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DUL: Assessment of water quality with depth (temperature, mmonia, nitrate and nitrite) at Tasik SST, UMS

AZAH: SARJANA MUDA SAINS TEKNOLOGI

AYA NISRINAH BT CHE AB. AZIZ SESI PENGAJIAN: 2003/2004
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ASSESSMENT OF WATER QUALITY WITH DEPTH (TEMPERATURE, AMMONIA, NITRATE, AND NITRITE) AT TASIK SST, UNIVERSITI MALAYSIA SABAH

NISRINAH BINTI CHE AB. AZIZ

TESIS INI DIKEMUKAKAN UNTUK MEMENUHI SEBAHAGIAN DARIPADA SYARAT MEMPEROLEHI IJAZAH SARJANA MUDA SAINS DENGAN KEPUJIAN

PROGRAM SAINS SEKITARAN
SEKOLAH SAINS DAN TEKNOLOGI
UNIVERSITI MALAYSIA SABAH

April 2006

DECLARATION

I am declaring that this dissertation is the result of my own independent work, except where otherwise started.

24 March 2006

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HS2003-3186

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ABSTRACT

The study was carried out to determine the status of water quality at Tasik SST, UMS, follow the depth. The water quality was conducted at three different stations. The following analyses were carried out in the field (in-situ) and analysis in the laboratory (ex-situ). YSI 650 Multiparameters Detection System and Hach Kit had been used to obtain the data. Result for the selected parameters, temperature are 30.96°C (0.5m), 30.83°C (1.0m), 30.78°C (1.5m) and 30.41°C(2.0m) ; concentration of ammonia are 0.60mg/L (0.5m), 0.56mg/L (1.0m), 0.58mg/L (1.5m) and 0.58 (2.0m), ; concentration of nitrate are 0.18mg/L (0.5m), 0.18mg/L (1.0m), 0.15mg/L (1.5m) and 0.19mg/L (2.0m). The last is nitrite, the concentrations are 8mg/L (0.5m), 10.33mg/L (1.0m), 13.33mg/L (1.5m) and 20.17mg/L (2.0m). From the study, changes in the chemical composition of the water quality observed. Referring to Interim National Water Quality Standards for Malaysia, the states of water quality suitable for recreational use with body contact.

PENILAIAN KUALITI AIR MENGIKUT KEDALAMAN (SUHU, AMMONIA, NITRAT DAN NITRIT) DI TASIK SST, UNIVERSITI MALAYSIA SABAH

ABSTRAK

Kajian ini dijalankan untuk menentukan status kualiti air di Tasik UMS, mengikut kedalaman yang dijalankan pada tiga stesen yang berlainan. Kajian dilakukan secara in-situ (di lapangan) dan ex-situ (di makmal) melibatkan pemonitoran terhadap parameter fizikal dan kimia. Analisis parameter yang di jalankan di lapangan ialah suhu dan analisis yang di jalankan di makmal ialah ujian ammonia, nitrat and nitrit dengan YSI 650 Multi Parameters Detection System (parameter in-situ) dan Hach Kit (parameter ex-situ). Hasil daripada kajian didapati suhu 30.96°C pada kedalaman 0.5m, 30.83°C pada kedalaman 1.0m, 30.78°C pada kedalaman 1.5m dan 30.41°C pada kedalaman 2.0m ; kepekatan ammonia pula 0.60mg/L pada kedalaman 0.5m, 0.56mg/L pada kedalaman 1.0m, 0.58mg/L pada kedalaman 1.5m dan 0.58mg/L pada kedalaman 2.0m, ; kepekatan nitrat pula 0.18mg/L pada kedalaman 0.5m, 0.18mg/L pada kedalaman 1.0m, 0.15mg/L pada kedalaman 1.5m dan 0.19mg/L pada kedalaman 2.0m. Parameter yang terakhir sekali adalah nitrite, dengan kepekatan 8mg/L pada kedalaman 0.5m, 10.33mg/L pada kedalaman 1.0m, 13.33mg/L pada kedalaman 1.5m dan 20.17mg/L pada kedalaman 2.0m. Di samping itu, perubahan musim yang di sebabkan oleh angin monsun timur mempengaruhi kandungan nutrien. Merujuk kepada piawai Interim Kualiti Air Nasional bagi Malaysia, kualiti air Tasik UMS masih berada pada paras yang bersih dan bersesuaian untuk kegunaan rekreasi yang melibatkan penyentuhan badan.

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%	percent
kg	kilogram
°C	celsius
m^2	meter square
<	more
~	around
m	meter
µg	microgram
g	gram
cm	centimeter
ml	milimeter
mg	miligram
L	liter
N	normal
AH_2	organic matter
CO_2	carbon dioxide
NH_3-N	ammoniacal nitrogen
NH_3	ammonia
NH_4^+	ammonium ion
$(NH_4)_2CO_3$	ammonium salts
NO_3^-	nitrate
NO_2^-	nitrite
N_2O	nitrous oxide
N_2	nitrogen
O_2	oxygen
Amm.N	ammonia nitrogen
BOD	biochemical oxygen demand

COD	chemical oxygen demand
DO	dissolved oxygen
DOE	Department Of Environment
DEP	Department of Environmental Protection
INWQS	Interim National Water Quality Standard for Malaysia
Org.N	organic nitrogen
ORP	oxidation-reduction potential
S1	station 1
S2	station 2
S3	station 3
SS	suspended solids
SST	School of Science and Technology
TSI	Trophic State Index
TSS	total suspended solids
WHO	World Health Organisation
WQI	Water Quality Index

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

It has already been mentioned that for a simplified discussion of the pollution problems, the environment will be divided into three elements: air, water, and soil (Patnaik, 1997). For each of these elements pollution is due to natural and anthropogenic activities (Brauer *et al*, 1981). The most abundant sources of water for human activities are surface waters, which include all the lakes, streams and rivers that flow (eventually) into the oceans that cover approximately 70 percent of the earth's surface. These waters are depleted by evaporation and replenished by precipitation as part of the natural hydrological cycle (Bender *et al*, 1994).

Over 70 percent of the earth's surface is covered by water. Most of this of course, is made up of the oceans. In fact, 97 percent of the earth's water, and only 3 percent from this is fresh water. Of that 3 percent, about 98 percent is frozen in the icecaps of an Antartica and Greenland. But the 2 percent of water that is not frozen makes a wide variety of freshwater ecosystems.

Only 3 percent of the water on earth is freshwater. Freshwater is also found in countless small lakes, ponds, rivers, streams and wetlands. Freshwater ecosystems, large and small, are vital to all of us. Freshwater ecosystems can be grouped into two categories, standing water and flowing water. Ponds and lakes are example of standing waters (Andrews, 1987). Surface waters are also used for transportation, recreation and electric power production, and of course surface water support all the aquatic life on the planet. It also comprises most of the human body and covers 72 percent of the earth. A seemingly endless resource is so valuable that people sometimes fight over it (Bender *et al*, 1994).

Monitoring of water quality in Malaysia has been conducted by Department Of Environment (DOE) since 1978, primarily to establish the status of water quality, detect water quality changes and identify pollution sources. This involves routine monitoring at predetermined stations, in-situ and ex-situ (laboratory analysis), and data interpretation in terms of their physicochemical and biological characteristics.

Water quality appraisal is based on Water Quality Index (WQI), involving parameters such as dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), ammoniacal nitrogen (NH_3-N), suspended solids (SS), and pH. The WQI serves as a basis for assessment of watercourse in relation to pollution categorization and designated classes of beneficial uses accordance with the proposed Interim National Water Quality Standard for Malaysia (INWQS) (JAS, 1999).

The need to define the quality of water has developed with the increasing demand for water quality which is suitable for specific uses and conforms to a desired quality. The most fundamental need is for water suitable for drinking, personal hygiene and food preparation and that poses no risk to human health. Increasing development and its associated industrialization have in addition, introduced the need for water quality with specific physical, chemical or biological characteristics. At the same time, however, water bodies offer a convenient option for the disposal of domestic, agricultural and industrial effluents and wastewater, all of which can significantly affect the natural physical, chemical and biological characteristics of receiving waters (Biswas, 1997).

Water analysis can be performed using a variety of techniques and instruments. The choice of device depends on the identity of the substance being measured, accuracy and precision needed, speed and ease of measurements, and amount of money which the analyst is willing to spend.

Several companies manufacture water test kits for educational use. Most such kits use "wet chemistry" methods involving the observation of some type of chemical reaction. More advanced kits will use these wet chemistry techniques in combination with instruments such as pH meters, hach kit, or other instruments.

1.2 SCOPE

The scope for these studies, to test temperature and concentrations of ammonia, nitrate and nitrite at every depth: 0.5m, 1.0m, 1.5m and 2.0m, for the surface and then compare the water quality parameter with Interim National Water Quality Standard for Malaysia (INWQS).

1.3 OBJECTIVE

1. To measure concentration of ammonia, nitrate and nitrite at Tasik SST.
2. To compare the water quality parameters in these studies with Interim National Water Quality Standards for Malaysia (INWQS).

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

Freshwater ecosystems are characterized as having running water (lotic ecosystems) or still water (lentic ecosystems). Lentic ecosystems (pools, ponds, some swamps, bogs, lakes, etc) vary considerably in physical, chemical, and biological characteristics. In general, they can be considered to have three zones; littoral, limnetic and profundal.

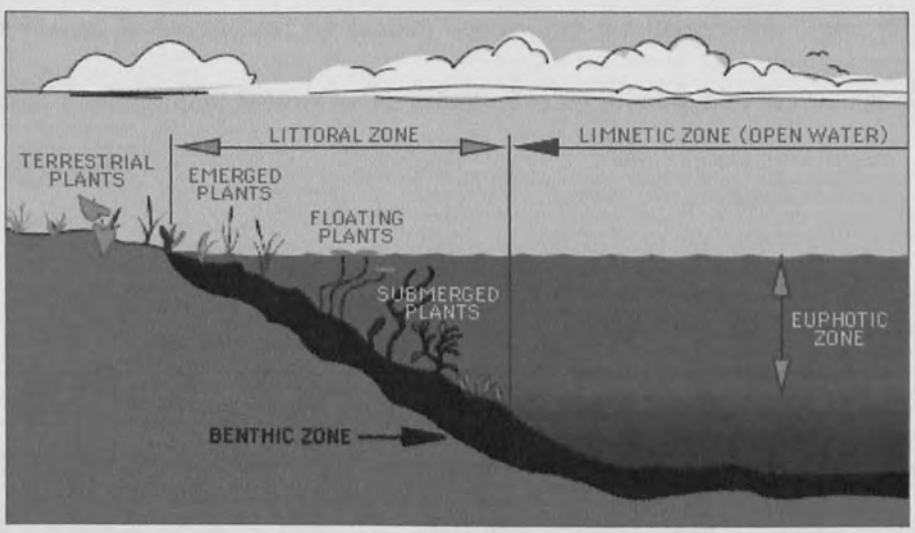

Figure 2.1: Three zones of lake (Sources: Blagojevich, 2004)

From the figure 2.1, a typical lake has distinct zones of biological communities linked to the physical structure of the lake. The littoral zone is the near shore area where sunlight penetrates all the way to the sediment and allows aquatic plants (macrophytes) to grow. Light levels of about 1% or less of surface values usually define this depth. The 1% light level also defines the euphotic zone of the lake, which is the layer from the surface down to the depth where light levels become too low for photosynthesizes. In most lakes, the sunlight euphotic zone occurs within the epilimnion (Blagojevich, 2004).

The littoral zones extends from the shoreline to the innermost rooted plants successively passing from rooted emergent forms, such as reeds and cattail, rooted species with floating levels, such as water lilies, and in deeper waters to various submerged but rooted species. This zone is populated by frogs, snakes, snails, clams, and a considerable variety of adult and larval insects. The depth and extent of the littoral zone, comprising as it does macrophytic plants, is determined by factors controlling the underwater light, its penetration and absorption. Among these factors is the effect of mixing caused by waves carrying varying amounts of sediment.

The limnetic zone is the open water down to the depth of light penetration; in shallow lentic environment the light may penetrate to the bottom. This zone contains phytoplankton that consists of diatoms, green and blue-green algae, and variety of zooplankton from protozoan to microarthropods. It is also the zone for a variety of larger, swimming organisms, the nekton, including fish, amphibians and larger insects.

The profundal zone accurse below the limnetic zone and in deep lakes, such as Lake Superior ; this zone may constitute the largest water volume of a lake. The major food source in the profundal zone comes from a detritus rain from the limnetic (and thus photosynthetic) zone. The bottom consists mostly of decomposers. The nekton vary with the temperature and nutrient conditions ; lake trout are found in the profundal zone of cold, nutrient-poor lakes whereas bass, pike, pickerel, and perch are found in this zone in warmer, nutrient-rich lakes (Kormondy, 1996). Table 2.1 shows five of the great lakes in the world, the lakes is Superior, Huron, Michigan, Erie and Ontario. The biggest lake is Superior with 82,103 square km and 406 meter of maximum depth.

Table 2.1: The great lakes of the world

Lake	Area (square miles)	Area (square km)	Maximum depth (feet)	Maximum depth (meters)
Superior	31,700	82,103	1,333	406
Huron	23,010	59,600	750	229
Michigan	22,300	57,757	923	281
Erie	9,910	25,667	210	64
Ontario	7,540	19,529	802	244

(Source: Beeton, 1969)

2.2 CHEMICAL CHARACTERISTIC

Chemical characteristics tend to be more specific in nature than some of the physical parameters and are thus more immediately useful in assessing the properties of a sample. It is useful at this point to set out some basic chemical; atomic weight, molecular weight, molar solution, valance and normal (N) solution. Chemical characteristics include pH, oxidation-reduction potential (ORP), conductivity, salinity, alkalinity, acidity, hardness, dissolved

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