



# **WATER TREATMENT FOR BOILERS NEEDS**

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

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B.Sc. in Civil Engineering, June 2009  
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(SANITARY ENGINEERING)**

by  
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# **DEDICATION**

I wish to dedicate this work to who suffered to educate, support  
and encourage me during the thesis work

**TO  
MY MOTHER  
MY FATHER SOUL**

**MY SISTER,  
MY BROTHER  
&**

**MY FRIENDS**

Also, I wish to dedicate my thesis to my professor

**PROF. DR. MOHAMED EL HOSSEINY EL NADI**

For his encouragement and support to complete this work.

## 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 MAY 2011 to DECEMBER 2012.

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: -        ---/-- /2013

Signature: - -----

Name: - *SHOROUK MOHAMED EL-BEHIERY*

## **ACKNOWLEDGMENT**

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## **ABSTRACT**

**NAME: - SHOROUK MOHAMED MOSTAFA EL-BEHIERY**

**Title: - “WATER TREATMENT FOR BOILERS NEEDS”**

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

**Specialty:** - Civil Eng., Public Works, Sanitary Eng.

**Abstract:-**

This study was made for main source of water in Egypt such as (surface water, ground water, sea water and portable water) that are not matching the required limits for boiler water .Untreated water caused many problems to the boiler, from here the study aim was treatment of water for boiler needs.

Several raw water samples from different possible sources (sea, surface and ground water) for water supply around Egypt were taken to obtain the water resources criteria around the country and to determine the possible treatment needed to produce suitable water for boiler use.

A treatment lines were proposed for each type of water resources applied in the study to obtain the suitable water inside boiler water limits. Laboratory analysis were made to investigate the most applicable treatment system (technically & economically) line for each water resource (sea, surface and ground water).

A comparison between the different treatment lines for each water resource was made to reach the optimum treatment line that meets the water criteria of the source. Then another comparison between the three different treatment lines for the three types of water resources to get the most optimum treatment solution technically and economically that can meet any type of water from these resources and produce water within the boiler water limits.

### **SUPERVISORS**

**Prof. Dr. Mohamed EL Hosseiny EL Nadi,**

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# **TABLE OF CONTENTS**

	<b>Page</b>
<b>COVER</b>	<b>i</b>
<b>APPROVAL COMMETTI</b>	<b>ii</b>
<b>DEDICATION</b>	<b>iii</b>
<b>STATEMENT</b>	<b>iv</b>
<b>ACKNOWLEDGEMENT</b>	<b>v</b>
<b>ABSTRACT</b>	<b>vi</b>
<b>TABLE OF CONTENTS</b>	<b>vii</b>
<b>LIST OF FIGURES</b>	<b>ix</b>
<b>LIST OF TABLES</b>	<b>xiii</b>
<b>CHAPTER I: INTRODUCTION</b>	
<b>1.1 BACKGROUND</b>	<b>1</b>
<b>1.2 AIM OF STUDY</b>	<b>1</b>
<b>1.3 SCOPE OF WORK</b>	<b>2</b>
<b>1.3.1 PRACTICAL APPLICATION STUDY</b>	<b>2</b>
<b>1.3.2 ANALYTICAL STUDY</b>	
<b>1.4 THESIS ORGANIZATION</b>	
<b>CHAPTER II: LITERATURE REVIEW.</b>	
<b>2.1 INTRODUCTION.</b>	<b>4</b>
<b>2.2 BOILER APPLICATION.</b>	<b>4</b>
<b>2.2.1 BOILING WATER FOR HEATING PURPOSES.</b>	
<b>2.2.2 ELECTRICITY GENERATION.</b>	<b>4</b>
<b>2.2.3 USING VAPOR FOR STRILIZATION.</b>	<b>5</b>
<b>2.2.4 STEAM TURBIN.</b>	<b>5</b>
<b>2.2.5 STEAM ENGINES.</b>	<b>6</b>
<b>2.2.6 VAPOR STEAM CLEANER.</b>	<b>6</b>
<b>2.3 WATER TREATMENT.</b>	<b>6</b>
<b>2.3.1 EXTERNAL TREATMENT.</b>	<b>6</b>
<b>2.3.2 INTERNAL TREATMENT.</b>	<b>7</b>
<b>2.3.3 CONDENSATE TREATMENT.</b>	<b>9</b>
<b>2.4 WATER SUPPLY CRITERIA FOR BOILER.</b>	<b>9</b>
<b>2.5 BOILER WATER PROBLEMS.</b>	<b>10</b>
<b>2.5.1 SCALING.</b>	<b>11</b>
<b>2.5.2 CORROSION.</b>	<b>12</b>
<b>2.5.3 CARRY OVER.</b>	<b>13</b>
<b>2.5.4 SILICA PROBLEMS.</b>	<b>13</b>
<b>2.5.5 FOULING.</b>	<b>13</b>

**CHAPTER III: MATERIALS & METHODS**

- 3.1 STUDY LOCATION**
- 3.2 LAB SCALE TREATMENT UNIT**
  - 3.2.1 DESIGN CRITERIA**
  - 3.2.2 TREATMENT UNIT DESCRIPTION**
- 3.3 OPERATION PROGRAM**
- 3.4 SAMPLING**
- 3.5 MEASURING ANALYSIS**
  - 3.5.1 BOD (BIOLOGICAL OXYGEN DEMAND)**
  - 3.5.2 COD (CHEMICAL OXYGEN DEMAND)**
  - 3.5.3 PH VALUE**
  - 3.5.4 HEAVY METALS**
  - 3.5.5 TSS (TOTAL SUSPENDED SOLIDS)**

**CHAPTER IV: RESULTS.**

- 4.1 GENERAL. 45**
- 4.2 RAW WATER CHARACTERISTIC FOR DIFFERENT SURFACE WATER SOURCES. 48**
  - 4.2.1 RAW WATER CHARACTERISTIC FOR UPPER EGYPT SURFACE WATER SOURCES. 52**
  - 4.2.1 RAW WATER CHARACTERISTIC FOR DIFFERENT SURFACE WATER SOURCES. 56**
- 4.3 RAW WATER CHARACTERISTIC FOR DIFFERENT GROUND WATER SOURCES 61**
  - 4.3.1 RAW WATER CHARACTERISTIC FOR UPPER EGYPT GROUND WATER SOURCES**
- 4.4 RAW WATER CHARACTERISTIC FOR DIFFERENT SEA WATER SOURCES.**
  - 4.4.1 RAW WATER CHARACTERISTIC FOR UPPER EGYPT SEA WATER SOURCES.**
  - 4.4.2 RAW WATER CHARACTERISTIC FOR LOWER EGYPT SEA WATER SOURCES.**

<b>CHAPTER V: DISSCUSION</b>	
<b>5.1 GENERAL</b>	<b>63</b>
<b>5.2 CHOICE OF SUITABLE TREATMENT</b>	
<b>5.2.1 WATER TREATMENT FOR SURFACE WATER SOURCES.</b>	<b>64</b>
<b>5.2.2 WATER TREATMENT FOR GROUND WATER SOURCES.</b>	<b>65</b>
<b>5.2.3 WATER TREATMENT FOR SEA WATER SOURCES</b>	<b>65</b>
<b>5.2.4 FINAL COMBIND WATER TREATMENT FOR ALL WATER SOURCES.</b>	<b>66</b>
<b>5.2.5 FINAL SIMPLIFIED WATER TREATMENT FOR ALL WATER SOURCES.</b>	<b>69</b>
<b>CHAPTER VI: CONCLUSION</b>	
<b>6.1 CONCLUSION</b>	<b>77</b>
<b>6.2 RECOMMENDATIONS</b>	<b>78</b>
<b>6.3 FURTHER WORK</b>	<b>79</b>
<b>REFERENCES</b>	<b>80</b>

## LIST OF FIGURES

<b>Figure</b>	<b>Page</b>
<b>CHAPTER (II) LITERATURE REVIEW</b>	
Figure (2/1) Clarifier	22
Figure (2/2) Two bed demineralizer	23
Figure (2/3) Simple figure for the reverse Osmosis	24
Figure (2/4) De-aeration	
<b>CHAPTER III: MATERIALS &amp; METHODS</b>	
Figure (3/1) Spectrophotometer	35
Figure (3/2) Atomic-absorption	36
Figure (3/3) PH Meter	37
Figure (3/4) Turbidimeters	38
Figure (3/5) Electric Balance	38
Figure (3/6) Electric Draying Furnace.	39
Figure (3/7) Electric Oven.	39
Figure (3/8) Standard Glass Goshes.	41
Figure (3/9) Photo of jar testing apparatus	42
<b>CHAPTER (V) DISCUSSION</b>	
Figure (5/1) Flow line for surface water treatment	43
Figure (5/2) Treatment flow line for ground water	44
Figure (5/3) Treatment flow line for sea water	55
Figure (5/4) Flow line for proposed general water treatment	56
Figure (5/5) Final Simplified Water Treatment Flow line	56
Figure (5/6) Final Simplified Water Treatment Flow Line in Detailed	

## LIST OF TABLES

<b>Table</b>	<b>Page</b>
<b>CHAPTER II LITERATURE REVIEW</b>	
Table (2/1) Characteristics of water for fire tube boiler(up to 25 bar)	15
Table (2/2) Characteristics of water for water tube boilers. Natural circulation softened or softened, carbonate-free make-up water	30 32
Table (2/3) Characteristics of water for water tube boilers. Natural circulation demineralized water.	33
Table (2/4) Average values of Wastewater Chemical Treatment in Paints Company	45
<b>CHAPTER IV RESULTS</b>	
Table (4/1) Water Characteristics in Abu Simbel	49 52
Table (4/2) Water Characteristics in Aswan	
Table (4/3) Water Characteristics in Edfu	53
Table (4/4) Water Characteristics in Luxor	57
Table (4/5) Water Characteristics in Qena	
Table (4/6) Water Characteristics in Nagahamd	58
Table (4/7) Water Characteristics in Misr El Kadema	61
Table (4/8) Water Characteristics in America	
Table (4/9) Water Characteristics in Menofiya	62
Table (4/10) Water Characteristics in Kafr El Shiekh.	
Table(4/11) Water Characteristics in Al-Hamol ( Kafr El Sheikh	
Table (4/12) Water Characteristics in Nokra	66
Table (4/13) Water Characteristics in Dandara	67
Table (4/14) Water Characteristics in Sepaaeyah	68
Table (4/15) Water Characteristics in Balat.	68
Table (4/16) Water Characteristics in Paris	69
Table(4/17) Water Characteristics in Mout	75
Table (4/18) Water Characteristics in Esna.	77
Table (4/19) Water Characteristics in Abutesht	
Table (4/20) Water Characteristics in Nakada	
Table (4/21) Water Characteristics in Marsa Alam.	
Table (4/22) Water Characteristics in Al Qusier	
Table (4/23) Water Characteristics in Hurghada.	
Table (4/24) Water Characteristics in Sharm El sheikha.	
Table (4/25) Water Characteristics in Ras Ghareb	
Table (4/26) Water Characteristics in Matrouh.	

Table (4/27) Water Characteristics in Al Saloum

**CHAPTER V: DISSCUSION**

Table(5/1) Surface water proposed Treatment

Table (5/2) Treated Surface water Results

Table (5/3) Ground water proposed Treatment

Table (5/4) Treated ground water Results

Table (5/5) Sea water proposed Treatment

Table (5/6) Treated sea water Results

# **CHAPTER I**

## **INTROUDUCTION**

### **1.1 BACKGROUND.**

The main source of water in Egypt such as (surface water, ground water, sea water and potable water) cannot match the required limits for boiler water .Untreated water to enter the boiler caused many problems, from here was the proposal subject to reach a form of treatment so when enter any source of water is obtained on the required specifications of the boiler.

Several studies had been applied to solve the problems of boiler. Our study will concentrate on this procedure of treatment.

### **1.2 AIM OF STUDY.**

This study objective study is combined the treatment units to treat all types of water to get the required specifications for boiler water with high efficiency and minimum cost.

### **1.3 SCOPE OF WORK.**

The study work plan is divided in to two main items:

- 1- Practical Application.
- 2- Analytical study.

And these two items were carried out according to several steps with different components to achieve the study objective as follows:

#### **1.3.1 PRACTICAL APPLICATION STUDY**

The study will apply experimental work according to specified program including the following:

- Take a several raw water samples from different possible source (sea, surface and ground water) for water supply around Egypt.
- Obtain the water criteria for different water source.

- Identify the required criteria for boiler water.
- A treatment lines were proposed for each type of water resources applied in the study to obtain the suitable water inside boiler limits.
- Laboratory analysis were made to investigate the most applicable treatment system (technically & economically) line for each water resource (sea, surface and ground water).
- A comparison between the different treatment lines for each water resource was made to reach the optimum treatment line that meets the water criteria of the source.
- There will be another comparison between the three different treatment lines for the three types of water resources to get the most optimum treatment solution technically and economically that can meet any type of water from these resources and produce water within the boiler water limits.

### **1.3.2 ANALYTICAL STUDY**

The analytical study is divided to three main tasks to cover the following items:

#### **1.3.2.1 DATA COLLECTION**

- Literature review for all the previous studies for boiler water treatment, water supply criteria for boiler, boiler application and boiler water problem.
- Study the boiler water application in Egypt and its problems.

#### **1.3.2.2 RESULTS ANALYSIS AND DISCUSSION**

- Analysis of all measured parameters and evaluation of field results to determine the system performance the effecting parameters.
- Study the procedure to give stable results and optimize the impurities content that cause problems for the boiler.
- Obtain the main affecting parameters.
- Put the treatment design for different water source for boiler.

### **1.3.2.3 THESIS PREPARATION**

- Complete the analysis and its discussion.
- Write the thesis.
- Discuss the results and define conclusions and recommendations.
- Complete the thesis in its final shape for judging.

## **1.4 THESIS ORGANIZATION**

The thesis consists from six chapters in addition to references and Arabic and English summary they could be illustrated as follows:

### **1.4.1 CHAPTER I: INTRODUCTION**

This chapter covers the study background about the boiler water and its problem, the objectives of this study, the scope of the study work and finally thesis organization and its contents.

### **1.4.2 CHAPTER II: LITERATURE REVIEW**

This chapter includes introduction about boiler and its importance application in world and in Egypt. Then it covers boiler water criteria, boiler water problems and finally different methods of water treatment for boiler water (internal and external treatment).

### **1.4.3 CHAPTER III: MATERIALS & METHODS**

This chapter illustrates the locations of collected samples and the time of taking them and the instruments and methods for measuring them according to the standard methods also presented the laboratory work for treating water to meet the required standards.

### **1.4.4 CHAPTER IV: RESULTS**

This chapter shows all the results of the characteristics for different raw water sources used in the study. Also it presented the results of the laboratory treatment work that made for each type of water due to its source.