

WATER CHARACTERIZATION AND TREND ANALYSIS FOR EDKO DRAIN

By

Dalia Shaban Mohamed Abu Salama

B.Sc. Sciences (Physics), Faculty of Girls, Ain Shams University, 1995

**A Thesis Submitted in Partial Fulfillment
of
The Requirements for the Master Degree
in
Environmental Science**

**Department of Basic Sciences
Institute of Environmental Studies & Research
Ain Shams University**

2011

APPROVAL SHEET

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2011

Abstract

Reuse of drainage water seems to be one of the most promising, practical and economical means of increasing the Egyptian water budget. However reuse of drainage water has its limitations. Available information shows that the river Nile, its branches, canals and the drains are suffering from an alarming increase in the pollution through wastewater. The drainage system particularly is receiving the heaviest pollution loads. The major sources of water pollution are agricultural chemicals (Salts, nutrients and pesticides) municipal and rural domestic sewage and industrial wastewater. This is the present situation in Egypt, where dependence on the Nile system makes management of its quality as important as management of its quantity.

The water quality of water resources is a subject of ongoing concern. The assessment of the short and long term water quality changes is also a challenging problem. During the last decade, there has been an increasing demand for monitoring water quality in Egypt in order to provide the policy makers decisions with the information needed to help them manage the water resources without harmful effect for the environment.

The main objectives of this research are to:

- Characterising waters and detecting trends for drainage water quality and quantity data. The data for Edko drain will be used as a case study.
- Investigate the variability of both water quantity and some water quality parameters with time using statistical techniques.
- Detect the general trends for the water quantity and some water quality parameters with time using simple statistical methods.
- Compare the water quality of the drainage water in EdKo drain with the local and international water quality standards.
- Assess the drainage water quantities which officially and unofficially reused.

Summary

Reuse of drainage water seems to be one of the most promising, practical and economical means of increasing the Egyptian water budget. However reuse of drainage water has its limitations Available information shows that the river Nile, its branches, canals and the drains are suffering from an alarming increase in the pollution through wastewater. The drainage system particularly is receiving the heaviest pollution loads.

The main objectives of this research are to:

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- Investigate the variability of both water quantity and some water quality parameters with time using statistical techniques.
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- Compare the water quality of the drainage water in EdKo drain with the local and international water quality standards.
- Assess the drainage water quantities which officially and unofficially reused.

CHAPTER 1

CHAPTER (1) includes the introduction, Problem Definition, and main objectives of this research

CHAPTER II

CHAPTER II Includes Review of Literature which discussed the different Egyptian Water Resources mainly (Conventional and Non-Conventional Water Resources and also contains the different sources of pollution which directly affected on the drainage water quality and the human health whatever this sources was come from the agricultural activities such as the different fertilizers and Pesticides or the pollution due to the arrival of the sewage water to the drainage systems

This Chapter also discussed the Drainage Water Quality Monitoring programme and water quality standards mainly Law 48/1982.

CHAPTER III

This Chapter contains Statistical Framework for Characterizing Water Quality which discussed the general Characteristics of Water Resources Data which mainly contain Seasonal Variation and Auto Correlation and introduce the suggested Statistical framework which describing the water quality .

This frame work consists of the following items:

1. Graphical Analysis of Single Data Sets such as;

- Frequency Tables and Histograms
- Box and Whisker Plots

2. Measures of Central Tendency

Several measures of central tendency for a data set are available such as :

- Mean, Median , Trimmed Mean , Mode

3. Measures of Dispersion such as:

- Range , Variance , Standard Deviation , Standard Error Coefficient of Variation , Coefficient of Skewness ,Kurtosis

4. Cluster Analysis

Cluster analysis is a multivariate technique used to identify similar characteristics in a group of observations.

CHAPTER IV

This Chapter contains The Description of Edko Drain System and Material and Methods which contain the following items:

- Water Quality Monitoring Locations
- Water Quality Parameters
- Sampling Frequency
- Statistical Evaluation

Descriptive Statistics and Percentile Analysis

The common *descriptive statistics* for *the monthly measurements* of 7 WQPs (Q (m.m³/month), BOD (mg/l), DO (mg/l), TDS (mg/l), NO₃⁻¹ (mg/l), NH₄⁺¹ (mg/l) and Fe (mg/l)) measured at the Edko drain monitoring locations during the period from August 2002 to July 2007 were calculated.

In addition, a percentile analysis was employed to identify the percentages of monthly measurements that comply with one or more of the national/international quality standards. These monthly averages were compared with some national and international quality standards

Pollution Loads

In order to identify the relative importance of each tributary (as a point source to Edko drain main stream) in terms of water pollution loads, the monthly average discharges and the estimated pollution loads for some WQPs that were recorded during the period from August 2002 to July 2007 were presented through Box Plots.

Hierarchical Cluster Analysis

The *Hierarchical Cluster Analysis (HCA)* was employed for overall medians of 34 WQPs (Q, Coli, Fecal, BOD, COD, Turb, TSS, TVS, NO_3^{-1} , NH_4^{+1} , TP, Cd, TN, Cu, Fe, Mn, Zn, Pb, Ni, Br, pH, EC, TDS, Ca^{+2} , Mg^{+2} , Na^{+1} , K^{+1} , HCO_3^{-1} , SO_4^{-2} , Cl^{-1} , SAR, Temp, Sal and DO) measured during the period from August 1999 to July 2007.

Trend Analysis

The trend tests; Mann Kendall, Seasonal Kendal and the Modified Seasonal trend tests were employed for the real measurements of all the examined time series except the cases that comprised Q as an exogenous parameter.

CHAPTER V

This Chapter contains The Results and Discussion and The Statistical Evaluation

CHAPTER VI

This Chapter contains The Summary And Conclusions and discussed the following :

Water Quality Status

- **Organic Material and Oxygen**

All locations showed violations of the BOD Egyptian standards for drainage water quality. It is not surprising that the DO concentrations in most locations are below the saturation level.

- **Nutrients**

Nutrients occur in drainage water as a result of the application of fertilizers within the agricultural activities as well as from domestic wastewater. and Ammonium ($\text{N} - \text{NH}_4^{+1}$) does not show large spatial variations over the Delta .

- **Salts**

Total Dissolved Solids (TDS) concentration is a good indicator for the salt concentrations. Generally TDS increases from south to north due to repeated use of water and also due to the local presence of saline groundwater in the north.

Heavy metals

Heavy and trace metals mainly occur in drainage water as a result of industrial discharges or from impurities in fertilizers.

Water Quality Trends

In Edko drain system, significant trends were difficult to proved, as the case with organic pollutants, because three developments influence these parameters: the local wastewater purification, population growth and finally fertilizer use as well as the subsidy policy for fertilizers.

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