



THE EXPOSUREASSESSMENT OFAIRBORNE
PARTICULETS FOR INDOOR AND OUTDOOR
ENVIRONMENT OF INTERNATIONAL ISLAMIC
SCHOOL GOMBAK SELANGOR, MALAYSIA

BY

DJABIR ABDOULAYE DJABIR

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ABSTRACT

Indoor air quality is one of the major problems needs to be address within the building design it is far more complex issue than other environmental challenges. Bad indoor air quality (IAQ) may affect human health and cause many health problems especially for young people due to weakness of their organs and it will be a more critical issue after a long period of time. The objective of this research is to determine the mass concentration level of airborne particles that affect the indoor and outdoor of the schools and to measure the level of airborne particles within the guidelines and standards of IAQ in Malaysia and other Asian countries. To know the impact associated with air borne particles among children learn in school. This research cover it by several stapes of primary data collection (case study, site survey, interview and questionnaire survey) and other sources such as literature review. The school selected for the case study is the International Islamic School of Malaysia in the Gombak area. The result shows that the mass concentration on level of airborne particles within the area of the school has exceed the permission limit of 0.15 mg /m^3 by the Code of practice for 2005 by Department of Safety and Health (DOSH), Malaysia and more than the standard stated by The Department of Environmental (DOE) . After eight hours of sampling This research finds the total average ratio of respirable divide to inhalable airborne particulates for outdoor ratio is 0.848 (traffic light) and for 0.696 (school canteen and for indoor ratio is 0.409 (Biological lab) and 0.751 for (Class Arif 1) . This is due to regular traffic in the school area and that because it is near to the main road and so close to open area of the school canteen. This could bring symptoms and other health problems during traffic between 9 am and 10 am. This is because of the proximity of the highway to the school building and that will increase the percentage and average of mass concentration in the school environment. Due to that it is highly recommended to implement the Malaysian standard and guidelines for indoor and outdoor air quality in order to avoid the high risk of Air borne particles.

ملخص البحث

يعتبر الهواء في الأماكن المغلقة واحدة من ضمن المشاكل البيئية الرئيسية والأكثر تعقيداً ويعتبر واحدة من ضمن التحديات البيئية قد تقل من جودة الهواء الداخلي ويؤثر على صحة الإنسان وتسبب العديد من المشاكل الصحية وخاصة للشباب الأصغر سناً بسبب ضعف الجهاز المناعي لهم، وتكون أكثر تعقيداً بعد فترة طويلة من الزمن. والهدف من هذا البحث هو تحديد مستوى تركيز كتلة الجسيمات المحمولة جواً التي تؤثر على البيئة الداخلية والخارجية لمبنى المدرسة الإسلامية العالمية بماليزيا وفقاً للمعايير الماليزية ودول آسوية أخرى. وللتعرف على التأثيرات المرتبطة بالجسيمات المحمولة جواً في المدرسة، تم تجميع العديد من البيانات الأولية إضافة إلى القيام بمسح موقع الدراسة إضافة إلى إجراء مقابلة واستبيانات ومصادر أخرى مثل مراجعة الدراسات السابقة. والموقع المحدد لإجراء الدراسة (المدرسة الإسلامية العالمية بماليزيا). وتظهر النتيجة أنّ تركيز كتلة الجسيمات المحمولة جواً داخل منطقة المدرسة قد تجاوز الحد المسموح به من 0.15 ملغم/م³ لنوعية الهواء في الأماكن المغلقة وفقاً لمعايير عام 2005م لإدارة السلامة والصحة (DOSH) بماليزيا وأكثر من 0.05 mg³ من قبل وزارة البيئة (DOE) في الهواء الطلق لفترة ثمانية ساعات من جمع العينات. تم الحصول على متوسط النسبة المئوية للجسيمات الموجودة في الهواء. ولوحظ أنّ نسب تركيز الجسيمات في منطقة إشارة ضوء المرور أعلى من المطعم العام للمدرسة، وفصل (تعريف 1) بالإضافة إلى المختبر البيولوجي، وذلك بسبب ازدحام في حركة المرور إضافة إلى قرب المدرسة من الطريق العام مما يجلب الكثير من الأعراض الصحية الأخرى. إضافة إلى تزايد نسب التركيز الشامل للجسيمات على بيئة المدرسة. ونظراً لذلك تُنصّ الدراسة باتباع المعايير الماليزية لنوعية الهواء في الأماكن المغلقة وذلك لتجنب الأضرار البيئية والصحية التاجمة من تلك الجسيمات.

APPROVAL PAGE

I certify that I have supervised and read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Master of Science in Building Services Engineering (MSBSE).

.....
Shamzani Affendy B. Mohd. Din
Supervisor

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Master of Science in Building Services Engineering (MSBSE).

.....
Puteri Shireen Jahn Kassim
Examiner

This dissertation was submitted to the Postgraduate Studies and is accepted as a fulfilment of the requirement for the degree of Master of Science in Building Services Engineering (MSBSE).

.....
M.Zainora Asmawi
Deputy Dean (Postgraduate)
Kulliyyah of Architecture and
Environmental Design

This dissertation was submitted to the Kulliyyah of Architecture and Environmental Design (KAED) and is accepted as a fulfilment of the requirement for the degree of Master of Science in Building Services Engineering (MSBSE).

.....
Abdul Razak Sopian
Dean, Kulliyyah of Architecture
and Environmental Design

DECLARATION

I hereby declare that this dissertation is the result of my own investigation, except where otherwise stated. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at IIUM or other institutions.

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This work is dedicated to my lovely and supportive family members specifically to

My beloved mother Fouad Adam Bashir

My Father, Abdoulaye Djabir

and to all my siblings ...

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Bismillahirrahmanirahim,

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LIST OF SYMBOLS

CH ₄	Methane
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
N ₂	Nitrogen gas
NO ₂	Nitrogen Dioxide
NO ₃ ⁻	Nitrate
SO ₂	Silver Dioxide
Ppm	Parts per million
μm	micrometer
SO ₄	Sulfate
Mg/m ³	milligrams per cubic meter
PM ₁₀	Particulate matter size-fractioned 10 micrometer
PM _{2.5}	Particulate matter size fraction 2.5 micrometer
PM _{0.1-1.0}	Particulate matter size fraction 0.1-1.0 micrometer
TSP	Total Suspended Particulates (TSP)

LIST OF ABBREVIATIONS

API	Air Pollution Index
DOE	Department of Environment
DOSH	Department of Occupational Safety and Health
EPA	Environmental Protection Agency
HCHO	Formaldehyde
HVAC	Heating Ventilation and Air Conditioning
IAP	Indoor Air Pollution
IAQ	Indoor Air Quality
ISO	International Standard Organization
PM	Particulate Matter
PM ₁₀	Particulate Matter of less than 10 Microns in Size
PM _{2.5}	Particulate Matter of less than 2.5 Microns in Size
TSP	Total Suspended Particles
UFP	Ultra-Fine Particulate
U.S EPA	United States Environmental Protection
Agency WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

With rapid development of the economy and a booming population growth, an enormous amount of resources such as energy, water, and food are required in contemporary societies in order to build a various activities of man. Consequently, various kinds of pollution have been produced amongst them, air pollution has caused major concern across the globe due to its ubiquitous nature, including the damages it is causing to the environment capable of causing potential health risk to humans. Although The concern has been raised regarding the emission of air pollutants from anthropogenic sources, the societies mankind dwell hitherto relies heavily on fossil fuels for various applications such as electricity generation, transportation, industrial and domestic heating (Wallace, 2013).

The aforementioned activities have no doubt culminated into a deterioration of the air quality, particularly in developing countries. The air pollution has become a public concern issue in modern metropolises. Numerous studies in physics, chemistry, geography, and other relevant areas have been conducted to investigate the cause and seriousness of air pollution problems (Figler, 2015). Likewise, the issue of indoor and outdoor air pollution has also piqued the interest of many scientists and engineers as people spend most of their time (>80%) indoors (Horvath, 2015). Although the time people spend indoors with varies season and other factors such as age , gender, type of work, health conditions of inhabitants, and so on, it is no gain saying that good air quality can safeguard the health of the occupants and increase the productivity of workers.

Apparently, indoor air quality ought to be better than outdoor air quality due to the shielding effect of buildings and possible installation of ventilation and possible installation of ventilation and air cleaning devices (Delling, 2016),

However, for those combined indoor and outdoor air quality studies in literature, more than 2/3 have found indoor air pollutant concentration to be higher than its outdoor counterpart (Formignani, 2013). This indicates the importance of conducting more studies in order to enhance our understanding regarding to this problems including the associated remedial measures that would be suitable to combat air pollution. Besides, the number of publications related to indoor air pollution has increased tremendously in recent decades. Many of such studies have confirmed that indoor air quality is highly affected than out door air quality. Therefore, in order to solve air pollution problems, both indoor and outdoor environment should be considered simultaneously. In this paper, various issues relating to indoor outdoor air quality including how they are affected by the outdoor air quality in urban environment shall be discussed (Berico, 2013).

In addition to the above, it is to mention that with the continual improvement in mankind's quality of life indoor and outdoor air quality has become an important area of concern in the twenty-first century. Indoor air quality is affected by many factors including the type and running conditions of indoor pollution sources, ventilation conditions, as well as indoor activities. Studies have revealed that the outdoor environment is also an important factor that cannot be neglected than indoor air quality studies. In this study, both indoor and outdoor air pollution relationships obtained from different studies are discussed in order to identify the key factors affecting the indoor air quality (Sexton, 2013).

1.2 STATEMENT OF THE RESEARCH PROBLEM

A nearby roadway is capable of putting household inhabitants or schools student health at risk because of conditions such as lack of thermal comfort, dampness and mold, indoor air pollution, infestations, school safety, noise, accessibility including other factors all of which can impact on health adversely such, air pollution remains a major investigation field implemented to improve health and public environmental he (Deguen ,2014). Again here, a complete investigation of how environmental risk factors operate in the reality of the social environment has not been reached, and would be very informative especially for designing effective policy responses (World Health Organization, 2010).

Additionally, the airborne particles concentration level at school near to the main road is credibly high, many study stated that the contrasts in the exposure of environmental nuisances are greater among children than among adults. However, many schools in addition to the international Islamic school Gombak Malaysia are generally located near major roads and this will lead to health risks from the elevated air borne particulates near the high way and traffic roadways where in many schools are situated. These are capable of causing a health risks in addition to the unfavorable environmental impact caused by airborne particulates into the indoor and outdoor environment. Furthermore, research continues to show that air pollution, or airborne particulates particularly from auto emissions, has profound negative effects on health. Such impacts are unequally distributed among local populations, largely based on nearness to major roadways (Grieken, 2013). The aforesaid is hinged tenaciously on the fact that, air born particles and pollution are severe based on proximity to source. Additionally, line-source pollution, is one of the most overlooked health threats in Malaysia because policy makers and regulators in this domain have done very little to

protect susceptible populations, including children, from the dangers of nearness air borne particles sources. Undoubtedly, this disproportionate lack of urgency concerning the health impacts of air pollution is attributable to its hidden and delayed impact (Richards, 2013). The health impacts of air pollution on general populations are certain, individual diagnoses of disease rarely identify air pollution as the cause.

Furthermore, air pollution's effect data are equivalents with results for particulate matter and respiratory infant mortality are fairly consistent and further supported by the strong and well established link between particles and adult mortality. This studies nevertheless have not been able to identify the specific components of particulate matter, nor elucidate the mechanism by which these pollutants affect health in children and infants, which may be different from adults and that is exactly what this study intends to investigate by way of empirical research (Szabó, 2013).

1.3 PURPOSE OF THE STUDY

The primary purpose of this study is to investigate airborne particles in a bid to understand the environmental impact on indoor and outdoor environment of International Islamic School Malaysia. The overall objective of this study is comprehensively investigate indoor and outdoor particulates characteristics, with a central focus on fine particulates and the relationship between indoor and outdoor particulates. The intent of this investigation and to determine the exposure assessment of airborne particulates of indoor and outdoor sources. Therefore there is strong links and dynamics all of which will push more in to advancing knowledge related to exposure assessment and improving of indoor and outdoor environment of the school afore mentioned.

1.4 RESEARCH AIM

School buildings may be subjected nearly to the same level of risk due to penetration of airborne particulates from Outdoor to indoor environment. The aim of the study are to determine the exposure assessment of airborne particulates of indoor and outdoor of international Islamic school of Gombak ,and knowing the ratio of the exposure towards the International Islamic School student and other member of the school.

1.5 THE OBJECTIVES

This study aims to achieve the following objectives:

- i. To measure data of indoor and outdoor particulates concentration levels and size of airborne particulates distributions characteristics.
- ii. To investigate and interpret the relationship between indoor and outdoor airborne particulates characteristics in the international Islamic school Gombak Malaysia.
- iii. To compare the level of airborne particulates with the existing guidelines of Malaysian and Asian standard
- iv. To investigate indoor and outdoor particle source characteristics.

1.6 SIGNIFICANCE OF RESEARCH

Investigating the impact of environmental airborne particles in indoor and outdoor for international Islamic high school in Malaysia is essential because the issue of exposure and health issue related to ambient air quality is complex hence it calls for appraisal, additionally, this study is important because children are more vulnerable than adults to environmental hazards. This is due to a range of factors, including different and unique exposures such as exploratory behavior and increased energy, water and air

intake, developmental physiology and a lower awareness of risk thereby leading to less control over the environment. While patterns vary between and within countries, the overall evidence shows that children schooling or living in adverse social circumstances suffer more from multiple and cumulative exposures and are more susceptible to a variety of environmental toxicants (Hirtle, 2011).

Thus, with a particular focus on sub micrometer particles and the relationship between indoor and outdoor particulates matter, findings from this study will enable the researcher to make recommendations to urban planning policy makers and the authorities of the International Islamic School Malaysia regarding how to prevent outdoor and indoor particulates sources, from adversely affecting the health of the students of the school. In addition, findings from this study shall also fill in the existing gap in the literature and the theories to be employed in this study thereby advancing knowledge related to exposure assessment and improving indoor air quality. These objective shall be achieved via policies aimed to have new system able to reducing air pollution within the vicinity of the school (Katragkou, 2011).

In addition to that, airborne particulates is become one of the major problems facing the entire glob causing a substantial damage to the human health system. This environmental issue raising industrial development around the world is considered as the key elements contributing to the level of airborne concentration or percentage in to our atmosphere beside the other elements such as emission from factories cars and other chemical and mechanical equipment. Furthermore, the technical ways of cleaning and painting besides repainting this method are become source of income for many people (Banks, 2015).This aerosol particles are playing a major for changing the chemical characterization of our atmospheric system Recently, many attention has been raised regarding to air quality purpose and the relationship between this particles .