



**FACULTY OF ENGINEERING IN AIN SHAMS  
CIVIL ENGINEERING DEPARTMENT**

**PERFORMANCE ASSESSMENT OF  
DIFFERENT MEDIA FOR A BIOLOGICAL  
FILTER WITHIN LOW COST  
WASTEWATER TREATMENT UNIT**

A Thesis

Submitted to the Faculty of Engineering Ain Shams University  
for the Fulfillment of the Requirement of M.SC Degree in Civil  
Engineering

Prepared by

**ENG. HATEM MOHAMED TAHA**

B.Sc. in civil Engineering 2009, Faculty of Engineering, ASU

**Supervisors**

**Prof. Dr. FIKRY HALIM GHOBRIAL,**

Professor of Sanitary & Environmental Engineering  
Faculty of Engineering, ASU, Cairo, EGYPT

**Prof. Dr. TAREK ISMAIL SABRY,**

Professor of Sanitary & Environmental Engineering  
Faculty of Engineering, ASU, Cairo, EGYPT

**Dr. AHMED SHAFIK ELGENDY,**

Associate Professor of Environmental Engineering  
Institute of Environmental Studies and Research, ASU, Cairo, EGYPT



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**THESIS APPROVAL**

**EXAMINER'S COMMITTEE SIGNATURE**

**Prof. Dr. MOHAMED EL SAID ALI BASSIONY**

.....

Professor of Sanitary & Environmental Engineering Faculty  
of Engineering, Banha University, Banha, Egypt

**Prof. Dr. MOHAMED HASSAN ABD ELRAZEQ**

.....

Professor of Sanitary & Environmental Engineering Faculty  
of Engineering, Ain Shams University, Cairo, Egypt

**Prof. Dr. FIKRY HALIM GHOBRIAL**

.....

Professor of Sanitary & Environmental Engineering Faculty  
of Engineering, Ain Shams University, Cairo, Egypt

Date: ----/--/2014

## DEDICATION

This work takes a period from my life. I wish to dedicate it to  
whom suffered to educate, prepare, build capacity and help  
myself to be as I am;

TO

**MY FATHER, MY MOTHER,  
MY SISTER&MY BROTHER**

ALSO TO MY  
***NIECE***

## 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 December 2009 to December 2013.

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

Date: - ---/---/2014

Signature:- -----

Name:- **HATEM MOHAMED TAHA**

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*At the end no words can express my deep thanks and regard to my beloved family*

# ABSTRACT

**Name:** *HATEM MOHAMED TAHA*

**Title:** **PERFORMANCE ASSESSMENT OF DIFFERENT MEDIA FOR A BIOLOGICAL FILTER WITHIN LOW COST WASTEWATER TREATMENT UNIT**

**Faculty:** *Faculty of Engineering, Ain Shams University.*

**Specialty:** *Civil Engineering, Public Works, Sanitary Engineering.*

**Summary:**

Wastewater treatment is one of the important subjects taken into consideration in developing countries. In such countries, the main source of pollution is due to discharging wastewater without adequate treatment into watercourses.

The use of conventional types of wastewater treatment in these countries in the rural areas is hindered by the huge investments and large area requirements of agricultural land. These reasons led the scientific community to seek solutions relying on the use of local products or by-products to establish low cost wastewater treatment systems employing new modified techniques suitable for serving different specific conditions.

Also, the concentration on minimizing of power consumption, maintenance requirements, complicated techniques and imported equipment became one of the main targets for the ongoing studies. This leads to choose the attached growth system after the anaerobic treatment unit to decrease the required land, minimize the construction and operation cost as possible and reach the requirements of law 48.

This study was carried out to check the possibility of applying biological filters following the USBR system. The biological filter receives the Down-flow effluent from the USBR system, which drops through perforated trays to increase the DO in level, before being introduced to the biological filter.

Four selected different filtration packed media were used as aerobic biological filter units. All the media are available in the local market, the tested media (sponge, plastic, Electrical flexible corrugated hoses, and gravel) were used in parallel modules to evaluate the performance of each separately and determine its removal efficiency for the different pollutants represented by the parameters COD, CODs, TSS, and VSS. To achieve the study objectives the tested media were exposed to several hydraulic loading rates and shock load during the experimental program using continuous flow pilot plant running for seven months period.

The use of passive aeration after the anaerobic phases of the treatment increases the dissolved oxygen contents of the anaerobic effluent to reach an average concentration of 5.22 mg/L.

All tested media achieved good removal efficiency of the monitored pollutants under hydraulic loading rate of  $2.5\text{m}^3/\text{m}^2/\text{day}$  to  $12\text{m}^3/\text{m}^2/\text{day}$  and produced effluent quality that meets Law 48 requirements most of the time.

The best removal efficiency occurred at hydraulic loading rate range of  $2.5\text{--}3.75\text{m}^3/\text{m}^2/\text{day}$  for all tested media. The best two media, however, were sponge and plastic.

All the tested media were affected during the shock load and impaired the effluent quality, but after 48 hours effluent quality returned back to the regular background range except gravel.

The sponge media was the best media for all hydraulic loading rates due to the big surface area and the high catchment of water that keep the biofilm wet at low hydraulic loading rate.

KEY WORDS :

**Wastewater, Wastewater Treatment, Attached growth system, Biological filter media, low cost treatment system.**

## **WHO ARE THESE SUPERVISORS**

### **Supervisors:**

**Prof. Dr. FIKRY HALIM GHOBRIAL,**

**Dr. TAREK ISMAIL SABRY,**

**Dr. AHMED SHAFIK ELGENDY**

## ABBREVIATIONS

| SYMBOL | MEANING                            |
|--------|------------------------------------|
| BOD    | Biochemical Oxygen Demand          |
| COD    | Chemical Oxygen Demand             |
| TSS    | Total Suspended Solids             |
| VSS    | Volatile Suspended Solids          |
| TKN    | Total Kjeldahl Nitrogen            |
| CODs   | Soluble Chemical Oxygen Demand     |
| BAF    | Biological aerated filters         |
| DBAF   | Dual Biological Aerated Filter     |
| RBC    | Rotating Biological Contactors     |
| USBR   | Upflow Septic Tank Baffled Reactor |
| DO     | Dissolved Oxygen                   |



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