APPLICATION OF DYNAMIC UP – FLOW SAND FILTER IN WATER SLUDGE TREATMENT

A Thesis For
Submitted to the Faculty of Engineering Ain Sham University for the Fulfillment of the Requirement of M.Sc. Degree
In Civil Engineering

Prepared by

ENG. MOHAMED KHAIRY MOHAMED IBRAHIM
B.Sc. in Civil Engineering, May 2014
High Institute of Engineering, ElShorouk Academy

Supervisors

Prof. Dr. MAHMOUD MOHAMED ABD ELAZEEM
Professor of Sanitary & Environmental Engineering
Faculty of Engineering, Ain Shams University, Cairo, Egypt

Dr. OLFAT HAMDY IBRAHIM ALI
Associate Professor of Sanitary & Environmental Engineering
High Institute of Engineering, ElShorouk Academy, Cairo, Egypt

Dr. HOSSAM MOSTAFA HUSSAIN
Lecturer of Sanitary & Environmental Engineering
Faculty of Engineering, Ain Shams University, Cairo, Egypt

2019

APPLICATION OF DYNAMIC UP – FLOW SAND FILTER IN WATER SLUDGE TREATMENT

A Thesis For

The M.Sc. Degree in Civil Engineering

(SANITARY & ENVIRONMENTAL ENGINEERING)

by

ENG. MOHAMED KHAIRY MOHAMED IBRAHIM

B.Sc. in Civil Engineering, May 2014

High Institute of Engineering, ElShorouk Academy-Cairo, EGYPT

THESIS APPROVAL

EXAMINERS COMMITTEE **SIGNATURE**

Prof.Dr. Mohamed ElHosseiny ElNadi
Professor of Sanitary engineering
Faculty of Engineering, Ain Shams University

Prof.Dr. Mohamed Elsayd Ali Bassiony
Professor of Sanitary engineering
Faculty of Engineering, Banha University

Prof.Dr. Mahmoud Mohamed Abd ELazeem
Professor of Sanitary engineering
Faculty of Engineering, Ain Shams University

Dr.Olfat Hamdy Ibrahim Ali
Associate Professor of Sanitary engineering
Faculty of Engineering, Elshourok Academy

Date: - ---/--/2019

Dedication

This thesis is lovingly dedicated to all the close, special and beautiful people in my life.

A special dedication to

my Supportive Father

and to

my Mother

and to

my wonderful
Little Sister & Brother

and finally
special dedication to

MY COUSIN

for encouraging me to complete this work and for always being there for me.

STATEMENT

This dissertation is submitted to Ain Shams University, Faculty of Engineering for the degree of M.Sc. in Civil Engineering.

The work included in this thesis was carried out by the author in the department of Public Works, Faculty of Engineering, Ain Shams University, from October 2017 to Novmber 2018.

No part of the thesis has been submitted for a degree or a qualification at any other University or Institution.

The candidate confirms that the work submitted is his own and that appropriate credit has been given where reference has been made to the work of others

Date: - ---/-- /2018

Signature: - ----------

Name: - ***MOHAMED KHAIRY MOHAMED IBRAHIM***

ACKNOWLEDGMENTS

First, thanks are all direct to Allah, for blessing this work until it has reached its end, as a part of generous help throughout my life.

It is with immense gratitude that I acknowledge the support and help of **Professor Dr. MAHMOUD MOHAMED ABDELAZIM**, *Professor of Sanitary & Environmental Engineering Faculty of Engineering, Ain Shams University, this thesis wouldn't have been possible unless his kind efforts, revision and scientific guidance.*

I am profoundly grateful to **Professor Dr. OLFAT HAMDY IBRAHIM**, *Associate Professor of Sanitary & Environmental Engineering, The High Institute of Engineering, EL Shorouk Academy for her great efforts and kind supervision, constructive criticism, true encouragement and keen interest in the progress and accomplishment of this work. I am thankful for all the time and effort she gave me.*

I would like to thank **Dr. HOSSAM MOSTAFA HUSSAIN**, *Assistant Professor of Sanitary Engineering, Faculty of Engineering, Ain Shams University, for his sincere help and guidance, true encouragement and keen interest in the progress and accomplishment of this work. I am thankful for all the time and effort he gave me.*

Sincere thanks to the Officers and staff of Sohag Security Directorate and General Administration of Engineering in Ministry of Interior for facilities, encouragement and cooperation during the preparation of this study

Last but not least, sincere thanks to the staff and personnel of Chemistry Department, in Holding Company of Water and Wastewater HCWW, ***specialy Dr. Ahmed Gamal Yehia ,*** *for facilities encouragement and cooperation during thesis experimental preparation of this study.*

ABSTRACT

Name *:* MOHAMED KHAIRY MOHAMED IBRAHIM

Title*:* "APPLICATION OF USING DYNAMIC UP-FLOW SAND FILTER IN WATER SLUDGE TREATMENT"

Faculty: Faculty of Engineering, Ain Shams University.

Specialty: Civil Eng., Public Works, Sanitary & Environmental Eng.

Abstract:-

In Egypt, Surface water treatment plants produce more than 100 million tons of sludge per year. Disposal of these massive quantities of sludge are discharged into natural water bodies. This study assessed the possibility to use the dynamic up flow sand filtration system (Dyna Sand) as a new technique successfully applied in different countries for water and wastewater from different sources in water sludge treatment. The current study was held to evaluate and examine the efficiency of using dynamic up flow sand filter to treat water works sludge that are produced from the surface water purification in conventional water treatment plants WTPs at different operation conditions.

The study was carried out to examine the performance of the existing conventional

system in handling WTS. The samples were collected from the sludge tanks in the plant. Moreover, samples were taken after the Dyna Sand to examine and prove the success of the filter. The parameters measured to assess the filter were Turbidity, BOD, Residual Aluminum, Algae, Total Bacterial Count and Total Suspended Solids. The filter showed high removal efficiency in eliminating these parameters. The treatment plant effluent resulted highly rates of impurities.

The study shows that the removal ratio for each material as follow:

- The removal efficiency of turbidity reached 94 %,
- Total Suspended Solids 90 %.
- Algae the removal efficiency was found to be 97%
- Bio chemical Oxygen Demand it was 84%.

After Filtration by dynamic up flow sand filter most of these impurities were removed, thus the effluent is complying with the ministry of health requirements for raw drinking water.

SUPERVISORS

Prof.Dr. Mahmoud Mohamed Abdel-Azim,
Ass.Prof. Olfat Hamdy Ibrahim,
Dr. Hossam Mostafa Hussain.

KEY WORDS

Water Sludge treatment (WTS), Dynamic up flow sand filter, Waterworks Sludge, Wastewater, Bio Chemical Oxygen Demand, Residual Aluminum.

TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER II: LITERATURE REVIEW

CHAPTER III: MATERIALS AND METHODS

CHAPTER IV: RESULTS

CHAPTER V: DISCUSSION

LIST OF TABLES

CHAPTER II: LITERATURE REVIEW

CHAPTER III: MATERIALS AND METHODS

CHAPTER IV: RESULTS

CHAPTER V: DISCUSSION

CHAPTER I
INTRODUCTION

1.1. GENERAL

Nowadays, Egypt development are growing quickly especially in cities like Cairo, Alexandria …etc. These developments suffer from several problems as level of utilities service available, the air pollution, the wastewater drainage & disposal and the shortage of potable water required for human usage in such developed cities. Surface water mainly from river is loaded with suspended as well as colloidal solids and other impurities. Raw water requires proper treatment, depending on the quality of available influent and quality needed by the consumers. The conventional WTPs involves the process of coagulation, flocculation, Sedimentation and filtration processes for removing colloidal as well as suspended solids from raw water. All water treatment plants (WTPS) during these treatment produce large quantity of residues or wastes known as water treatment sludge during the purification of raw water finally the water sludge from most of the WTPs is being discharged into nearby drains, which ultimately meet the water source on downstream side of intake.

Filtration systems which has been effectively used in treating several varieties of water resources to produce potable water

around the world (such as England, Sweden, Holland) had succeeded in producing good results. Moreover, Filtration is a unit process widely used in water and wastewater treatment for the removal of particulate materials commonly found in water.

1.2. PROBLEM IDENTIFICATION

Discharging water sludge into river, streams, ponds, lakes, drains etc. or landfilling, the dewatered water sludge is not always abiding to the environmental laws of disposal.

Proper handling and disposal of voluminous sludge produced from water treatment plants has to be economical and environmental friendly managed. Disposal is a challenging task, requires careful consideration and further studies.

1.3. OBJECTIVES OF CURRENT RESEARCH

The general target for the present research is to evaluate and optimize the performance of the dynamic up flow sand filter in treating water sludge from sludge tank in water treatment plant to minimize requirements for reuse