IMPROVEMENT OF THE SOLAR MIRRORS DESALINATION PLANTS

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

Prepared by

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Date: - ---/--/2019

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***

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ABSTRACT

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Title: "IMPROVEMENT OF THE SOLAR MIRRORS DESALINATION PLANTS ."
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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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KEY WORDS **Desalination, Solar desalination, Solar collector, Seawater, Fresh water.**

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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.

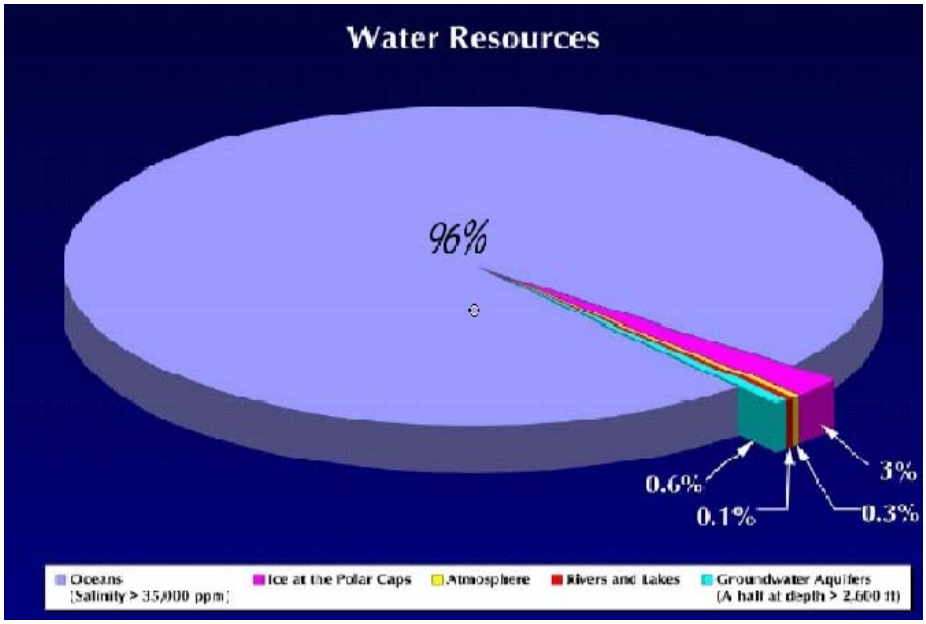

Figure (1/1) Water Resources [1]

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.