



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**STUDY OF PHYSICAL PROPERTIES OF INDOOR AIR QUALITY
AT UNIVERSITY TECHNICAL MALAYSIA MALACCA
LIBRARY**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Refrigeration and Air-conditioning) with Honours

by

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I hereby, declared this report entitled Study of Physical Properties of Indoor Air Quality in UTeM Library is the result of my own research except as cited in the references

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ABSTRACT

Indoor Air Quality (IAQ) is the most vital thing to a building and structure since the beginning of development in the world. The issue of the indoor air quality is always been discuss by the government of the world to make sure the quality is good. The good indoor quality is important because human spend 90% of their time in the building. So, good indoor air quality is a must to have a better life. next, bad indoor air quality can cause a health problem to an occupant. The common symptoms are an irritation to eyes, headaches, and dizziness. Indoor air quality has 2 type of analysis indoor air quality parameters which is the physical parameter and indoor air contaminants. The physical parameters consist of air movement, air temperature and relative humidity. This physical parameter or properties also play an important role in preserving the indoor air quality in the building. The purpose of this research is to study the physical properties of indoor air quality in University Technical Malaysia Malacca. This study will be done in the reference unit and Administration unit of University Technical Malaysia Malacca (UTeM). the airflow, air temperature and relative humidity of both place will be measure. Next, the parameter of physical measurement by Industrial Code of Practice IAQ 2010 will be used in the library. It is found that reference unit and administration face an indoor air quality problem.

ABSTRAK

Kualiti Udara Dalam (IAQ) adalah perkara yang paling penting untuk bangunan dan sejak permulaan pembangunan di dunia. Isu kualiti udara dalaman selalu dibincangkan oleh kerajaan dunia untuk memastikan kualitinya baik. Kualiti dalaman yang baik adalah penting kerana manusia menghabiskan 90% masa mereka di dalam bangunan. Oleh itu, kualiti udara dalaman yang baik struktur mestilah mempunyai kehidupan yang lebih baik. seterusnya, kualiti udara dalaman yang teruk boleh menyebabkan masalah kesihatan kepada penghuninya. Gejala umum adalah kerengsaan mata, sakit kepala, dan pening. Kualiti udara dalaman mempunyai 2 jenis analisis parameter iaitu kualiti udara dalaman yang merupakan parameter fizikal dan pencemaran udara dalaman. Parameter fizikal terdiri daripada pergerakan udara, suhu udara dan kelembapan relatif. Parameter atau sifat fizikal ini juga memainkan yang penting dalam memelihara kualiti udara dalaman di dalam bangunan. Tujuan kajian ini adalah mengkaji sifat fizikal kualiti udara dalaman di Universiti Technical Malaysia Melaka. Kajian ini akan dilakukan di unit rujukan dan Unit Pentadbiran Universiti Teknikal Malaysia Melaka (UTeM). aliran udara, suhu udara dan kelembapan relatif kedua-dua tempat akan diukur. Seterusnya, parameter pengukuran fizikal oleh Kod Amalan Industri IAQ 2010 akan digunakan di perpustakaan. Dijumpai bahawa unit rujukan dan pentadbiran menghadapi masalah kualiti udara dalaman.

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DEDICATION

Special dedicated to my parents

My siblings,

My friends,

And to all who stand by my side through hardness

For all your support and love

Thank you.

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LIST OF ABBREVIATIONS, SYMBOL AND NOMEMCLATURE

IAQ - Indoor Air Quality

MVAC – Mechanical Ventilation and Air Conditioning

DOSH – Department of Safety and Health

CAV – Constant Air Volume

VAV- Variable Air Volume

FCU – Fan Coil Unit

AHU – Air Handling Unit

EMV – Eviromental Monitoring Device

CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter will discuss the whole information about the research. It is the guidelines for the people to understand the detail information in the next section. This section will cover the research background, statement of research, research question, hypothesis, the objective of the research, research scope and the significant of study.

1.1 Research Background

Indoor air quality (IAQ) is the air that effects the person health, comfort and ability to work inside the building. Temperature, humidity, mold, poor ventilation and exposed to the chemical is the usual measure in indoor air quality. All of this must follow the industry code of practice on indoor air quality 2010 in order to prevent the indoor air quality problem(DOSH, 2016).

Department of safety and health Malaysia (DOSH) also stated that good indoor air quality (IAQ) is needed for a healthy indoor environment. With a poor indoor air quality can cause a variation of short-term and long-term health problem. The common health problem cause by a poor indoor air quality is an allergic reaction, difficulty of breathing, red eyedness and my more. Indoor air quality problem happens to a building equipped with mechanical ventilating and air conditioning (MVAC) system.

The physical properties of indoor air quality also play a main role to human comfort and health. The physical propeprties of indoor air quality consists of 3 thing is air movement or

airflow, air temperature and relative humidity. Airflow is one of the important thing in the physical properties of indoor air quality. air movement or airfow is becoming n critical factors to increase human thermal comfort and energy efficiency (Wei Yu, Hong Liu, Chenquie Du, Yu Ji, Runiming Yoa, 2019).

Other than the airflow, air temperature also one of the physical properties of indoor air quality. if the temperature is too cold it is not good and if the temperature is too it also not good. Thermal comfort for indoor conditions of building is between 23°C to 26°C under air temperature. (SUN, 2012). Nevertheless, air temperature must be in the acceptable range in order to preserved an occupants comfort.

Next, relative humidity also play a role in the physical properties of indoor air quality. according to SUN, (2012), the occupants fell more warmer if the humidity is high due to the rate of heat transfer is low. Other than that, tropical climates like Malaysia is a favourite place for microbial pollutants to growth due to the high humidity in Malaysia. Thus, the relative humidity must be in range between 40% to 70% in order to have a good indoor air quality in a building.

1.2 Problem statement

Indoor air quality has been a common thing that happens in the building in Malaysia and around the world. Day by day the government of the world are trying to improve the comfort, health, and comfort of the building occupants. It has been estimated more than 50% of people spend their time in the building such as home, gym, and workplace. Indoor air quality problem not only effect the health, but it also affects the working performance of the occupant(Martellini, 2017).

Example poor indoor air quality such as small dust can cause cough, wheeze and chest tightness for a short-term effect. While for a long-term, increased weakness to chronic obstructive lung diseases including asthma. So, this matter needs to be solved and prevent in order to achieve good indoor air quality(WHO, 2008).

Furthermore, since the research is done in the library, the previous study has been done by Chou, (2018) in the library in University of Science and Technology Beijing shows that the level of indoor air quality is difference in every place in the library. It says that the

level of indoor air quality is difference because the requirement of fresh air and the functionality of the space usage should be considered in the ventilation system or central air-conditioning system.

Next, previous research also done by (Nik Nur Faraheda Binti Nik Zulkifli, 2015) in library UTeM show that the level of indoor air quality below the level set by Industrial Code of Practice IAQ 2010 by DOSH Malaysia on air velocity. Which is the cause of respiratory problem to the occupants of the library.

To improve the indoor air quality, the research is done to study the physical properties of indoor air quality in library University Technical Malaysia Malacca. The research work is discussed in the next chapter.

1.3 Research questions

- What is the current condition of indoor air quality in the library?
- Which is the worst indoor air quality problem?
- Does the location in the library effect the temperature ?
- Why the physical properties of indoor quality must be in range ?

1.4 Hypothesis

From the observation done by informal questionnaire, the occupant of the library says that they are having a problem of breathing and sneezing when entering the library. Other than that, the previous study by Nik Nur Faraheda Binti Nik Zulkifli,(2015) state that respiratory problem effect the occupant by 42.6 % in the first floor of the library. This shows that., the library has faced some serious issue on indoor air quality.

from the previous research done by Nik Nur Faraheda Binti Nik Zulkifli, (2015).the worst indoor air quality problem is air velocity and temperature. It is shown that both parameters are below the industry code of practice on indoor air quality 2010 acceptable limit. So, this research will show more why the problem happens in the library. The reason

why health problem happens in the UTeM library, the indoor air quality from the library is bad.

The location of library does effect the temperature. This because temperature at high location more warm than the temperature in ground location. Since the research is done in the ground floor and second floor. The result will definedly show that, the temperature in the ground floor is lower than the upper floor.

The physical properties must be in range of Industry Code of Practice indoor air quality 2010 in order from the occupants to have a comfort place to work. If the temperature is below or above the range it will cause occupants ability to concentrate is lower. In range temperature lead to better employee engagement which lead to a better performance. (Rockwool, 2018). Other than that, relative humidity also must be in range in order to prevent mold and mildew to form that can cause to health problem. Furthermore it the relative humidity is below the range it can cause a health problem such as irritation skin and dry eyes.(News, 2015). Lastly the airflow must be in range because low air movement or air flow causing the temperature to be warm. It also difficult to identify odor in the building.(united states enviroment protection agency, 2018). The condition causing the occupants to have discomfort and also causing a health problem to the occupants.

1.5 Research Objectives

1.5.1 Main Objectives

- To study the physical properties of indoor air quality in the University Technical Malaysia Malacca (UTeM) library

1.5.2 Specific Objectives

- To measure physical level of indoor air quality in the library at Reference unit and administration unit.
- To compare the data taken with the Industry Code of Practice on Indoor Air Quality

2010 by DOSH Malaysia.

- To relate the relative humidity and temperature

1.6 Research scope

Data collection and will be done base on this;

- Reference unit
 - The physical measurement of IAQ (relative humidity, temperature, air movement)
 - The physical and measurement will compare with Industrial Code of Practice IAQ 2010 by DOSH Malaysia
- Administration unit
 - The physical measurement of IAQ (relative humidity, temperature, air movement)
 - The physical and measurement will compare with Industrial Code of Practice IAQ 2010 by DOSH Malaysia

1.7 Significant of Study

A better indoor air quality level of air conditioning system will prevent the occupants of the library to health problem and help the occupants the have condition at an optimum level. Besides that, the study also provides new data about the physical properties to the indoor air quality in reference unit and administration unit in library UTeM and can solve this problem in the near future.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

As you know indoor air quality is one of the important things to keep a healthy life. One of the related quality levels of indoor air quality is relative humidity. The humidity is an important role in indoor air quality because high humidity can affect the building and next effect the occupant of the building. High relative humidity can cause mold to growth. Mould needs water to grow over time. So, mold can cause several types of illness such as asthma, numbness, and tingling.

2.1 Ventilation

As you know ventilation is the most important thing to maintain good indoor air quality and relative humidity. In the library, both indoor air quality and relative humidity is important to make sure the book is preserved and well through the time

2.1.1 Natural Ventilation

In natural ventilation air is provide and expel into indoor space with using any type of mechanical mechanism. The pressure difference around the building structure between inside and outside that cause natural ventilation(Hamdani et al., 2017). Because of the pressure difference, inside and outside temperature become contrast and causing the stack effect.

According to Hamdani et al (2017), Stack effect is a difference between outside and inside air density. The movement of air change because of differential temperature between