UNIVERSITI TEKNOLOGI MARA

INDOOR AIR QUALITY IN MICROENVIRONMENT OF PRIMARY SCHOOLS IN KUALA SELANGOR DISTRICT

ADIBAH BINTI AZMI
MARYAM SAKEENAH BINTI YAHAYA
NUR AZIRA BINTI ZAMRI

Project submitted in fulfillment of the requirements for the degree of
Bachelor in Environmental Health and Safety (Hons.)

Faculty of Health Sciences

July 2020

ACKNOWLEDGEMENT

In the name of Allah, The Most Gracious, The Most Merciful

First of all, we praise to Allah S.W.T., The Supreme Lord of the Universe, for providing good health, strength and ability to complete the project on time. High appreciation and deepest gratitude are given to our dearest supervisor, Assoc. Prof. Rodziah Ismail for her kind attention, invaluable guidance, encouragement, great advice, patience and strong support in completing this project from the beginning until the end of this project.

Other than that, we also wish to thank the Principal, teachers, students and staff of primary schools in Kuala Selangor district for their kindness in helping us to complete our assessment of indoor air quality in primary school smoothly. Not to forget, we would like to thank all the lecturers in Department of Environmental Health and Safety, Faculty of Health Sciences; Dr. Ahmad Razali Ishak, Puan Siti Rohana Mohd Yatim, Dr. Abdul Mujid Abdullah, En Megat Azman Megat Mokhtar, Dr Farah Ayuni Shafie, En Nasaruddin Abd. Rahman, Dr. Nazri Che Dom, Tuan Haji Mohd Pozi Mohd Tahir, En Mohd Izwan Masngut, Dr Nadiatul Syima Mohd Shahid, Dr Shantakumari Rajan, Dr Alia Azmi and Dr Muhammad Afiq Zaki who always share their thoughts, knowledge and advice throughout our study in UiTM Puncak Alam. Only God can reward all of you with goodness.

Last but not least, many thanks and love to our family for their prayers, support and encouragement through thick and thin of our study. Sincere thanks and appreciation go to all the staff from the department and laboratory who gave their full cooperation and assisted us in many ways throughout our study.

A special thanks to our friends from HS243 for their willingness to sharing the burden and supporting each other weaknesses in order to complete the final year project. Lastly, we would like to thank everyone who involved directly and indirectly in this study. Above all, we wish everyone happiness and wellness in their life. May Allah bless our lives in this world and the hereafter. Thank you.

TABLE OF CONTENTS

TITLE PAGE
DECLARATION BY STUDENT ii
INTELLECTUAL PROPERTIES iii
APPROVAL BY SUPERVISOR vi
ACKNOWLEDGEMENT vii
TABLE OF CONTENTS viii
LIST OF TABLES xi
LIST OF FIGURES xiii
LIST OF ABBREVIATIONS xiv
ABSTRACT xv
ABSTRAK xvi

CHAPTER 1: INTRODUCTION
1.1 Background 1
1.2 Problem Statement 3
1.3 Significance of Study 5
1.4 Objectives 6
1.5 Conceptual Framework 7

CHAPTER 2: LITERATURE REVIEW
2.1 Background 8
2.2 Included Studies on Indoor Air Quality School 10
2.3 Physical Parameter 17
2.4 Chemical Parameter 19
2.5 Biological Parameter 25
2.6 Legal Requirement 29

ABSTRACT

The status of indoor air quality in primary schools has become a global concern as children spent most of their time in schools five times a week and they are considered as high-risk groups compared to adults. Poor indoor air quality may decrease children's concentration level and productivity as well as it may damaging their upper respiratory system. This study was conducted at selected five public primary schools in Kuala Selangor district to determine the concentration of indoor air pollutants in the microenvironment of schools which are classrooms, prayer rooms and libraries depending on the school's age buildings and school period during school days and non-school days. Parameters involved are physical, chemical and biological i.e. relative humidity, temperature, particulate matter (PM_{10}), carbon dioxide (CO_2), total volatile organic compound (TVOC), total fungal and bacterial count. Children's exposure to indoor air pollutants was assessed using the Health Risk Assessment and Exposure Dose calculation. The results show that indoor air pollutants for PM_{10}, TBC and TBC at classrooms, prayer rooms and library at five primary schools have exceeded the acceptable limits required by DOSH. Besides that, there is a positive correlation with the age of buildings both during school days and non-school days for a certain parameter. Meanwhile, the result of health risk assessment for PM_{10} and TVOC at these three microenvironments indicates that there is no potential health risk occurs towards the students for all five primary schools. Indoor air pollutants can be overcome and reduce through proper housekeeping maintenance and education on indoor air quality towards the school's community including teachers, students, staff, cleaner and even the student's parents itself.

Keywords: *IAQ, Indoor air pollutants, Primary school, Age of building, Health Risk Assessment.*

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Indoor Air Quality (IAQ) is a term that refers to the quality of air inside and around buildings and structures as represented by pollutants concentration and thermal conditions that affect the health and comfort of building occupants (U.S. EPA, 2019). The health effects from indoor air pollutants can be occurred for a short period of time (acute) or long period of time (chronic) after exposure to the pollutants (Annesi et al., 2013; M. Simoni et al., 2010). Health problems usually related with poor IAQ include allergic reactions, respiratory problems, eye irritation, sinusitis, bronchitis and pneumonia. Besides, the primary cause of indoor air quality problems is inadequate ventilation could increase the level of indoor pollutant by failing to provide sufficient outdoor air to dilute emissions from indoor sources as well as by not filtering the indoor air pollutants out of the area. Moreover, the concentration of pollutants can be increased by high temperature and humidity level (U.S. EPA, 2019). Hence, it is important for us to understand and control the common indoor air pollutants in order to reduce the indoor health risk.

Schools offer children an indoor environment away from their home as they may spend 10 hours per day at school and at least 10 hours per year depending on when they arrive at school and on the time of their departure from school (G. Zhang *et al.*, 2006). This means that most of their days, they are exposed to indoor air condition in the school. Recently, the issue of healthy educational buildings such as