CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The basic requirements as human being to continue living is can breathe a clean air without any worries. However, nowadays air pollution continues to pose a significant threat to human health worldwide. According to a World Health Organization (WHO) in 2012 assessment of the burden of disease due to air pollution, more than two million premature deaths each year as consequence from the effects of urban outdoor air pollution and indoor air pollution (caused by the burning of solid fuels). Concerning for indoor air quality (IAQ), over the last 30 years, there have been significant developments, both in the intensity with which IAQ is being challenged, and in the understanding of the interactions and causalities among the various parameters that impact on indoor air quality. The evidence of the impact that IAQ on people makes compelling consideration for its enhancement to mitigate against adverse health consequences, improve quality of life and the work environment with consequential benefits to wellness and occupants performance (Tham, 2016).
The National Health and Medical Research Council defines indoor air as air in the building occupied for at least one hour by peoples from the states that have difference health (Environmental, 2001). This can include the office, classroom, dormitories, shopping central, hospital and home. The indoor air quality (IAQ) can be the major concern to the occupants of the building because it can impact the health, well-being, comfort and productivity. IAQ also can be defined as the overall characteristics of indoor air that affect a person's health and well-being thus can be the major concern to the businesses, employees and building managers because it can impact the health, well-being, comfort and productivity to the occupants. IAQ also refers to the air quality in or around the buildings and structures, especially as it relates to the health and comfort of the building occupants. Besides that, ASHRAE has defined acceptable IAQ as “air in which there are no known contamination at the harmful concentrations as determined by cognizant authorities and with which a substantial majority 80 percent or more of the people expose do not express dissatisfaction”.

In general, the concept of indoor refers to the airtight building space, typically including residences, office rooms, classrooms, libraries, supermarkets and cinemas, etc. However, because of the change of human behaviours and lifestyle, human activities have gone beyond the limit bound by the concept above. Correspondingly, indoor PM$_{2.5}$ research subsequently tends to be diverse. Hence, the concept of indoor is extended in this paper, after which it includes not only usually considered airtight architectural spaces, but also various non-building airtight spaces that are closely related to public life, typically including compartment of bus and train, aircraft cabin or isolation ward (Li, Wen, & Zhang, 2017).

Indoor air pollution refers to the poor quality of air within and around the structure and buildings. It leads to the health problems and discomfort for the occupants of the building. Most of the indoor air pollutants are produced within the building whereas some of the pollutants might enter from outside due to improper ventilation. Health effects due to poor indoor air quality generally occurs after years of exposure to pollutants but some health effects like irritation in throat, eyes and nose, dizziness and headache might occur even after a short term exposure to the pollutants. A debate is still going on whether the
size, chemical composition or surface area is most relevant in predicting the health effects due to particulate matter (Suryawanshi, Singh, Verma, & Gupta, 2016).

One general measure of PM effects on populations is the number of premature or excess deaths occurring in a given time geographical area over a specific time. Toxicological and epidemiological studies can tie together the occurrence of episodic or chronic PM concentrations with observed changes in population health. Episodic increases in pollutants give the most striking examples of excess mortality. An inversion layer traps high concentrations of pollutants at urban area for several days and the number of death increase significantly above the expected number. The effects of PM on children can be particularly egregious. Young lungs are more susceptible to damage from PM and other pollutants than are mature lungs and the damage can be harmful to the entire life of the individuals. For recent years, there are significantly increases children who are suffered from asthma problem (McKenna, Turner, & Jr, 2008). The close association between lungs and heart suggests an easy route to cardiac problems when lungs are compromised. However, some studies find no, or little, damage to either system when exposed to experimental inhalation of PM.

PM is estimated to cause an average reduction in life expectancy of around 8.6 months per person. Exposure to unhealthy concentrations of PM has been connected to increased respiratory/cardiovascular illnesses, by different research groups with the smaller air particles able to penetrate deeper into the lungs and having longer residence times, as well as being linked to adverse birth outcomes, neurodevelopment, cognitive function and diabetes. Sources of urban PM include combustion of solid fuels, vehicle emissions and road dust created by tyre friction, with the vehicle exhausts being the largest urban generator of PM$_{2.5}$ and PM$_{10}$ (Pekey et al., 2010). The ratio between PM$_{2.5}$: PM$_{10}$ and analysis of the PM$_{2.5}$ fraction into its inorganic and organic source components has been used to attribute the main sources of PM air pollution; for example the proportion of PM$_{2.5}$ as elemental carbon has been shown to reduce with distance from urban areas as it is associated with vehicle exhaust emissions or other combustion sources more prominent in cities (Challoner & Gill, 2014). Other studies have shown that the increasing percentage of diesel engines compared with petrol (gasoline) engines also affects the make-up of PM$_{2.5}$.