



IMPROVEMENT OF THE SOLAR MIRRORS DESALINATION PLANTS

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

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2019



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Dedication

*This thesis is dedicated to those who
contributed to educating, raising and
supporting me to be able to accomplish in
this picture.*

***Special dedication to my professor and my
father***

PROF. DR. MOHAMED EL HOSSEINY EL NADI,
*for his help, guiding and encouraging me to
complete this work*

A special thanks to

MY PARENTS

***MY BROTHER & MY HUSBAND AND
MY DAUGHTER***

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

And finally

Special dedication to

ASSIS.PROF. DR. AISHA ZAKI MAGE
*for her help, guiding and encouraging me 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 November 2016 to December 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: - ---/-- /2019

Signature: - -----

Name: - *Rania Adel Soliman Amin*

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. Mohamed El Hossieny El Nadi**, Professor emeritus of Sanitary & Environmental Engineering Faculty of Engineering, Ain Shams University, this thesis wouldn't have been possible unless his great efforts, true encouragement, meticulous revision, scientific guidance and tremendous support. I am thankful for all the time and effort he gave me.*

*I am profoundly grateful to **Associate Professor Dr. Mohamed Sobhy Abdel Rahaman**, Associate Professor of Sanitary Engineering, Faculty of Engineering, Ain Shams University, for his revision and accomplishment of this work.*

*I would like to thank **Dr. Aisha Zaki Maged Mostafa**, Assistant professor emeritus of Sanitary Engineering, Faculty of Engineering, Ain Shams University, for her close and kind supervision, her 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 she gave me*

*I would like to thank **Dr. Hossam Mostafa Hussein**, Assistant professor of Sanitary Engineering, Faculty of Engineering, Ain Shams University, for his revision of this work.*

ABSTRACT

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Title: “IMPROVEMENT OF THE SOLAR MIRRORS
DESALINATION PLANTS .”

Faculty: Faculty of Engineering, Ain Shams University.

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

Abstract:

For the shortage of water resources in Egypt and Arab countries, A need to develop low cost technology of seawater desalination to save a resource of potable water. The objective of this thesis is to improve the recovery ratio and the efficiency with minimum cost of the direct Solar desalination system plant using concentrated mirrors. The pilot plant was erected on the experimental laboratory site area of faculty of engineering, Ain Shams university, Cairo, Egypt. This study was made in summer in four months which covers the best climatic period which helped in obtaining the best performance of the pilot plant.

The pilot plant after the improvement was made from acrylic with a glass face to allow the Sun rays passing through it and heat the raw water without any losing in energy. The system used three mirrors of galvanic steel to concentrate sun rays on seawater channels and directed for the all Sunshine period. The raw water heated by a solar collector made from a red copper in wooden box lined with a glassy wool and galvanized steel sheet painted with a black and covered with a glass.

The measurements for temperature, TDS, PH, and the flow rate of inlet and outlet waters and recorded the air temperature, humidity ratio and the sunshine period.

The results were good in quality and quantity of produced fresh water with minimum cost. The thesis shows that the recovery ratio was (8%-45%) which is a good ratio and TDS was 120 ppm even though the degree of salinity of inlet seawater that tell us the high efficiency of the pilot plant in salts removal.

The low in construction cost, easy in operating, and the high of efficiency give it the chance to be the most preferable solution for desalination technically and financially.

SUPERVISORS

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Assistant Prof. Dr. Hossam Mostafa Hussein.

KEY WORDS Desalination, Solar desalination, Solar collector, Seawater, Fresh water.

TABLE OF CONTENT

| | Page |
|---|-------------|
| COVER | i |
| APPROVAL COMMITTEE | ii |
| DEDICATION | iii |
| STATEMENT | iv |
| ACKNOWLEDGMENTS | v |
| ABSTRACT | vi |
| TABLE OF CONTENTS | vii |
| LIST OF TABLES | x |
| LIST OF FIGURES | xi |
| | |
| CHAPTER I: INTRODUCTION | 1-3 |
| | |
| 1.1 BACKGROUND | 1 |
| 1.2 STUDY OBJECTIVES | 2 |
| 1.3 SCOPE OF WORK | 2 |
| 1.3.1 THEORTICAL PART | 2 |
| 1.3.2 EXPERIMENTAL PART | 2 |
| 1.4 THESIS ORGANIZATION | 3 |
| 1.4.1 CHAPTER I: INTRODUCTION | 3 |
| 1.4.2 CHAPTER II: LITERATURE REVIEW | 3 |
| 1.4.3 CHAPTER III: MATERIALS AND METHODS | 3 |
| 1.4.4 CHAPTER IV: RESULTS | 3 |
| 1.4.5 CHAPTER V: DISCUSSION | 3 |
| 1.4.6 CHAPTER VI: CONCLUSIONS | 3 |
| | |
| CHAPTER II: LITERATURE REVIEW | 4-33 |
| | |
| 2.1 INTRODUCTION | |
| 2.2 METHODS OF DESALINATION | 5 |
| 2.2.1 THERMAL DESALINATION | 7 |
| 2.2.1.1 THERMAL EVAPORATION TECHNIQUES | 7 |

| | |
|---|-----------|
| a. Multi Stage Flash Desalination (MSF) | 7 |
| b. Multiple Effect Desalination (MED) | 9 |
| 2.4.1.3 Mechanical Vapour Compression (MVC) | 9 |
| c. Thermal Vapour Compression (TVC) | 10 |
| d. Solar Desalination (SD) | 12 |
| 2.2.1.2 CRYSTALLISATION | 12 |
| a. Freezing | 12 |
| b. Humidification De-Humidification (HDH) | 14 |
| 2.2.1.3 FILTRATION & EVAPORATION | 15 |
| 2.2.2 MECHANICAL DESALINATION | 15 |
| 2.2.2.1 MECHANICAL VAPOUR COMPRESSION (MVC) | 15 |
| 2.2.2.2 REVERSE OSMOSIS | 18 |
| 2.2.3 ELECTRICAL SELECTIVE FILTRATION (ELECTRO DIALYSIS (ED) PROCESS) | 20 |
| 2.2.4 CHEMICAL DESALINATION (ION EXCHANGE) | 21 |
| 2.2.4.1 DESAL PROCESS | 22 |
| a. THREE-UNIT VARIATION | 22 |
| b. TWO-UNIT VARIATION | 23 |
| 2.2.4.2 RDI PROCESS | 24 |
| 2.2.5 BIOLOGICAL DESALINATION | 25 |
| 2.3 SOLAR DESALINATION | 26 |
| 2.3.1 DIRECT SOLAR DESALINATION | 27 |
| 2.3.1.1 DESCRIPTION OF DIRECT SOLAR STILLS | 27 |
| 2.3.1.2 DIFFERENT SHAPES OF SOLAR STILLS | 28 |
| a. The Inclined or Tilted-Tray Solar Still | 28 |
| b. Tilted-Wick Still | 28 |
| c. Multiple-Wick Solar Still | 28 |
| d. Multiple-Effect Diffusion Solar Still | 29 |
| 2.3.2 INDIRECT SOLAR DESALINATION | 29 |
| 2.3.2.1 SOLAR DESALINATION BY MIRRORS | 30 |
| 2.4 FACTORS AFFECTS SOLAR STILLS | 32 |
| 2.5 APPLICATIONS OF SOLAR STILLS | 33 |
| 2.6 PROBLEMS FACED SOLAR STILLS | 33 |

CHAPTER III: MATERIALS AND METHODS 34-40

| | |
|---|-----------|
| 3.1 LOCATION OF STUDY | 34 |
| 3.2 PROPOSED PILOT | 34 |
| 3.3 PILOT PLANT MODIFICATIONS | 37 |
| 3.4 WATER PATH THROUGH THE PILOT | 38 |
| 3.5 OPERATION PROGRAM | 38 |
| 3.6 ANALYTIC MEASUREMENTS | 39 |
| 3.6.1 TEMPERATURE | 39 |
| 3.6.2 PH VALUE | 40 |
| 3.6.3 TOTAL DISSOLVED SOLIDS (TDS) | 40 |

CHAPTER IV: RESULTS 41-56

| | |
|--|-----------|
| 4.1 INTRODUCTION | 41 |
| 4.2 RESULTS | 41 |
| 4.2.1 RAW WATER ANALYSIS RESULT | 42 |
| 4.2.2 THE SALINE WATER ANALYSIS RESULTS | 47 |
| 4.2.3 FRESH WATER ANALYSIS RESULTS | 52 |

CHAPTER V: DISCUSSION 57-71

| | |
|--|-----------|
| 5-1 INTRODUCTION | 57 |
| 5-2 DISCUSSION OF STUDY RESULTS | 57 |
| 5-2-1 DISCUSSION OF APRIL RESULTS | 57 |
| 5-2-2 DISCUSSION OF MAY RESULTS | 58 |
| 5-2-3 DISCUSSION OF JUNE AND JULY RESULTS | 58 |
| 5-2-4 DISCUSSIONS OF THE WHOLE PERIOD RESULTS | 58 |
| 5-3 FACTORS AFFECTING THE RESULTS | 60 |
| 5-3-1 EFFECT OF SUNSHINE PERIOD | 61 |
| 5-3-2 EFFECT OF TEMPERATURE OF AIR | 61 |
| 5-3-3 EFFECT OF TOTAL DISSOLVED SOLID | 62 |
| 5-3-4 EFFECT OF RAW WATER TEMPERATURE | 63 |
| 5-3-5 EFFECT OF HUMIDITY RATIO | 63 |
| 5-4 COMPARISON WITH PREVIOUS WORKS | 64 |

| | |
|--|------------------|
| 5-4-1COMPARISON BETWEEN TWO ACRYLIC PLANTS | 64 |
| 5-4-2 COMPARISON BETWEEN ACRYLIC PLANT AND STEEL PLANTS | 68 |
| CHAPTER VI:CONCLUSIONS | 72-73 |
| 6-1 CONCLUSIONS | 72 |
| 6-2 RECOMMENDATIONS | 73 |
| 6-3 FURTHER WORKS | 73 |
| REFERENCES | 74-77 |
| ARABIC SUMMARY | |
| ARABIC THANKS | |
| ARABIC DEDICATION | |
| ARABIC IDENTIFICATION OF THE AUTHER | |
| ARABIC ACCEPTANCE | |
| ARABIC APPROVAL COMMITTEE | |
| ARABIC COVER | |

LIST OF TABLES

| Table | Page |
|---|------|
| CHAPTER II LITERATURE REVIEW | |
| Table (2/1) Water classification according to Salinity Content | 4 |
| Table (2/2) Comparison between seawater and river water | 5 |
| Table (2/3) TVC desalination plant around the world | 11 |
| Table (2/4) MVC desalination plant around the world | 17 |
| CHAPTER IV RESULTS | |
| Table (4/1) the raw water analysis results in April 2018. | 42 |
| Table (4/2) the raw water analysis results in May 2018. | 43 |
| Table (4/3) the raw water analysis results in June 2018. | 44 |
| Table (4/4) the raw water analysis results in July 2018. | 45 |
| Table (4/5) Average raw water analysis results | 46 |
| Table (4/6) the saline water analysis results in April 2018. | 47 |
| Table (4/7) the saline water analysis results in May 2018. | 48 |
| Table (4/8) the saline water analysis results in June 2018. | 49 |
| Table (4/9) the saline water analysis results in July 2018. | 50 |
| Table (4/10) Average saline water analysis results | 51 |
| Table (4/11) Fresh water analysis results in April 2018. | 52 |
| Table (4/12) Fresh water analysis results in May 2008. | 53 |
| Table (4/13) Fresh water analysis results in June 2018. | 54 |
| Table (4/14) Fresh water analysis results in July 2018. | 55 |
| Table (4/15) Average fresh water analysis results | 56 |
| CHAPTER V: DISSCUSION | |
| Table (5/1) Results of the Two Acrylic Plants | 65 |
| Table (5/2) Results of the Acrylic Plant and steel plant | 69 |

LIST OF FIGURES

| Figure | Page |
|--|-------------|
| CHAPTER I: INTRODUCTION | |
| Figure (1/1) Water resources | 1 |
| CHAPTER (II) LITERATURE REVIEW | |
| Figure (2/1) Methods of Desalination according to energy use | 6 |
| Figure (2/2) Schematic for MSF desalination plant | 8 |
| Figure (2/3) Schematic for MED desalination plant | 9 |
| Figure (2/4) a schematic for a TVC desalination plant | 11 |
| Figure (2/5) a schematic for a solar desalination plant | 12 |
| Figure (2/6) a Schematic for Freezing desalination plant | 13 |
| Figure (2/7) a Schematic for HDH desalination plant | 14 |
| Figure (2/8) a Schematic for MVC desalination plant | 16 |
| Figure (2/9) a schematic of RO desalination plant | 18 |
| Figure (2/10) a photo of RO desalination plant at Orange County (Capacity of 378,000 m ³ /day) | 19 |
| Figure (2/11) a Schematic for ED desalination plant | 20 |
| Figure (2/12) a photo for Ion exchange resin beads | 21 |
| Figure (2/13) Three-unit variation Desal Process | 23 |
| Figure (2/14) Two-unit variation Desal Process | 24 |
| Figure (2/15) RDI process | 25 |
| Figure (2/16) a Schematic for Direct Solar Desalination Plant | 27 |
| Figure (2/17) Schematic for Inclined Solar Desalination Plant | 28 |
| Figure (2/18) Schematic for Multiple-Effect Diffusion Solar Desalination Plant | 29 |
| Figure (2/19) a Photo of Solar Mirror Desalination plant | 30 |
| Figure (2/20) Solar Mirror Desalination plant | 31 |
| Figure (2/21) Draw of Modified Pilot for Solar Mirror Desalination plant | 32 |
| CHAPTER III: MATERIALS & METHODS | |
| Figure (3/1) Sketch for the Study Pilot Plan | 34 |

| | |
|---|----|
| Figure (3/2) Photo for the Study Pilot Plant before & after Modifications | 37 |
| Figure (3/3) a centigrade thermometer. | 39 |
| Figure (3/4) a digital PH meter pen | 40 |
| Figure (3/5) TDS Meter | 40 |

CHAPTER (V) DISCUSSION

| | |
|---|----|
| Figure (5/1) Different flow rate and recovery ratio | 59 |
| Figure (5/2) Temperature of inflow raw water and the recovery ratio | 59 |
| Figure (5/3) Different values of pH | 60 |
| Figure (5/4) Relation between Sunshine period and Q fresh. | 61 |
| Figure (5/5) Relation between T air and Q fresh. | 61 |
| Figure (5/6) Relation between TDS fresh and TDS raw. | 62 |
| Figure (5/7) Relation between TDS raw and Q fresh. | 62 |
| Figure (5/8) Relation between Q fresh and T | 63 |
| Figure (5/9) Relation between Q fresh and the humidity ratio. | 64 |
| Figure (5/10) Q fresh plant 1 and Q fresh plant 2 | 66 |
| Figure (5/11) T inflow plant1 and T inflow plant2 | 66 |
| Figure (5/12) TDS fresh plant1 and TDS fresh plant2 | 67 |
| Figure (5/13) TDS raw plant1 and TDS raw plant2 | 67 |
| Figure (5/14) Recovery Ratios of plant1 and plant2. | 68 |
| Figure (5/15) Recovery Ratio for plant1, plant 2 and plant3 | 70 |
| Figure (5/16) Inflow Temperature for plant1, plant2 and plant3 | 70 |
| Figure (5/17) TDS raw for plant1, plant2 and plant3. | 71 |
| Figure (5/18) TDS fresh For plant1, plant2 and plant3. | 71 |

CHAPTER I

INTRODUCTION

1.1 BACKGROUND

All the world faces a very difficult problem that the shortage of fresh water. The percentage of fresh water in rivers and lakes is 0.1% as shown in figure (1/1), and it is a very small percent according to a huge increase in people's number.

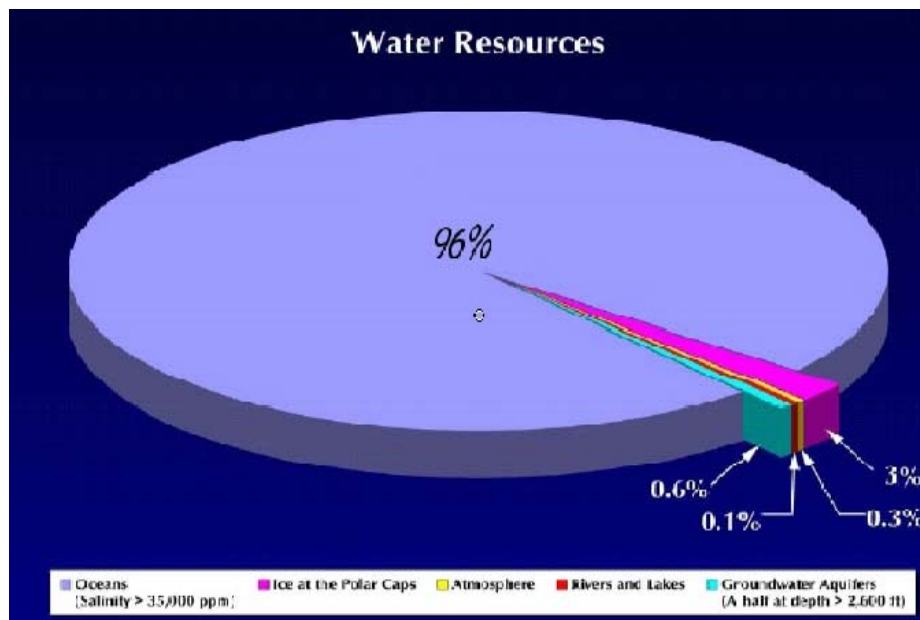


Figure (1/1) Water Resources [1]

The percentage of saline water is 96%. The big difference between the two percentages make the world think trying to solve the problem by desalination of saline water to produce fresh water. Fresh water is very important for agriculture, industry, and domestic purpose. The percent of Egypt from Nile River is 55.5 BCM of fresh water; this percent will decrease after Ethiopian dam so saline water should be desalinated. Conventional methods of desalination need high cost in construction and operation, high amount of power and electricity, high qualified workers, have a bad effect on environment so Solar desalination is a good solution for Egypt. Due to the available area, good climate all the year such as good temperature and long period of Sun shine. Solar desalination process

is simple, has no effect on environment, no need for electricity or high energy, low cost, no need to high trained workers but it has low recovery ratio. Some researchers made development on Solar desalination process to increase the recovery ratio and decrease the area used by using concentrating solar mirrors to concentrate Sun rays on saline water to rapid the evaporation and condensation process [1].

1.2 STUDY OBJECTIVES

This study was done to improve the recovery ratio and the efficiency with minimizing the cost of the direct solar desalination system plant using concentrated mirrors by applying different modifications on its construction.

1.3 SCOPE OF WORK

The study was divided to two main parts due to the work type in the work program as follows

1.3.1 THEORTICAL PART

This part includes the following works:

1. Literature review.
2. Improvement on the pilot construction.
3. Modifications on experimental operation program.
4. Doing the Results analysis and discussions.
Compare the results with previous work to evaluate the applied modifications

1.3.2 EXPERIMENTAL PART

The study used an existing pilot plant erected in the experimental laboratory site area at faculty of engineering, Ain Shams University, Cairo, Egypt. This study was made in spring & summer seasons during four months which covers the best climatic period that helped in obtaining the best performance of the desalination plant by solar mirrors. In this part from the study the experimental work was raised by operating the pilot plant and measuring the in and out parameters to evaluate the system by following these steps:

1. Operating the pilot after its modifications.
2. Measuring data for the plant during the operation period.