CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Indoor air quality has a very strong influence on human well-being and productivity. A study by Jenkins et al. (1992) showed that people spend 87% of their time indoors, with only 6% outdoors, and 7% in transit. Hence, increase of indoor pollutants is believed to increase the risks for a wide array of diseases. There is mounting evidence that exposure to poor indoor air quality leads to excess morbidity and mortality (Sundell, J., 2004).

The indoor environment can be further divided into microenvironments, such as office, shopping mall, residential houses and school. The characteristics of indoor particles can be indoor microenvironment specific (He, 2004). Many studies have revealed the significance of indoor sources to the increase of particulate concentration. These sources include many everyday activities, such as cleaning, printing, cooking, smoking, burning of candles and incense sticks and even walking (Abt et al., 2000; He et al., 2004, 2007; Hussein et al., 2006; Géhin et al., 2008; Glytsos et al., 2010). Most of the previous researches were studying on the influence of cooking activities on the indoor concentration in residential houses. There is still very limited information available on the influence of office activities.

This research will focus mainly in office since office is one of the easiest places for particles to settle and accumulate. Various electronic equipments such as printers, photocopy machines, computers and typing machine are widely used in offices and they are a potential source of indoor pollutants, producing a variety of particle emissions
(Lee et al., 2001; Kaji et al., 2007). It is also important to note that the smaller and larger particles in the air behave differently (He, 2004). In addition to the penetration of pollutants from outdoor air, most indoor built environments contain air pollution sources that release fibers, particles, organic vapours, or inorganic gases (He et al., 2007).

From the previous studies, it showed that the major sources of indoor pollutants in office are generated from photocopier, printers and air freshener spray. According to He et al. (2007), the monitoring of particle characteristics in a large open-plan office showed that particles generated by printers can significantly affect the submicrometer particle (< 1 μm) number concentration levels in the office. Besides that, fine particles were detected (< 1 μm) in the study of Afshari et al. (2005) during the use of air freshener sprays. Though specific printer-emitted VOCs and PM has been studied (Kagi et al., 2007), no information on the size distribution of the photocopier-emitted particles has been reported. Field studies on the impact of photocopiers and printers on indoor air quality are still relatively limited.

Furthermore, this research focused more on the particle number concentration and distribution of different indoor activities. This is due to the existing database is very limited to particle mass concentration and emission rates with only a few studies reported on particle number concentration. However, since the smaller particles can be high in number but contribute very little to mass, and they have higher probability of penetration into deeper parts of human respiratory tract, they should be getting more attention from researchers. Recent studies have also suggested that the particle number concentration would be a more appropriate predictor of health impact than mass concentration.

1.2 PROBLEM STATEMENT

Human exposure to particulate matter can have significant harmful effects on the respiratory and cardiovascular system. These effects vary with number, size, and chemical composition of particulate matter, which vary significantly with space and time (Davidson et al., 2005). The PM concentration during indoor activities can reach
elevated values (up to tenfold compared to the situation without the sources) for short or even for longer periods of time (Wallace, 2006). Since particle size determines the fate of particles on or in the human body which in turn affects a person’s exposure risk, it is necessary to fully understand the size distribution of particles when determining secondary exposure.

Hence, in this research, several indoor activities in an office were studied in order to provide size-specific particle number distribution. This is important because particulate matter of different sizes is known to cause different levels of adverse health impacts to human. Finer particles penetrate into deeper parts of the human body and cause respiratory or cardiovascular disorders (Jimoda, 2012).

1.3 RESEARCH OBJECTIVES

The aim of the study intends to meet the objectives below:

i. To investigate the particle size distribution under different indoor activities;
ii. To evaluate the relationship between different indoor activities and indoor particle concentration level.

1.4 RESEARCH QUESTIONS

This research is further guided by the research questions below with the purpose to gain better understanding of the research based on the identified research objectives.

The two research questions are as follows:

i. How is the particle size distribution under different indoor activities?
ii. Is there any relationship between indoor activities and indoor particle concentration levels?