

STUDY ON CURRENT STATUS OF WATER  
QUALITY AND HEAVY METALS AT  
TASIK CHINI IN 2013 AND 2019 DURING  
DRY SEASON

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## STUDENT'S DECLARATION

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.

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HEAVY METALS AT TASIK CHINI IN 2013 AND 2019 DURING  
DRY SEASON

HANIN ALI YAHYA ALSHAEER

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## DEDICATIONS

Specially dedicated to my beloved parents ,to my beloved uncle Khaled , to my beloved siblings and sisters who they support me and gave me the maximum love and guidance to me which supporting me to complete all the tasks in order to achieve my goals.

To my beloved supervisor, Dr. Nadiatul Adilah Bt Abdul Ghani. ,to my friends and coursemates and for all their encouragement , patience

And support thanks so much for every one that he assist me during  
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## ABSTRAK

Tujuan kajian ini adalah untuk menganalisis kualiti air dan menentukan kepekatan logam berat di tasik Tasik Chini. Kajian ini dijalankan di 4 stesen pensampelan pada tahun 2019 iaitu Sg.Jemberau, Sg.Jeranking, Sg.Gumum dan Sg.Melai semua stesen semasa musim kemarau. Sebanyak tiga belas parameter kualiti air dan dua belas logam berat telah diuji dan berdasarkan Indeks Kualiti Air, Jabatan Alam Sekitar (DOE-WQI) telah dikira dan dikelaskan mengikut Piawaian Standard kualiti Air Negara (INWQS). Antara parameter fizikal dan kimia seperti pH, kekonduksian elektrik (EC), kekeruhan, Suhu, Jumlah Pepejal Terampai (TSS), pepejal terampai (SS), permintaan oksigen biokimia (BOD), permintaan oksigen kimia (COD), oksigen terlarut (DO), nitrogen ammonia (NH<sub>3</sub>-N), nitrat (N), Kalium (K), Fosforus (P) adalah analisis in-situ dan ujian makmal. Dua belas parameter untuk mengenalpasti kepekatan logam berat seperti Iron (III) oksida (Fe<sub>2</sub>O<sub>3</sub>), Silicon Dioxide (SiO<sub>2</sub>), Aluminium Oksida (Al<sub>2</sub>O<sub>3</sub>), Mangan Oksida (MnO), Kalium Oksida (K<sub>2</sub>O), Titanium Dioxide (TiO<sub>2</sub>), Fosforus pentoksida (P<sub>2</sub>O<sub>5</sub>), Barium Oxide (BaO) Lead Oksida (PbO), Kalsium oksida (CaO), trioksida Sulphur (SO<sub>3</sub>), dan zink oksida (ZnO) juga dianalisis dengan menggunakan ujian ICP-MS. Lima parameter kepekatan logam berat untuk diuji ini ialah Cadmium (Cd), Copper (Cu), Chromium (Cr), Zinc (Zn) dan Lead (Pb) diuji dengan menggunakan Spektroskopi Penyerapan Atom (AAS). Hasilnya juga menunjukkan bahawa air Tasik Chini tidak tercemar dalam kajian ini dengan logam berat kerana semua bacaan logam berat direkodkan di bawah Kelas I, yang sesuai untuk pemuliharaan persekitaran semula jadi dan spesies akuatik yang sangat sensitif. Walau bagaimanapun, pembalakan haram, perlombongan besi, aktiviti perindustrian dan pertanian di sekitar tasik akibatnya menjejaskan pencemaran air di Tasik Chini. Keputusan berdasarkan WQI Malaysia menunjukkan bahawa air di Tasik Chini dikelaskan sebagai Kelas III, yang boleh digunakan untuk aktiviti rekreasi. Berdasarkan pemerhatian penggunaan tanah yang dilakukan semasa lawatan tapak dan penilaian tahunan menggunakan aplikasi Google Earth, aktiviti pembalakan haram, perlombongan besi, industri dan pertanian di kawasan sekitar tasik telah menjejaskan kualiti air Tasik Chini

## ABSTRACT

The purpose of this study is to analyse water quality and determine the concentration of heavy metals in Tasik Chini lake. This study was conducted at 4 sampling stations in 2019 which are Sg.Jemberau, Sg.Jeranking, Sg.Gumum and Sg.Melai all stations are during dry season. A total of 13 water quality parameters and 12 heavy metals were measured and classified based on the Interim National Water Quality Standard of Malaysia (INWQS). The measured and analyzed parameter variables were divided into three main categories which are Physical, Chemical and Heavy metals contents. Physical and Chemical parameter variables were Temperature, Dissolved oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solid (TSS), Turbidity, pH, Nitrate(N), Phosphate(P), Ammonia Cal Nitrogen (NH<sub>3</sub>-N), Conductivity (EC), Temperature, and Potassium (K). was analysis in-situ and laboratory experiments. Twelve parameters to identify heavy metals concentration are Iron (III) Oxide (Fe<sub>2</sub>O<sub>3</sub>), Silicon Dioxide (SiO<sub>2</sub>), Aluminum Oxide (Al<sub>2</sub>O<sub>3</sub>), Manganese Oxide (MnO), Potassium Oxide (K<sub>2</sub>O), Titanium Dioxide (TiO<sub>2</sub>), Phosphorus pent oxide (P<sub>2</sub>O<sub>5</sub>), Barium Oxide (BaO), Lead Oxide (PbO), Calcium Oxide (CaO), Sulfur Trioxide (SO<sub>3</sub>), and Zinc Oxide (ZnO) also had test by run ICP-MS. Five parameters of heavy metals concentration to be tested in this research which are Cadmium (Cd), Copper (Cu), Chromium (Cr), Zinc (Zn) and Lead (Pb) were tested by using Atomic Absorption Spectroscopy (AAS). The result also indicates that the Tasik Chini water are not polluted in this study with heavy metals since all heavy metal readings were recorded below Class I, which suitable for conservation of natural environment and very sensitive aquatic species. However, illegal logging, iron mining, industrial and agriculture activities in surrounding of the lake consequently affected the pollution of water at Tasik Chini. Results based on Malaysian WQI have shown that the water in Tasik Chini is classified as Class III, which can be used for recreational activities. Based on the land use observations done during site visits and yearly assessment using Google Earth application, the illegal logging, iron mining, industrial and agriculture activities in the surrounding area of the lake significantly affected the water quality of Tasik Chini.

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## LIST OF ABBREVIATIONS

AN	Ammoniacal Nitrogen
APHA	American Public Health Association
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
DID	Department of Irrigation and Drainage
DO	Dissolved Oxygen
DOE	Department of Environment
EC	Electrical Conductivity
EPA	Environmental Protection Agency
FE	Iron
HACH DR 5000	Spectrophotometer Procedures Manual
H <sub>2</sub> SO <sub>4</sub>	Sulphuric Acid
K	Pottasium
Mg	Magnesium
Mg/L	Milligram per litre
MPN	Most Probable Number
Na	Sodium
NH <sub>3</sub> -N	Ammonical Nitrogen
NO <sup>-3</sup>	Nitrate
NTU	Nephelometric Turbidity Units
NWQS	National Water Quality Standard
pH	Potential Hydrogen
PO <sup>3-4</sup>	Phosphate
SI	Sub-indices
TSS	Total Suspended Solid
US	United State
μs/cm	Microsiemens per centimetre
WQI	Water Quality Index

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Background of study**

Lake is an essential renewable resource for mankind and environment and it is inland bodies of water that lack any direct exchange with an ocean. It is important for industrial and recreational purposes. Quality of water used in lake is affected by the chemical properties of soils. In addition, increasing of heavy metal concentration will be harmful to the aquatic life and affect the quality of water in the lake. According to (Tchobanolous .1985), a plentiful supply of water is clearly one of the most important factors in the development of modern societies. However, lake's water in downstream areas is also important for farmers and fishermen, who depend on the lake for irrigation and fishery. As a result of extensive evaporation of water from the lake due to high temperature and low rain in this region, the increase of salts, heavy metals and other pollutants are responsible factors for the poor quality of the lake ecosystem (Kazi .2009)

Water quality in lake will be affected by surrounding activity near the lake area. The quality of water is identified in terms of it physically, biological and chemical parameters. Human activities near the lake which handled under control will cause lake water polluted. Water pollution is an additional of material and energy which will caused harmful to human beings, animals and aquatic life whom use the water. Term water pollution refers to any types of aquatic contamination between two extremes which are a highly productive enriched water body and a body of water poisoned by toxic chemicals

which eliminate living organism or even exclude all forms of life. (Shafi,2005). Water quality is also an important concern for both human use of lakes and other freshwaters, as well as the ecological value of water bodies. Water quality is used in determining the state of aquatic environments and it is interesting point of study in determining both human impacts and natural processes in the environment. Low water quality affects the value of lakes – both economically, ecologically, and socially. For example, if pollution enters a lake, it can reduce the water quality that it is unsafe to drink as well as harm organisms that live in the water, reducing the ecological value of the lake. These changes can alter perceived value of the water body and hence reduce recreational activity and nearby land values.

Heavy metals are high pollutants because of their relative high toxicity and persistent nature in the environment .Therefore, heavy metal pollution of lakes has a seriously detrimental impact on people and ecosystems that rely on such bodies of water. Heavy metals are of pollutants that cause serious adverse effects to aquatic pollution. These elements are discharge through numerous anthropogenic sources and collective into receiving systems such as sediment, soil and water. Heavy metal pollution of water systems is one of the main causes of environmental hazards, due to their high level of toxicity. Toxic metals are from various sources, such as , namely discharge of industrial or sewage influents, domestic wastewater, periodic precipitation contaminated with airborne pollutants, transport, burning of fossil fuels and fertilizers containing trace metals. Heavy metal concentrations in aquatic ecosystems are usually monitored by measuring its concentration in water , which generally exist in low levels in water. Heavy metal pollution of lakes has a seriously detrimental impact on people and ecosystems that rely on such bodies of water. According to a study published in the current issue of Interdisciplinary Environmental Review, researchers have focused on the physicochemical properties and toxicology of water.

Heavy metals constitute an ill-defined group of inorganic chemical hazards, and those most commonly found at contaminated sites are lead (Pb), Chromium (Cr), Zinc (Zn), Cadmium (Cd), Copper (Cu). Also, heavy metals are commonly defined as those elements with a high relative density. Those heavy metals represent an important group

of inorganic contaminants that may be present in food products. Heavy metals are present in varying concentrations in all ecosystems. They are kept under environmental pollutant category due to their toxic effects on plants, animals and human being. The impact of the heavy metals on aquatic organisms is due to the movements of pollutants from various diffuse or point sources which gives rise to coincidental mixtures in the ecosystem. Thus posing a great threat to aquatic fauna especially to fishes which constitutes one of the major sources of protein rich food for mankind. There is a huge number of heavy metals. They are found in elemental form and in a variety of other chemical compounds. However, heavy metals are produced from a variety of natural and anthropogenic sources.

In addition to being toxic, these elemental metals are also known or probable carcinogens. These metals are common in the environment, occurring in air, food, and water. They occur naturally in water and soil. Additionally, they are released into the environment from industrial processes.

## **1.2 Problem Statement**

Lakes are important sources of water in Malaysia which considered as multipurpose functions. Tasik Chini Lake is facing the issue of water quality pollution. In 2005, the iron mine that located nearby Tasik Chini was re-activated because of the high demand for iron. As indicated by (M. B. Gazim et al. 2012), there are logging, press mineral mining, and oil palm exercises complete by neighborhood occupants at Melai Village upstream of the catchment. Previously, mining was done by a designated mining organization, yet it was surrendered when the legislature ended their agreement. The presence of nutrients and heavy metal from mining activities has given negative impact to the environment especially water quality of Tasik Chini. Mining activity will increase the heavy metal concentration in Tasik Chini (Fernandez, 2012). The increasing of heavy metal concentration will be harmful to the aquatic life and affect the quality of water in lake. Unwell-operated mining activity will caused increasing of heavy metal concentrations in water body.

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