ASSESSMENT AND IMPROVEMENT OF QARUN LAKE WATER CHARACTERISTICS IN FAYOUM GOVERNORATE

By

MORAD MOHAMMAD ABO-ALESAAD ABUGHAMJA
Higher Diploma (Desalination), Institute of Water and Soil, Al-Ajailat, Libya

A Thesis Submitted in Partial Fulfillment

Of

The Requirements for the Degree of

MASTER OF SCIENCE
in
Agricultural Sciences
(Soil Science)

Department of Soil Science
Faculty of Agriculture
Ain Shams University

2018

Approval Sheet

ASSESSMENT AND IMPROVEMENT OF QARUN LAKE WATER CHARACTERISTICS IN FAYOUM GOVERNORATE

By

MORAD MOHAMMAD ABO-ALESAAD ABUGHAMJA
Higher Diploma (Desalination), Institute of Water and Soil, Al-Ajailat, Libya

This thesis for M.Sc. degree has been approved by:

Dr. Hesham Ibrahim El-Kassas ……..
Prof. of Soil and Water Environment, Institute of Environmental Studies and Research, Ain Shams University.

Dr. Mohamed El-Sayed El-Nennah …...……
Prof. Emeritus of Soil Science, Faculty of Agriculture, Ain Shams University.

Dr. Mahmoud Mohamed Elbordiny ….……..
Prof. of Soil Science, Faculty of Agriculture, Ain Shams University.

Date of Examination: / / 2018

ASSESSMENT AND IMPROVEMENT OF QARUN LAKE WATER CHARACTERISTICS IN FAYOUM GOVERNORATE

By

MORAD MOHAMMAD ABO-ALESAAD ABUGHAMJA

Higher Diploma (Desalination), Institute of Water and Soil, Al-Ajailat, Libya

Under the supervision of:

Dr. Mahmoud Mohamed Elbordiny

Prof. of Soil Science, Department of Soil Science, Faculty of Agriculture, Ain Shams University. (Principal Supervisor) .

Dr. Yasser Metwally Zakaria

Lecturer of Soil Science, Department of Soil Science, Faculty of Agriculture, Ain Shams University.

.

ABSTRACT

Morad Mohammad Abo-Alesaad Abughamja. Assessment and improvement of some irrigation water characteristics in Fayoum Governorate. Unpublished M.Sc. Thesis, Department of Soil, Faculty of Agriculture, Ain Shams University, 2018.

This study was conducted to assess and evaluate water quality of Qarun lake, Fayoum Governorate, as a result of drainage wastewater. Some important physio-chemical parameters of Qarun lake were evaluated for the criteria of water quality. Water samples were collected from 46 points in Qarun lake with GPS. Sampling was conducted three times over a period of three years from 2015 to 2017. Water quality parameters such as, pH, electrical conductivity (EC), chemical oxygen demand (COD), sodium adsorption ratio (SAR), sodium percent (SP), macro and micronutrients as well as heavy metals were monitored to determine their status in relation to the health of the water lake ecosystem. The results were then compared to the recommended water quality standards for Egypt and World Health Organization (WHO) with respect to support aquatic life, potable water supply and irrigation.

Water quality index (WQI) reduces the number of parameters used in monitoring water quality to a simple expression in order to facilitate interpretation of the data, allowing public access to water quality data. Values used for different parameters are the mean value of the 46 sites taken from Quron lake during the period from 2014 to 2015 to predict WQI. WQI was calculated by combination of 10 parameters; pH, Cl^-, COD, NO_3^-, NH_4^+, Alkalinity, Fe, Cr, B and P. The relative weight assigned to each parameters ranged from 1 to 5, based on the important parameters for aquatic life. WQI is one of the most effective tools to communicate information on the quality of water to the concerned citizens and policy makers.

Use geographic information systems (GIS) to investigate the effect of time from 2004 to 2017 on Qarun lake water quality degradation. certain amendments i.e., zeolite and bentonite, enormously abundant

natural clay as well as, chitosan, and biochar; natural organic wastes water tested to improve some water characteristics. Laboratory experiments were conducted to study the effect of contact time, dose of different materials as well as pH on the water characteristics.

The results show that the highest values of water parameters were recorded in the samples taken in 2014 far from the discharge point. Whereas, the lowest ones were in 2017 and in the point near the discharge point due to increase of organic matter in this area. The study revealed that all parameters for water Qarun lake were higher than the permissible limits for aquatic life and irrigation. Water of Qarun lake could be classified as it causes sever problems, while waters of Bahr Yossof was classified within the permissible limits. The results indicated that WQI of Qarun lake deteriorated from the year 2014 to 2015 and could be categorized into Unsuitable class.

The results are analyzed by using the GIS which requires building a network database which is linked to GIS to make benefit from its analysis power and geographical distribution of data across the study area. Maps of each parameter water created using geostatistical (Kriging) approach. The maps shows the water quality index for years (2004, 2010, 2014, 2015, 2017). The database used to keep tracking the physical, chemical, and biological pollutants and archiving their behavior through the time.

Zeolite and bentonite were more effective in the removal of cations Whereas, chitosan and biochar were effective in the removal al of anions with increasing contact time. The removal increased to maximum and then decreased with pH variation from 6 to 9. Also data reveal that removal efficiency of the different ions usually improved on increasing adsorbent doses.

Key words: Wastewater, Water quality index (WQI), GIS-Improvement, Water quality, Zeolite, Bentonite, Chitosan, Biochar.

ACKNOWLEDGMENT

The author wishes to express his deepest gratitude to **Prof.Dr. Mahmoud M. Elbordiny** Professor of Soil Chemistry, Soils Dept., Fac. of Agric., Ain Shams Univ., for modification of the experimental work, valuable advice, generous assistance and writing the manuscript.

Special gratitude to and **Dr. Yasser. M. Zakaria** Lecturer of soil pedology, Soils Dept., Fac. of Agric., Ain Shams Univ. for suggesting the title and the pre supervision on this study.

Special thanks to colleagues in the Soil Sci. Dept., Fac. Agric., Ain Shams Univ. for their assistance and encouragement.

I am sincerely grateful thanks and indebted are due to my family, for their help and kind feeling.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATION

BOD	**:**	Biological Oxygen Demand
COD	**:**	Chemical Oxygen Demand
°C	**:**	Temperature
DO	**:**	Dissolved Oxygen
EC	**:**	Electrical Conductivity
EPA	**:**	Environmental Protection Agency
FAO	**:**	Food and Agricultural Organization
FC	**:**	Fecal Coliform
GIS	**:**	Geographic Information System
OP	**:**	Ortho phosphors
SAR	**:**	Sodium Adsorption Ratio
SSP	**:**	Soluble Sodium Percent
TC	**:**	Total Coliform
TDS	**:**	Total Dissolved Solids
TP	**:**	Total Phosphorus
TS	**:**	Total Solids
TSS	**:**	Total Suspended Solid
WHO	**:**	World Health Organization
WQI	**:**	Water Quality Index

INTRODUCTION

Water is the essential need for life. The demand for clean and portable water has increased tremendously due to rapid development and growing population. To preserve water quality and quantity, it is necessary to obtain data from regularly sampling at predetermined stations for in-situ and laboratory analysis. This information permits one to establish priorities with regards to preservation and quality control in the country.

Over the past decades, the natural quality of watercourses has been altered by the impact of various human activities and water uses. Most pollution situations have evolved gradually over time until they have become apparent and measurable. Recognition of a pollution problem, usually took considerable time, and application of the necessary control measures took even longer time.

Qarun lake receives the agricultural and sewage drainage water from El-Fayoum Governorate. Most of the drainage water reaches the lake through two main drains, El-Batts and El-Wadi Drains. Since, 1973 El-Wadi drain partially delivers most of its water into Wadi El-Rayan Lakes to maintain established water level of Qarun lake.

Lake monitoring may provide early warning signs of ecosystem degradation resulting from contaminant inputs, nutrient addition, sediment runoff, and overuse of the resource. By monitoring the physical, chemical, and biological status of a lake, changes for many aspects of the ecosystem can be detected quickly, and hopefully, harmful impacts can be eliminated before their consequences become unmanageable **(Leiser et al., 2005).**

A Geographical Information System (GIS) is an important tool for integrating spatial data with other information. It allows one to analyze the integrated data and to represent the information spatially facilitating planning of resource development, environmental protection and

scientific research. This capability makes GIS a powerful tool for ground water assessments. GIS not only provides tools for interpolating measured values of water quality parameters from specific locations, but also enables one to link water quality with land use, soil characteristics, and other relevant information. In addition, GIS provides sophisticated map-generation capabilities, useful in communication results of data analysis (**Asadi et al., 2007).**

Bentonite, natural zeolite, chitosan and biochar technique was successfully applied to improve wastewater quality and upgrade its use in agricultural and industrial purposes. Bentonite is a natural clay characterized by possessing excess of negative charges on its lattice and swell into very large surface area when dispersed in water. Natural zeolites are environmentally and economically acceptable hydrated aluminosilicate materials with exceptional ion-exchange and sorption properties. Their effectiveness in different technological processes depends on their physical-chemical properties that are tightly connected to their geological deposits. The unique tree-dimensional porous structure gives natural zeolites various application possibilities. Because of the excess of the negative charge on the surface of zeolite, which results from isomorphic replacement of silicon by aluminum in the primary structural units, natural zeolites belong to the group of cationic exchangers. Chitosan has the highest sorption capacity for several metal ions **(Deshpande, 1986).** Chitosan (2-acetamido-2-deoxy-β-D-glucose-(Nacetylglucosamine) is a partially deacetylated polymer of chitin and is usually prepared from chitin by deacetylation with a strong alkaline solution. The term biochar has arisen to describe the type of charcoal that results from the thermal treatment (heating) of natural organic feedstocks (such as crop waste, wood chip, municipal waste or manure) in an oxygen-limited environment. The process is termed pyrolysis in which bioenergy biochar is produced by dry carbonization or pyrolysis and gasification of biomass

INTRODUCTION

Assessment of water quality can be defined as the analysis of physical, chemical and biological characteristics of water. Water quality indices aim at giving a single value to the water quality of a source reducing great amount of parameters into a simpler expression and enabling easy interpretation of monitoring data.

Therefore the purpose of this work was to: (1) assess and evaluate water quality of Qarun lake which collected wastewater from Fayoum Governorate compared with Nile water from Bahr Yossof canal as a control. (2) evaluate of certain natural absobent such as bentonite, zeolite, chitosan and biochar in improving some physical and chemical characteristics of wastewater from Qarun lake. (3) study the change in Qarun lake water characteristics over time.