



شبكة المعلومات الجامعية

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



شبكة المعلومات الجامعية
@ ASUNET



شبكة المعلومات الجامعية التوثيق الالكتروني والميكروفيلم



شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكرو فيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأفلام قد أعدت دون أية تغيرات



يجب أن

تحفظ هذه الأفلام بعيدا عن الغبار

في درجة حرارة من ١٥-٢٥ مئوية ورطوبة نسبية من ٢٠-٤٠%

To be Kept away from Dust in Dry Cool place of
15-25- c and relative humidity 20-40%

بعض الوثائق الأصلية تالفة

بالرسالة صفحات لم ترد بالاصل



Mansoura University
Faculty Of Engineering
Mechanical Power Engineering Department

2406
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**USING OF REFRIGERATING SYSTEMS
FOR
WATER CONDENSING OUT FROM MOIST AIR.**

By

ENG. MOHAMED MAHMOUD ABD-EL RAOUF.

Thesis

Submitted in partial fulfillment of the requirements for the
degree of master of science in mechanical engineering.

Under Supervision of

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1995



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***TO THE
SPIRIT
OF MY
PARENTS***

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ABSTRACT

The present study is dealing with the extraction of water from atmospheric moist air, in which a theoretical analysis is made to study the optimum values of condensate recovery (λ).

A mathematical model, based on the thermodynamics of simple vapour compression refrigeration cycle is used to serve all the cases studied in this work, using refrigerant (R12) to cool the atmospheric moist air in order to condensate the moisture from it.

The cases studied in this work are divided into three cases. In **Case I** the atmospheric moist air flows through the cold evaporator in which the temperature is reduced below air dew point, the condensation of moisture occurs and the outlet air drawn to atmosphere, and/or the cooled outlet air flows from the evaporator to cool the condenser in **Case II** while in **Case III** this cooled air is used to cool the inlet atmospheric moist air without mixing them.

Many parameters have affected the process of condensation of moisture such as moist air state (dry bulb temperature (t_a), relative humidity (R.H.)), evaporator temperature (t_e), condenser temperature (t_c) and the design of the refrigeration system specially the evaporator and the condenser (*i.e. temperature difference between refrigerant and air in both of them (Δt_{ad})*).

To make this study more useful for the MIDDLE EAST AREA and GULF COUNTRIES too, the range of moist air temperature (t_a) has been chosen between 20°C up to 50°C and the relative humidity (R.H.) between 10% up to 90%.

The calculated data is listed in tables and plotted in graphs as a relation between condensate recovery (λ) and its maximum value (λ_{\max}) with the other parameters. It is seen from these results that (λ) increases with the decrease of evaporator temperature (t_e) up to a maximum value and then it decreases with further decrease of (t_e). The calculated results show also that (λ) along-with (λ_{\max}) increase with (R.H.) and ambient temperature (t_a). It is shown also that the condensate recovery (λ) and its maximum value (λ_{\max}) in **Case II** are higher than these in **Case I**, and (λ) & (λ_{\max}) in **Case III** are the highest compared with **Case I** and **Case II** for the same conditions. The increase in (λ_{\max}) in **Case II** over that in **Case I** is ranged between 8 : 10 % and the increase in **Case III** over that in **Case I** is in the range between 24 % to 50 %, also the condensate recovery (λ) as well as its maximum value (λ_{\max}) are increased with the decrease of Δt_{ar} (terminal temperature difference) in case I only.

The correlations to calculate the maximum condensate recovery for the three cases are found as follows.

$$\lambda_{\max} = A. \text{EXP}(B. (R.H.) + C. \Delta t_{ar})$$

where :

In case I :

$$A = (5.8388 t_a - 30.57) \cdot 10^{-6}$$

$$B = (0.07865 - 0.0013 t_a + 1.557 \cdot 10^{-5} t_a^2)$$

$$C = -0.073$$

In case II :

$$A = (-1210.57 + 58.34 t_a - 0.5682 t_a^2) \cdot 10^{-6}$$

$$B = 0.0283 + 0.00106 t_a - 1.2 \times 10^{-5} t_a^2$$

$$C = 0$$

and :

In case III :

$$A = (-1894.7 + 91.0779 t_a - 0.959 t_a^2) \cdot 10^{-6}$$

$$B = 0.3229 - 0.01186 t_a + 1.32 \times 10^{-4} t_a^2$$

$$C = 0$$

Finally it is found that for λ_{\max} the ratio between the absolute value of evaporator temperature and moist air temperature (T_e / T_a) depends only on the relative humidity (R.H.), and a correlation between (T_e / T_a) and (R.H.) is found.

$$T_a / T_e = 1.449 (\text{R.H.})^{-0.08}$$

CONTENTS

Page

ACKNOWLEDGMENTS.....	I
ABSTRACT	II
CONTENTS.....	V
NOMENCLATURE.....	VIII
LIST OF FIGURES	X
LIST OF TABLES	XV
CHAPTER 1: INTRODUCTION.....	1
<i>1.1. Distillation.....</i>	<i>3</i>
<i>1.2. Vapour Reheat Distillation.....</i>	<i>3</i>
<i>1.3. Solar Distillation.....</i>	<i>4</i>
<i>1.4. Freezing.....</i>	<i>4</i>
<i>1.5. Electrodialysis.....</i>	<i>4</i>
<i>1.6. Hyperfiltration(Reverse-Osmosis).....</i>	<i>5</i>
CHAPTER 2: ANALYSIS OF LITERATURE REVIEW AND THE PRESENT RESEARCH PROBLEM	6
<i>2.1. characteristic of supplying arid regions with water.....</i>	<i>6</i>
<i>2.2. solar distillation as a water supply method in arid territories.....</i>	<i>9</i>
<i>2.3. attainment of world science and application of works concerning water production from atmospheric air.....</i>	<i>11</i>
<i>2.4. Analysis of climatical conditions in hot desert.....</i>	<i>15</i>
2.4.1. main factors affecting climate of deserts	16
2.4.2. Air temperature in deserts.....	17
2.4.3. Air humidity.....	17

CHAPTER 3: THERMODYNAMICAL ANALYSIS OF THE PROBLEM.	22
3.1. <i>Mathematical model</i>	22
3.2. <i>determination of the parameters of condensate recovery (λ):.....</i>	29
3.2.1. Moisture content difference between dew point and evaporator temperature($\Delta\omega$)	29
3.2.2. enthalpy difference across the compressor.	30
3.2.3. enthalpy difference across the evaporator.....	32
3.2.4. enthalpy difference of worked air.	32
CHAPTER 4: RESULTS AND DISCUSSION	34
4.1. <i>The results of case (I)</i>	35
4.1.1 The effect of ambient temperature (t_a) on the values of condensate recovery (λ).....	35
4.1.2 The effect of relative humidity (R.H) on the values of condensate recovery (λ).....	40
4.1.3 The effect of terminal temperature difference between air and refrigerant (terminal temperature difference Δt_{ar}) on the values of condensate recovery (λ).....	46
4.2 <i>The results of case (II)</i>	52
4.3 <i>The results of case (III)</i>	55
4.4 <i>Determination of the assumed values of temperature difference (Δt) in case (II) and case (III)</i>	58
4.4.1 Choice of temperature difference at condenser (Δt_c) for case (II)	58
4.4.2 Choice of temperature difference of air (Δt_a) for case (III)	60
4.5 <i>Comparison between the three different cases</i>	61

<i>4.6 Correlations</i>	65
<i>4.7 The economical study</i>	74
4.7.1 The calculations of condensate water in various conditions	74
4.7.2 Total cost for each k.watt/hour	74
4.7.3 The costing of water condensing out from moist air for various conditions.....	75

CHAPTER 5: CONCLUSIONS AND FUTURE WORKS	77
5.1 General focusing on the water problem	77
5.2 Conclusions	78
5.3 Suggestions for future works	82
REFERENCES	83

APPENDIX

A ____ Psychrometric chart of moist air at sea level.....	
B ____ Properties of moist air	
C ____ Pressure-enthalpy diagram of refrigerant (R12).....	
D ____ Properties of refrigerant (R12)	
E ____ Calculated properties used for condensate recovery calculations.....	
F ____ Results of case I	
G ____ Results of case II.....	
H ____ Results of case III	