



Faculty of Engineering

WATER QUALITY STUDY ON UNIMAS LAKE

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WATER QUALITY STUDY ON UNIMAS LAKE

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Special dedication to my mother and family.

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LIST OF ABBREVIATION

BOD	-	Biochemical Oxygen Demand
COD	-	Chemical Oxygen Demand
cm	-	Centimetres
DO	-	Dissolved Oxygen
DOE	-	Department of Environmental
FEPA	-	Federal Environmental Protection Agency
H ⁺	-	Ion Hydrogen
L	-	Litre
mg/L	-	Milligram/Litre
ml	-	Millilitre
N ₂	-	Nitrogen Gas
NH ₃ -N	-	Ammonia Nitrogen
NO ₂	-	Nitrite
NO ₃	-	Nitrate
NSF WQI	-	National Sanitation Foundation Water Quality Index

NTU	-	Nephelometric Turbidity Units
OH-	-	Hydroxyl
pH	-	Hydrogen Ion Concentration
RM	-	Ringgit Malaysia
TDS	-	Total Dissolved Solids
TSS	-	Total Suspended Solids
UNIMAS	-	Universiti Malaysia Sarawak
U.S	-	United States
USEPA	-	U.S Environmental Protection Agency
WHO	-	World Health Organisations
WQI	-	Water Quality Index
Y.B	-	Yang Berhormat

ABSTRAK

Kajian kejuruteraan persekitaran merupakan bidang kajian khusus yang memberi fokus kepada bidang rawatan air dan air sisa, dan kawalan kualiti air. Bidang lain yang berkait rapat dengan kejuruteraan persekitaran ini ialah Indeks Kualiti Air yang merupakan kaedah terbaik bagi mengkaji perubahan sifat fizikal, kimia, dan biologi dalam sistem akuatik. Tujuan utama kajian ini ialah untuk menentukan Indeks Kualiti Air bagi tasik UNIMAS dan mengklasifikasikan tasik tersebut berdasarkan piawai Bahagian Persekitaran, dan piawai Kualiti Air Kebangsaan. Kajian ini memfokuskan kepada sifat fizikal dan kimia seperti Oksigen Terlarut (DO), Keperluan Oksigen Biokimia (BOD), Keperluan Oksigen Kimia (COD), Ammonia Nitrogen ($\text{NH}_3\text{-N}$), Jumlah Pepejal Terampai (TSS), dan kosentrasi ion Hydrogen (pH). Enam kerja amali terlibat dalam mengkaji sifat-sifat fizikal dan kimia air sebelum Indeks Kualiti Air bagi tasik UNIMAS dapat ditentukan. Daripada kajian ini, Indeks Kualiti Air bagi tasik UNIMAS ialah 91.44 dan dapat diklasifikasikan sebagai “Bersih” dan “Kelas II”. Kelas II bermaksud, air tersebut sesuai digunakan untuk tujuan bekalan air beserta rawatan yang konvensional diperlukan, sesuai bagi spesies akuatik yang sensitif, selain sesuai untuk kegunaan rekreasi.

ABSTRACT

Environmental engineering studies include a special area of study, which focuses about water and wastewater treatment and water quality control. Another important thing related to environmental engineering is the study about the Water Quality Index (WQI). WQI is the best approach for simulating the physical, chemicals, and biological changes in the aquatic systems. The aim of this study is to determine the WQI for UNIMAS lake and to classify the water based on the Department of Environmental standards and the Interim National Water Quality standards for Malaysia. This study focuses on the physical and chemical parameters such as Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Ammonia Nitrogen ($\text{NH}_3\text{-N}$), Total Suspended Solids (TSS) and Hydrogen Ion Concentration (pH). Six experimental works involved in physical and chemical parameter was carried out to finalize all the parameter value before determining the WQI for UNIMAS lake. From this study, the value of WQI for UNIMAS lake is 91.44 and the lake can be classified as “Clean”. The lake also can be classified as “Class II” which is suitable for water supply with a conventional treatment required, suitable for sensitive aquatic species and also suitable for recreational use with body contact.

CHAPTER 1

INTRODUCTION

Water is mainly used for water supply, industrial and agricultural water supply, hydro-electrical power supply, recreational purposes, navigational and transportation. It shows that, water is the most important elements in our lives, and waters are the soul of life.

Water covers 70% of the world and 97% of it are saline and the remaining 3% is insipid water. Three percent of the insipid water are formed in ice and glaciers or located in the ground surface, which is too difficult and not economical to take out (Miller, 1995). Only 0.003% from the insipid water can be use and it is in the form of soil moisture, groundwater, steams, lakes and rivers. Table 1.1 shows the types of water, volume covered, and percentage of the total water on earth.

Table 1.1: Estimated Earth's Water Inventory

Location	Volume (10³km³)	Percentage total water
Fresh water lakes	125	0.62
Rivers	1.25	
Soil Moisture	65	
Groundwater	8250	
Saline lakes and inland sacs	105	0.008
Atmosphere	13	0.001
Polar ice-caps, glaciers and snow	29200	2.1
Seas and oceans	1320000	97.25
Total	1360000	100

There are two sources of water; surface water and ground water. In Malaysia, surface water is the main source for water supply (Abdillah, 1990). Rivers are the main source for the water supply in Malaysia thus, it is very important to prevent water pollution especially cases which involves the river system.

Water studies may involve fields such as water quality engineering, hydraulic, hydrology, water resource engineering, wastewaters engineering and fluid mechanic. These studies are about water cycle, water in physical, chemical and biological parameters, water quality index, water treatment, the purpose of water and others.

Nowadays the water quality study is very important. In developed and developing countries, supplying water with good qualities is very important because it can contribute in ensuring the health of people.

The function of water quality study is very important. It is used to determine the Water Quality Index (WQI) for water and to classify it from very bad to excellent water condition based on the physical and chemical parameters. From the Interim National Water Quality Standards for Malaysia, water can also be classified into six classes from very bad to excellent classes. The objective of this study closely related to water quality and the determination of WQI of the selected water system. The water system that has been chosen for this study is Universiti Malaysia Sarawak (UNIMAS), which is shown in Figure 1.1.



(UNIMAS website)

Figure 1.1: Location of UNIMAS

1.1 Project Background

Universiti Malaysia Sarawak (UNIMAS) was established on 24th December 1992 as the first public university in the state of Sarawak. UNIMAS is located at Kota Samarahan, about 25 kilometres from the city of Kuching. UNIMAS offers undergraduate degree, postgraduate, and PhD programmes.

The location site for this study is at the UNIMAS lake, which is located at the west campus. Photo 1.1 shows the UNIMAS lake. UNIMAS lake is among the beautiful landscapes of the west campus. It also surrounds part of the new campus landscape. The most popular activity at UNIMAS lake is kayaking. Photo 1.2 shows the kayaking activities. The grandstand and the bridge are the facilities provided for UNIMAS lake surrounding. Photo 1.3 and photo 1.4 shows the facilities provided at UNIMAS Lake. The lake has a maximum depth of 7.62 m and the major source of the lake water is rainfall (Department of Development and Asset Management UNIMAS).