mining, artificial construction, tourism and hot-spring exploitation lead to the degradation of the environment. Pesticides can be introduced into aquatic environments through intentional application, aerial drift, run-off from agricultural applications or run-off from accidental release in agriculture practices. The impacts of the presence of pesticides derived from agricultural practices have generally been associated with significant detrimental changes in the biological communities of riverine environments. Municipal wastes mainly consist of human faeces and contain relatively few chemical pollutants, yet they are notable for high concentration of pathogenic organisms.

The physical, chemical and biological parameters of Sungai Balok needed to be investigated because they area effecting the river water quality. Precipitation and rainfall may dilute chemical waste for a period of time. However untreated waste such as heavy metals from industrial sector is still a main concern for water quality. A constant and thorough observation and investigation will helps identify the pattern of changes in Sungai Balok water quality annually whether it is improving or reducing in quality level. This information is essential to the characterization of Sungai Balok in the future.

1.3 Objectives

The objectives of the study are;

- I. To evaluate the spatial variation of water quality in the Sungai Balok

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