UNIVERSITI TEKNIKAL MALAYSIA MELAKA

THE EFFECTIVENESS OF THE CONTROL INDOOR ENVIRONMENTS IN MINIATURE MODEL OF POULTRY HOUSE (ASSESSMENT ON GENERAL VENTILATION SYSTEM)

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

by

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B071210512

911217-08-5381

FACULTY OF ENGINEERING TECHNOLOGY

2015

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TAJUK: **THE EFFECTIVENESS OF THE CONTROL INDOOR ENVIRONMENTS IN MINIATURE MODEL OF POULTRY HOUSE: ASSESSMENT ON GENERAL VENTILATION SYSTEM**

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

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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 and Air Conditioning Systems) (Hons.). The member of the supervisory is as follow:

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(MR AZWAN BIN AZIZ)

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ABSTRACT

This study addressed the effectiveness of the control indoor environments in miniature model of poultry house. Specifically, this study is focus on the application of General Ventilation System on the model. Ventilation is strategic solutions of engineering control on the aspect of eliminate or decrease the concentration of harmful contaminants. The flows of fresh air into any enclosed space allow diluting any toxic contaminants concentration to a tolerable level. The objective of this study was concerned about the air quality in the miniature model of poultry house by applying general ventilation system. Secondary, this study aimed (1) to identify the effectiveness of general ventilation system in miniature model of poultry house by measuring the air velocity, temperature, and humidity; (2) to determine the effectiveness of general ventilation system by locating the exhaust fan in rear with different location; (3) to compare the placement of exhaust fan affect the indoor air quality. In observing and comparing the effectiveness of general ventilation system in the miniature model, CPU (central processing unit) fan is used to replace industrial exhaust fan that will be placed on rear. As the result shown, the condition of fan operation in term of full capacity with booster has the most efficient result. A total of 34% in temperature variation and 57% in humidity level variation compared in between the initial and final indoor condition. The air velocity was negative correlation condition with the indoor temperature and was positive correlation with the humidity level.

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ABSTRAK

Projek ini mengkaji tentang keberkesanan dalam aspek pengawalan persekitaran dalaman untuk model reban ayam. Secara umunnya, kajian ini fokus kepada aplikasi Sistem Pengudaraan Umun untuk model reban ayam. Pengudaraan merupakan satu aspek yang amat kritikal dimana ia dapat mengurangkan dan menghapuskan bahan-bahan tosik dalam kepekatan yang tinggi. Pengaliran udara segar ke dalam sesuatu ruang adalah penting demi memenuhi kehendak kesihatan. Pengudaraan yang baik dapat membantu menyediakan oksigen yang mencukupi dan mencegah peningkatan kadar kepekatan gas-gas yang sedia ada dimana boleh membawa ketidakselesaan serta kematian. Matlamat kajian ini menekan tentang kualiti uadara di dalam model reban ayam dengan mengaplikasikan sistem pengudaraan umum. Secara khususnya, kajian ini menuju kepada 1) keberkesanan sistem pengudaraan umum dalam aspek suhu, kelembapan, dan halaju udara; 2) kerbekesanan sistem pengudaraan umum di lokasi yang berlainan; 3) bandingan lokasi kipas dengan kualiti udara dalaman. *CPU Fan* atau Kipas Unit Pemprosesan Pusat digunakan sebagai alat mengyingkirkan udara kepada amosphera dimana ianya akan diletak di bahagian hujung model. Ianya untuk mengantikan kipas berkuasa tinggi yang digunakan dalam industri. Melalui eksperimen-eksperimen yang telah dijalankan, keputusan menunjukkan bahawa situasi dimana kipas dan kipas sokongan "*booster"* dioperasikan sepenuhnya mendapat keputusan yang paling cekap. Sebanyak 34% perubahan dalam suhu dalaman dan 57% perubahan dalam kelembapan dalaman dengan cara membandingkan situasi awal dan akhir. Halaju udara di dalam model rumah menunjukkan korelasi negatif dengan suhu manakala kolerasi positif dengan kelembapan.

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DEDICATIONS

This dissertation is dedicated to my parent, siblings and relatives whose offering me physically and mentally supports in order to complete this project. Never forget to thanks to my friends and colleague for their assistance during my tough times. Last but not least, thanks and appreciate to my group mates who assist me in order to solve my problems.

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ACKNOWLEDGMENTS

I would like to express the deepest gratitude to my supervisor, Mr Azwan Bin Aziz, from the Faculty of Engineering Technology, UTeM for his guidance, supervision, and supports towards the process of this final year project. Without his guidance and persistent help this dissertation would not have been possible.

I would also like to thank Mr Khairul Fitri, assistant engineer from the Mechanical Department for giving us priority in lending the equipments for our project works. In addition, thanks to the lecturers who offer me advices and supports. Last but not least, the encouragement and support that given to me from my parents and peers.

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LIST OF SYMBOLS AND ABBREVIATIONS

CFM	=	Cubic Feet Per Minute
ASHRAE	=	American Society of Heating, Refrigeration and Air Conditioning Engineers
OSHA	=	Occupational Safety and Health Administration
IAQ	=	Indoor Air Quality
DOSH	=	Department of Occupational Safety and Health
ICOP-IAQ 2010	=	Industry Code of Practice on Indoor Air Quality 2010
RH	=	Relative Humidity
RPM	=	Rotation per minute/ revolution per minute
hr	=	Hour
°C	=	Degree Celsius
m/s	=	Meter per second
ppm	=	Parts per million

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CHAPTER 1
INTRODUCTION

1.0 Introduction

Ventilation is essential to sustain life not only for human, but for all the living beings on the Earth. Ventilation is the process of supplying air to or removing air from a space for the purpose of controlling air contaminant levels, humidity, or temperature within the space, defined in ASHRAE Standards 62-1-2007. Oxygen, which contain in ambient air for 21%, is one of key to sustain life. Oxygen is function to kill harmful bacteria in our bodies other than provide us life. Supplying fresh air into a confined space is required to dilute dangerous contaminants in high concentration level. Gaseous contaminants in critical level of concentration may expose the occupants in the space with the high probability to death.

General ventilation is solution to dilute the concentration of air contaminants in a space by supplying fresh air. Primarily general ventilation systems are used to control internal humidity and temperature, removing odors and remove toxic substances and microorganisms. The ventilation system can be in natural or mechanical. Natural ventilation system is applying the stack effect concept where heat flows with a temperature differences (ASHRAE, 2011). It is also depends on the pressure differences that caused by wind. When the natural ventilation method could not provided sufficient level of comfort for the birds, mechanical supports is provided to enhance the ventilation quality. As the named mechanical, some additional equipments or components are use to create flow in the house. Here, fans are used to create the static pressure difference in between the ambient and indoor.

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Poultry and poultry products has become a popular food for human beings. Poultry has spent their entire life cycle in a confined space. There are amount up to 40,000 broilers in a house completing average 42 days of production cycle (René van den Hoven, 2011). Proper ventilation must be provided to ensure the growth of poultry in optimum. In other words, house thermal comfort is important to ensure the production quality as well. While the internal temperature increasing, the birds started to react by showing some behavior in order to balance their body temperature with the environmental change. Birds become stressful in this condition and this called, heat stress. Heat stress may cause death in critical and also affect the production which adversely affects the company's profit.

In a research conducted on the topic of "Heat Stress in Poultry: Practical Tips", the researchers Amir and Saeed (2014) has stated that heat stress is among the environmental stressors to the poultry production worldwide. The quality and safety of poultry and egg were affected by the uncomfortable thermal environment. As the birds have to spend their entire production life cycle in a confined space, the indoor air quality of the space must be the most concerned factor. A low concentration of gas contaminants could lead respiratory infection through inhalation. Ammonia is among the common gas contaminants that produced by the bird's feces and urea. Exposure to high concentration of ammonia can cause immediate irritation and rapidly fatal in long exposure time.

As the several aspects that discussed above, this project is conduct based on the effectiveness of indoor environment control by applying general ventilation system for a poultry miniature model. A model complete with exhaust fan to create negative pressure air flow is build in this study.

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1.1 Objectives

1.1.1. Main Objective:

This study is focusing on the air quality in miniature model of poultry house by applying General Ventilation System (GVS).

1.1.2. Specific Objectives

i. To identify the effectiveness of GVS in miniature model of poultry house by measuring the air velocity, temperature and humidity.

ii. To determine the effectiveness of GVS by locating the exhaust fans in rear with different location.

iii. To compare the placement of exhaust fans (Central Processing Unit Fan) affect the indoor air quality.

1.2 Scope

The scope of this study will be focusing on:

i. Data collecting on air velocity, temperature, humidity, exhaust fan speed and indoor air quality based on the miniature model of poultry house.

ii. Observation on the air movement in the miniature model.

iii. Comparing the placement of exhaust fans by observed the efficiency to draft out the air from miniature model.

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1.3 Problem Statements

There are four problem statements in this study to be focus:

i. Heat stress is the top cause of chicken death among the poultry industry. Fail to work of ventilation create huge tension for the birds which adverse poultry production and health.

ii. High concentration of gaseous contaminants promotes sickness to the birds and workers. In critical, it causes death. Sufficient level of fresh air supply is a must to dilute harmful gases to tolerable levels. It is also eliminate the growth of microorganism in the house.

iii. Panting is a result of dehydration of the bird. Heavy panting reduces the ability to cope with the environment change. Panting is consequences to the growth rate and egg production of poultry.

iv. The outdoor environmental temperature affects the indoor environment air quality. The temperature trends has indicate warming trends where a rate of increment 1.5°C to 2.7°C per 100 years due to the climate change. (Sources from the Malaysia Meteorological Department).

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CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

According to ASHRAE Standard 62-1(2007), the ventilation goal is to control the air contaminants level, humidity or temperature by supplying or removing the air in a space. It is a fundamental of effective ventilation to the provision of stable, thermally comfortable environment. The ventilation system is also a factor that influences indoor air quality not only for the human beings but also animals. Poor indoor quality can cause a variety of short term or long term health effect by according to the DOSH Malaysia in the writing of ICOP- IAQ 2010. Short terms effects could be eye and throat irritation while long term could be cancer or respiratory disease. High concentration of some gases such as ammonia or carbon monoxide can cause immediate death. World Health Organization, (2013) has state that air pollution, is a major environmental risk to health. Outdoor air pollution was announced as carcinogenic reason to humans on a press released make by the WHO based on their specialized cancer agency's research. In the aspect of animals, specifically on livestock, the effects of poor air quality may results on their production such as milk, eggs or toxic residues in meat without obvious clinical symptoms. In the poultry, average 42 days production cycle for broilers and they grow from 600 grams to about 200 kilograms (René 2011). Their activities in the house will definitely increase dust levels. Without proper handling on ventilation, broiler's inhalation and ingestion will be infected.

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2.1 General Ventilation System

Ventilation is an extremely flexible and effective engineering control method for reducing air concentration of toxic contaminants, by William *et.al.* (2007). General ventilation also known as dilution ventilation systems is referring to diluting the concentration of air contaminants in a space by supplying fresh air. General ventilation systems are used to control indoor space temperature, relative humidity, and exhaust excessive toxic substances and microorganisms. Poor or no ventilation could be hazardous factors that could cause physically or mentally illness. Fresh air flows are compulsory that provide human oxygen to sustain life. In the same times, remove carbon dioxide that human breathe out and dilute hazardous gases. General ventilation system is generally divided into three types which are natural ventilation, mechanical ventilation and hybrid ventilation.

2.1.1. Natural Ventilation System

Natural ventilation, by it name stated the flow of air must be in natural flow without any assistance from mechanical devices. The movement of air is driven by the wind pressure difference and buoyancy. The ventilation conduct the natural flow of hot air rises above cold air which called "stack effect". Natural ventilating allows fresh air to flow into a space and lead warm air to rise and escape through vents. The natural ventilation not only provide quality air for health and comfort, it also provides cooling 'service' for free of charges since there are absent of mechanical systems. Proper design of building's ventilation system can reduce cost in terms of operation and construction, energy consumption will also significantly been reduced.

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