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وقد تمت مناقشة الرسالة والموافقة عليها:

اللجنة: التوقيع

1- ا.د/طارق حسين غانم

أستاذ ورئيس قسم هندسة التصنيع . كلية الهندسة الزراعية

جامعة الأزهر

2- ا.د/فاروق محمد التلاوي

أستاذ ورئيس قسم العلوم الزراعية البيئية . معهد الدراسات والبحوث البيئية

جامعة عين شمس

3- ا.د/محمد نبيل العوضي

أستاذ متفرغ بقسم الهندسة الزراعية . كلية الزراعة

جامعة عين شمس

2015

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في العلوم البيئية

قسم العلوم الزراعية البيئية

تحت إشراف :-

1- ا.د/محمد نبيل العوضي

أستاذ متفرغ بقسم الهندسة الزراعية . كلية الزراعة

جامعة عين شمس

2- ا.د/أسامة محمد رضوان

أستاذ تكنولوجيا الأغذية بقسم العلوم الزراعية البيئية . معهد الدراسات والبحوث البيئية

جامعة عين شمس

2- د./وليد كامل الحلو

مدرس بقسم الهندسة الزراعية . كلية الزراعة

جامعة عين شمس

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DESIGN OF A DUAL SOURCE RENEWABLE ENERGY DRYER AND ITS IMPACT ON DRIED FOOD QUALITY

Submitted By

Aalaa-Ullaah Tarek Youssef

B.Sc. of Agric. Sci. (Mechanization), Faculty of Agriculture,

Ain Shams University, 2006

Diploma of Environmental Sciences, Institute of Environmental Studies and Research, Ain Shams University, 2007

A thesis submitted in Partial Fulfillment
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APPROVAL SHEET

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This thesis Towards a Master Degree in Environmental Sciences
Has been Approved by:

Name Signature

1-Prof. Dr. Tarek Hussien Ghanem
Prof. and Head of Agricultural Product Process Engineering Department
Faculty of Agricultural Engineering
Al-Azhar University

2-Prof. Dr. Farouk Mohamed El Tellawy
Prof. and Head of Department of Environmental Agricultural Sciences
Institute of Environmental Studies and Research
Ain Shams University

3-Prof. Dr. Mohammed Nabil El Awady
Emeritus Prof. of Agricultural Engineering
Faculty of Agriculture
Ain Shams University

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Under The Supervision of:

1-Prof. Dr. Mohammed Nabil El Awady
Emeritus Prof. of Agricultural Engineering
Faculty of Agriculture
Ain Shams University

2- Prof. Dr. Usama Muhammad Ridwan
Prof. of Food Technology in Department of Environmental
Agricultural Sciences – Institute of Environmental Studies and Research
Ain Shams University

3-Dr. Waleed Kamel Al-Helew
Lecturer of Agricultural Engineering
Faculty of Agriculture
Ain Shams University

2015

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ABSTRACT

The present study was conducted in order to design and test a dual source solar dryer in the shape of a truss for drying some agricultural crops, including figs, strawberries, grapes, and tomatoes by using solar cells, and a source of illumination – in Egypt. Furthermore, in comparison, the dryer was tested without a solar cell, and the results were compared to each other and also compared with those of another (half-inclined) solar dryer, as well as an electrical dehydrator, and circle electric and solar dehydrator – in Saudi Arabia. The dual source solar dryer consisted of a wooden frame painted dim black to increase the rate of solar radiation absorption inside the dryer. A double-wall made of transparent Lyxan polycarbonate with black thermal insulation was placed in between; and two food trays with a wooden frame encasing black perforated plastic polypropylene that can withstand high temperature and is safe for food, as it does not react nor stick to dried food. There is also a wire screen to prevent the entry of insects through the vents; a filter to purify the air inside the dryer; a black solar collector; a fan; a solar cell to run the fan, an electrical inverter; and a light bulb to provide heat.

The results showed the following:

1. The temperatures inside the dryer reached 70.1º, 64.1º; 67°, and 50°, as compared to the temperatures outside the dryer which reached 41.9º, 37.1º, 49.1°, and 31.6° for the figs, strawberries, grapes, and tomatoes, respectively. In other words, there were differences of 28.2º, 27º, 35.4 and 18.4 respectively between the temperatures inside and outside the dryer.

2. When the drying time increased, the relative air humidity decreased; and the rate of decrease for the relative air humidity was higher inside the dryer than outside it, as the percentage of moisture reached 10%, 41%, 22%, and 10% inside the dryer at the end of the experiment for the figs, strawberries, grapes, and tomatoes, respectively – as compared to the humidity percentages outside the dryer which were 21%, 52%, 24%, and 45% for the figs, strawberries, grapes, and tomatoes with differences of 11%, 11%, 2%, and 35% in air humidity inside and outside the dryer, respectively.

Keywords: Solar dryer, electric dehydrator, how to dry figs, strawberries, grapes and tomato, solar collector, solar fan, temperature, moisture content, air velocity, relative humidity, rehydration percentages, TSS, and cost.

CONTENTS

LIST OF TABLES