



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**APPLICATION OF THE COOLING PAD AS EVAPORATIVE  
COOLING SYSTEM IN POULTRY HOUSE**

This report submitted in accordance with requirement of the Universiti Teknikal  
Malaysia Melaka (UTeM) for the Bachelor degree of Mechanical Engineering  
Technology  
(Refrigeration and Air-Conditioning System) (Hons.)

by

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**SESI PENGAJIAN: 2015/16 Semester 2**

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I hereby, declared this report entitled “Application of the cooling pad as evaporative cooling system in poultry house.” is the results of my own research except as cited in references.

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## **APPROVAL**

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Refrigeration & Air-Conditioning Systems) (Hons.). The member of the supervisory is as follow:

.....

(Mr. Azwan Bin Aziz)

## ABSTRACT

This study discusses the cooling system in the poultry house, where each poultry house at least has an evaporative cooling pad to provide comfort and prevent the poultry mortality. Evaporation pad used in evaporative cooling system as a cooling medium, in this way a more efficient and effective to cool the poultry house. Bracket constructed from lightweight materials to support the evaporative cooling pad on the left and right of the hen house. Performance evaluation for three types of evaporative cooling pad for poultry house and make comparisons between the three materials suitable for use as a cooling pad in the poultry house. Methods for evaluating the performance of each material based on environmental parameters such as temperature and humidity. In addition, the following parameters on the materials used, such as the length and thickness of the material. The results of this study to obtain the expected performance related (temperature, humidity and efficiency) for three different materials used as a medium in the cooling system for poultry houses. Beside that the expected results on the material parameters (thickness and length) will affect a significant difference between the three types of materials is used as a medium in the evaporative system. However, all three types of materials will provide a cooling effect to the poultry house and there will be a difference in terms of performance.

## ABSTRAK

Kajian ini membincangkan tentang sistem penyejukan di bangunan ayam, yang mana setiap bangunan ayam sekurang-kurangnya mempunyai satu pad penyejukan penyejukan untuk memberi keselesaan kepada ayam serta mencegah kematian. Pad penyejukan yang diguna pakai didalam sistem penyejukan penyejukan adalah sebagai medium penyejukan, dengan cara ini lebih cekap dan berkesan untuk menyejukan bangunan ayam. Pendakap dibina daripada bahan yang ringan untuk menyokong pad penyejukan penyejukan di sebelah kiri dan kanan rumah ayam. Penilaian prestasi untuk tiga jenis pad penyejukan penyejukan untuk bangunan ayam dan membuat perbandingan antara ketiga-tiga bahan yang sesuai untuk digunakan sebagai penyejukan pad dibangunan ayam. Kaedah menilai prestasi untuk setiap bahan berdasarkan parameter alam sekitar seperti suhu dan kelembapan udara selain itu, parameter berikut kepada bahan yang digunakan, seperti panjang dan ketebalan bahan. Hasil jangkaan kajian ini untuk mendapatkan prestasi berkaitan (suhu, kelembapan udara dan kecekapan) untuk tiga bahan yang berbeza digunakan sebagai medium didalam sistem penyejukan untuk bangunan ayam. Selain itu keputusan yang dijangkakan terhadap parameter bahan (ketebalan dan panjang) akan memberi kesan perbezaan yang ketara antara ketiga-tiga jenis bahan yang digunakan sebagai bahan perantaraan didalam sistem penyejukan penyejukan . Walau bagaimanapun, ketiga-tiga jenis bahan akan memberikan kesan penyejukan di bangunan ternakan ayam dan akan ada perbezaan dari segi prestasi.

## DEDICATIONS

I dedicate my disquisition work to my family and many friends. A feeling of humble and gratitude to my loving parents Mohd Yusof Bin Haroon and Faridah Binti Abdul Hamid whose words of encouragement and push for tenacity ring in my ears. My brothers Mohd Amir Zakwan Bin Mohd Yusof and Mohd Amir syafiq Bin Mohd Yusof have never left my side and are always there for me. They who always supported me and listens to my problems. I also dedicate this disquisition to my many friends and class mates who have always giving me encouragements throughout the process. I will always appreciate all they have done, especially Dareen John Scully for helping me develop my English skill and for many hours of proof reading, Muhamad Fadhil Bin Jamaludin for being all ears on the long nights of complaining, and my class mates for helping me complete this research with ease. I dedicate this work and give special thanks to my best friends Sarni Nur Atikah Binti Abdul Rahim, Choo Hong Liang, Muhamad Ikram Bin Sarani and Muhamad Afiqri Bin Rohman for being there for me throughout the entire bachelor degree project. All of you have been my best cheerleaders.



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# TABLE OF CONTENTS

DECLARATION .....	iv
APPROVAL.....	v
ABSTRACT.....	vi
ABSTRAK .....	vii
DEDICATIONS.....	viii
ACKNOWLEDGMENTS .....	ix
TABLE OF CONTENTS.....	x
LIST OF FIGURES .....	xiv
LIST OF TABLE .....	xv
LIST OF SYMBOLS AND ABBREVIATIONS .....	xvi
CHAPTER 1 .....	1
1.0 Introduction .....	1
1.1 Background of the study.....	1
1.2 Poultry house evaporative cooling .....	2
1.3 Problem Statement .....	3
1.4 Objectives of Research .....	3
1.4.1 Main Objective:.....	3
1.4.2 Specific Objective: .....	3
1.5 Scope of Research .....	4
CHAPTER 2 .....	5

2.0	Introduction .....	5
2.1	Evaporative cooling.....	5
2.2	Evaporative cooling process.....	6
2.3	Advantages and disadvantages of evaporative cooling.....	7
2.4	Type of cooling pad material.....	8
2.5	How to select the cooling pads.....	10
2.6	Poultry house ventilation.....	10
2.7	Application of evaporative cooling pad .....	10
2.8	Factors influenced the cooling pads performance.....	11
2.8.1	Pad thickness performance.....	11
2.8.2	Cooling pad area .....	11
2.8.3	Air velocity performance .....	12
2.9	Water flow rate.....	13
2.10	Temperature and humidity for poultry house.....	14
2.11	Cooling pad running and dry.....	14
CHAPTER 3 .....		16
3.0	Introduction .....	16
3.1	Selection material of cooling pad.....	16
3.2	Data collection.....	17
3.3	Cooling pad efficiency .....	17
3.4	Evaporative cooling process.....	18
3.5	Psychrometric chart.....	18
3.6	Evaporative cooling system idea.....	21

3.6.1	Simulation evaporative cooling .....	21
3.6.2	Water circulation concept .....	23
3.7	Material and measurement equipment .....	23
3.7.1	Cooling pad .....	23
3.7.2	Fan motor .....	26
3.7.3	Type of pipe .....	27
3.7.3.1	Pvc pipe.....	27
3.7.3.2	Pvc flexible hose pipe .....	27
3.7.4	Water pump .....	28
3.7.5	Rubber stopper .....	28
3.7.6	Storage box .....	29
3.8	Measurement equipment .....	29
3.9	Process for built the evaporative cooling system .....	31
3.10	Procedure taking the data .....	36
3.10.1	Measuring temperature and humidity .....	36
3.10.2	Procedure to measuring water evaporated .....	36
CHAPTER 4	.....	37
4.0	Introduction .....	37
4.1	Specific Physical Parameter Results .....	37
4.2	Temperature inside and outside the model poultry house.....	38
4.3	Relative humidity .....	39
4.4	Water evaporated for each material.....	41
4.5	Efficiency of each evaporative cooling pad .....	43

4.5.1	Sample calculation for cooling efficiency.....	46
4.6	Process for each pads .....	49
CHAPTER 5	.....	52
5.0	Introduction .....	52
5.1	Summary of Research .....	52
5.1.1	Objective of Research .....	53
5.2	Research methodology .....	53
5.3	Problems faced during research.....	54
5.4	Conclusion.....	54
5.5	Suggestion for Future Work .....	55
APPENDIX A	.....	57
APPENDIX C	.....	59
APPENDIX E	.....	61
Storage box	.....	61
Water pump	.....	61
Fan motor	.....	61
Car Battery	.....	61
REFERENCES	.....	62

## LIST OF FIGURES

Figure 2.1: Evaporating process.....	6
Figure 2.2: Corrugated Cellulose .....	9
Figure 2.3: Aspen Pads .....	9
Figure 2.4: Corrugated Cellulose pad that has been attacked by algae.....	15
Figure 3.1: Process chart.....	18
Figure 3.2: Psychrometric line name .....	19
Figure 3.3: Air flow enter the poultry house.....	20
Figure 3.4: Evaporative process .....	20
Figure 3.5: Combination of deflector, water spray nozzle and water reservoir .....	21
Figure 3.6: Cooling pad position.....	22
Figure 3.7: Water circulation for evaporative cooling system.....	23
Figure 3.8: Sponge .....	24
Figure 3.9: Fabric .....	25
Figure 3.10: Cellulose pad .....	25
Figure 3.11: Fan motor.....	26
Figure 3.12: Pvc pipe .....	27
Figure 3.13: Pvc flexible hose pipe.....	27
Figure 3.14: Water pump .....	28
Figure 3.15: Rubber stopper.....	28
Figure 3.16: Storage box .....	29
Figure 4.1: Graph of temperature inside and outside.....	38
Figure 4.2: Graph humidity inside and outside.....	40
Figure 4.3: Graph for amount of water evaporate.....	42
Figure 4.4: Graph efficiency for the different pad type .....	45
Figure 4.5: Wet bulb for cellulose pad.....	47
Figure 4.6: Wet bulb sponge .....	47
Figure 4.7 :Wet bulb cloth .....	48
Figure 4.8 : Process for cellulose pad at 1.00pm .....	49
Figure 4.9 : process for sponge at 1.00pm .....	50
Figure 4.10 : Process for cloth at 1.00pm .....	50

## LIST OF TABLE

Table 2.1: Advantages and disadvantages of evaporative cooling .....	7
Table 2.2: Average of saturation efficiency and variety pad thickness .....	13
Table 2.4: Recommended water flow rate and sup capacities for vertically-mounted .....	14
Table 3.1 : Dimensions of material .....	24
Table 3.2: List of instruments .....	30
Table 3.3 : Process built the evaporative cooling system .....	31
Table 4.1: Maximum temperature inside and outside the model poultry house .....	38
Table 4.2: Humidity inside and outside the model poultry house.....	40
Table 4.3 : Amount of water evaporate.....	42
Table 4.4 : Efficiency for the different pad type at 8.00AM.....	43
Table 4.5 : Efficiency for the different pad at 1.00PM.....	44
Table 4.6 : Efficiency for the different pad type at 6.00 PM .....	44
Table 4.7: Efficiency for the different pads type at 1.00PM.....	46
Table 4.8 :Temperature and humidity for inside and outside model poultry house ..	49

## LIST OF SYMBOLS AND ABBREVIATIONS

ASHRAE	=	American Society of Heating, Refrigeration, and Air-Conditioning Engineers
°C	=	Degree Celsius
T <sub>e db</sub>	=	Enter Temperature Dry Bulb
T <sub>e wet</sub>	=	Enter Temperature Wet Bulb
μ	=	Efficiency
HVAC	=	Heating Ventilation and Air-Conditioning
UTEM	=	Universiti Teknikal Malaysia Melaka
%	=	Percentage



# CHAPTER 1

## INTRODUCTION

### 1.0 Introduction

The HVAC is an acronym that standard for “Heating Ventilation and Air Conditioning,” which is commonly referred to as “HVAC”. The term itself is used for heating and air conditioning system installed in home, building and businesses worldwide. Hvac system, there is one technology that is increasingly well-known in the world and growing dynamic growth phase is defined by the nature of the life circle of competition and consumer demand. Today, the industry is focused on quality system that can save energy and consumer. There are various types of hvac systems have been designed to suit the venue. Due to the economic relation, hvac industry has a strong multiplier effect on the growth of the country and thus could be driver of economic growth.

### 1.1 Background of the study

Recent warm temperatures swept the world and give the impression that is very important to tropical countries like Malaysia. This is closely related to the phenomenon of global warming is having a big impact around the world. Global warming has stemmed from the use of chemicals and gases that can damage the ozone layer structure cause the release of the sun to the earth without vetting process.

## 1.2 Poultry house evaporative cooling

Hence the poultry house now many have been equipped with a cooling system comprising an exhaust fan at the end of the poultry house and on the left and right are equipped with a cooling pad to maintain the ideal temperature for chicken feel more comfortable during the summer time. The air is cooled by moisture evaporative as the air passes through the pads. There are several types of materials have been used as cooling pad like cloth, sponge and coconut fiber to maintain the temperature inside the poultry house. This system has many advantages compared with vapor compression refrigeration. There are advantages in evaporative cooling system is, the evaporation system does not generate a lot of noise like a vapor compression. The next advantage is not using evaporative cooling system coolant, but it was replaced with water so it is good for the environment. (Bucklin *et.al*, 1993)

The fan is a conventional method and the earliest to freshen environment an also the cheapest way. However, the fan only helps air movement without eliminating or reducing warmth. Product such as evaporative cooling pad can provide lower temperature and cost savings in terms of installation and maintenance costs, in addition to the evaporative cooling pads also can save electricity compare to vapor compression. In this study, there are three types of materials used as cooling pads and will be compared in terms of cooling efficiency. This is because chickens need a good or comfortable temperature for growing and producing high-quality chicken, if the temperature inside the poultry house is high and it can cause poor appetite chicken and chicken productivity will also decrease. Materials used as pads should be able to absorb water and air can easily pass through the pads such as sponge, fabric and pvc fill. In this research, the author purpose is to compare the performance of three different material used as a cooling pads. This cooling pad will be tested on the model poultry house. After doing some analysis and surveys, I have chosen the title "Application of The Cooling Pad as Evaporative Cooling System in Poultry House" as the title of my review. (Bucklin *et.al*, 1993)

### **1.3 Problem Statement**

Poultry house should be well ventilated and cool temperatures to prevent the mortality of the poultry. Poultry need a comfortable temperature and humidity appropriate to growing up. Choosing the type of material as a cooling pad is a factor that determines the good temperature and humidity in poultry house. Besides that, the latest data and information to be recorded and documented for process improvement.

### **1.4 Objectives of Research**

Based on the "Application of The Cooling Pad as Evaporative Cooling System in Poultry House", the objectives to be achieved at the end of this project are as below:

#### **1.4.1 Main Objective:**

To determine suitable material to be use as a cooling pad for poultry house where the material is able to give comfort to the poultry.

#### **1.4.2 Specific Objective:**

- i. To measure the different temperature and humidity inside and outside poultry house after use evaporative cooling system.
- ii. To compare the performance of material used for cooling pads.
- iii. To correlate relationship between the type of material used and the effect of temperature in the poultry house.

## **1.5 Scope of Research**

In this research, the focus will be mainly on comparing the data collected between three types of material fabrics, sponge and corrugated cellulose to determine suitable material to use as a cooling pad for poultry house. To get the cooling efficiency there are several parameters that need to be measured which is the temperatures and humidity of the air inside and the outside the poultry house by using a temperature and humidity meter.

## **1.6 Result expectation**

- i. Can produce low temperatures and high humidity in the poultry house.
- ii. Get three different data from three different type of material.
- iii. Poultry will be more comfort and can prevent the mortality of the poultry.

## **CHAPTER 2**

### **LETERATURE REVIEW**

#### **2.0 Introduction**

While the first chapter clarified the background of the study, this chapter proceeds with a fully-referenced review from the relevant literature. It covers introduction to evaporative cooling, research and observation of evaporative cooling, factor affecting evaporative cooling, material of cooling pad, advantages and disadvantages of evaporative cooling and the performance of evaporative cooling condition on poultry house.

#### **2.1 Evaporative cooling**

In a poultry house system, growing chicken, chicken quality, and the quality of eggs produced is usually dependent on the circumstances surrounding chicken is consisting of several factors that influence it. Evaporative cooling pads have been used to improve air temperature and provide a comfortable situation to humans and animals for long periods of time. This is one of the main methods that can be used to obtain low temperatures and comfortable. In addition, this method does not require spending a lot of money in terms of installation and maintenance, but need more open space for the use of this system. (Ernst V.H, 2004).

To prove that the cooling pads can provide comfort to people, livestock and could lower the temperature, the psychrometric been used. By using psychrometric chart, can know what the process is going on when the chart was plotted according to the results obtained. According to Bucklin, *et.al*, (1993), said that with the two parameters namely the external temperature and Relative Humidity, we can calculate

the wet bulb temperature, which theoretically, would be the temperature of the incoming air.

According to EL-Soaly (2002), there are two buildings. The first building was installed cooling pads of coconut fibers while building the second depends on natural ventilation. As a result it was found that a reduction in temperature is 7.0°C and 2.6°C in the first building and the humidity inside the first building is higher than a second building that is 13.4% as the average.

## 2.2 Evaporative cooling process

In this process, air and water will come in cross flow arrangement. The water will fall down by gravity while air will enter horizontally. High-temperature air will be attracted into the poultry house and going through the pads. After that, the water will absorb heat from the air passing through the pads and evaporated. This shall result in a low-temperature air. To maintain the temperature in a state of constant, water is sprayed onto the surface pads or water is allowed to fall under gravity to the pads. (Malli *et .al*, 2010).

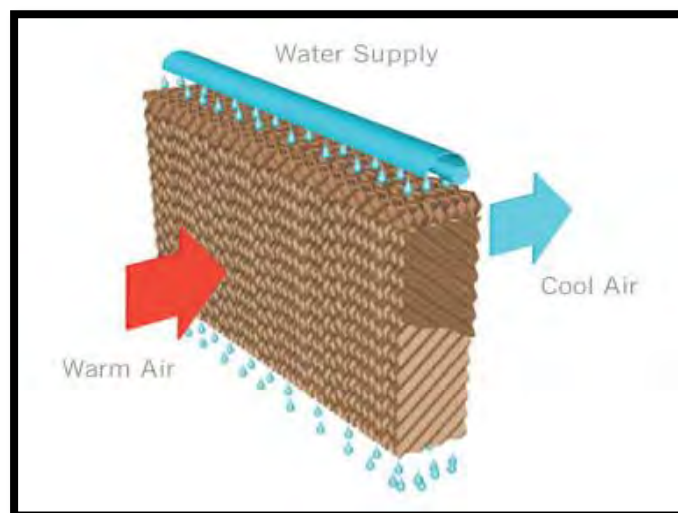


Figure 2.1: Evaporating process

(Source: <http://www.nature-cool.com/images/processilluslg.jpg>)

### 2.3 Advantages and disadvantages of evaporative cooling

According to Liu (2007), evaporative cooling pad have the advantages and disadvantages and it can summarized as below;

Table 2.1: Advantages and disadvantages of evaporative cooling

<b>Advantages</b>	<b>Disadvantages</b>
<b><u>Less expensive to install</u></b> <ul style="list-style-type: none"><li>• The estimated cost for installation is about half the cost of the installation of air conditioning.</li></ul>	<b><u>Performance</u></b> <ul style="list-style-type: none"><li>• High dew point (humidity)</li></ul>
<b><u>Less expensive to operate</u></b> <ul style="list-style-type: none"><li>• Electricity consumption is limited to the fan and water pump. This because evaporation does not require any energy and no use of the compressor as vapor compression.</li><li>• Use water and no use of refrigerants such as ammonia, sulfur dioxide or CFCs which may cause toxic. By using water, ozone can also be taken care of and cheaper.</li></ul>	<b><u>Water</u></b> <ul style="list-style-type: none"><li>• Evaporative cooling system requires a continuous supply of water to wet the pad.</li></ul>
<b><u>Ease of maintenance</u></b> <ul style="list-style-type: none"><li>• There are only two parts that can be maintained, namely water pump and fan. Both of which can be maintenance with low cost.</li></ul>	<b><u>Pollution</u></b> <ul style="list-style-type: none"><li>• Easily infected by algae if not properly maintained.</li></ul>

---

### **Ventilation air**

- This system can increase the humidity in the air and provide comfort to the user and to reduce the problem of static electricity.
  - Cooling pads themselves can act as a filters, it is also able to filter out many pollutants in the air without calculating the weather.
- 

### **2.4 Type of cooling pad material**

There are various types of cooling pads are commercially available and it is able to provide comfort to the user, the type that is often adopted is corrugated cellulose and aspen pads. Both types are often used because it gives a better effect than other types. Moreover, both types are also easily available in the market. But both also have their own advantages and disadvantages.

According to Bucklin *et.al*, (1993), the advantages of the corrugated cellulose is it can last for ten years if properly maintained and can produce cool air better. Corrugated cellulose is dissolved with salt to prevent the occurrence of decay.

Watt and Brown (1997) said, sheets bonded together at opposing angles to form a 15-cm thick filter. The angles of the corrugated cellulose are intended to maximize air contact and evaporation.