



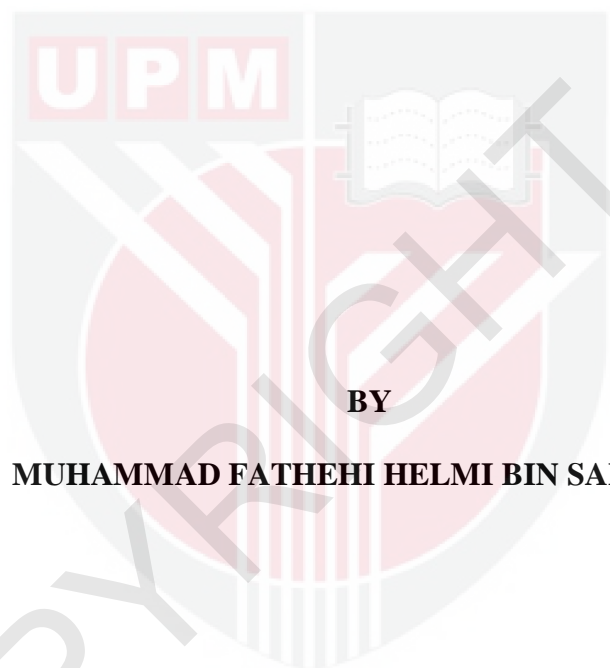
UNIVERSITI PUTRA MALAYSIA

***KNOWLEDGE, ATTITUDE AND PRACTICE ON GOLDEN POTHOS
PLANT IN REDUCING VOLATILE ORGANIC COMPOUNDS (VOC)
LEVEL AMONG OFFICE WORKERS IN UNIVERSITI PUTRA
MALAYSIA***

MUHAMMAD FATHEHI HELMI BIN SAIDUIN

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BY

MUHAMMAD FATHEHI HELMI BIN SAIDUDIN

**Thesis submitted in fulfilment of the requirement for the degree of Bachelor
Science (Environmental and Occupational Health) from the Faculty of Medicine
and Health Sciences, Universiti Putra Malaysia.**

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ABSTRACT

KNOWLEDGE, ATTITUDE AND PRACTICE ON GOLDEN POTHOS PLANT IN REDUCING VOLATILE ORGANIC COMPOUNDS (VOC) LEVEL AMONG OFFICE WORKERS IN UNIVERSITI PUTRA MALAYSIA

MUHAMMAD FATHEHI HELMI BIN SAIDUDIN

Introduction: Indoor air may be contaminated by two or three times as much as poor outdoor air, and IAQ could lead to or worsen up to 50% of all illnesses (EPA, 1987). VOCs are a large group of chemicals found in a variety of products used to manufacture and repair our homes. There is a wide range of VOC sources in office buildings, such as building and interior finishing materials, furniture, office products, cleaning agents, and office machines. Alternative measures have been suggested to reduce the amount of indoor VOC by putting indoor plants inside the office building. Therefore, the background of knowledge, attitude and practice (KAP) of office workers in perceiving the importance of indoor plant in reducing the indoor VOC levels is of interest in this study. **Objectives:** The aim of the study is to determine the level of KAP among office workers in UPM in relation to the Golden Pothos plant in reducing indoor VOC levels. **Methodology:** Using UPM intranet email as a questionnaire delivery platform, a total of 64 office workers who meet the inclusive criteria and agree to the research consent participate in this study. **Results and Discussion:** The results of this study shows that most of the office workers have good knowledge, attitude and practice of having indoor plant in their office and its role to enhance IAQ. There is no significant association between knowledge and attitude, attitude and practice, and knowledge and practice among the respondents. However, significant association ($p \leq 0.001$) was found between the knowledge and gender of the respondents. **Conclusion:** In summary, many individual have good perception regarding houseplant can help maintaining good indoor air quality. Implementation of having houseplant in the office can be reconsider as houseplant also can help in increasing productivity of the workers.

Keywords: Volatile Organic Compound (VOC), Golden Pothos plant, KAP, Office Workers.

ABSTRAK

KESAN PENYIMPANAN TERHADAP PELEPASAN BISPHENOL A DARIPADA MINUM BOTOL AIR DAN RISIKO KESIHATAN PENGGUNAAN

YUN WEN MIN

Pengenalan: Udara dalaman mungkin tercemar dua atau tiga kali lebih banyak daripada udara luar yang buruk, dan IAQ boleh menyebabkan atau memburukkan sehingga 50% daripada semua penyakit (EPA, 1987). VOC adalah sekumpulan besar bahan kimia yang terdapat dalam pelbagai produk yang digunakan untuk pembuatan dan pembaikan rumah kita. Terdapat banyak sumber VOC di gedung pejabat, seperti bahan penamat bangunan dan dalaman, perabot, produk pejabat, agen pembersih, dan mesin pejabat. Langkah-langkah alternatif telah dicadangkan untuk mengurangkan jumlah VOC dalaman dengan meletakkan tanaman dalaman di dalam bangunan pejabat. Oleh itu, latar belakang pengetahuan, sikap dan amalan (KAP) pekerja pejabat dalam memahami pentingnya kilang dalaman dalam mengurangkan tahap VOC dalaman adalah menarik dalam kajian ini. **Objektif:** Tujuan kajian ini adalah untuk mengetahui tahap KAP di kalangan pekerja pejabat di UPM berhubung dengan kilang Golden Pothos dalam mengurangkan tahap VOC dalaman. **Metodologi:** Dengan menggunakan e-mel intranet UPM sebagai platform penyampaian soal selidik, seramai 64 pekerja pejabat yang memenuhi kriteria penyertaan dan bersetuju dengan persetujuan penyelidikan mengambil bahagian dalam kajian ini. **Keputusan dan Perbincangan:** Hasil kajian ini menunjukkan bahawa kebanyakan pekerja pejabat mempunyai pengetahuan, sikap dan amalan yang baik untuk memiliki kilang dalaman di pejabat mereka dan peranannya untuk meningkatkan IAQ. Tidak ada perkaitan yang signifikan antara pengetahuan dan sikap, sikap dan amalan, dan pengetahuan dan amalan di kalangan responden. Walau bagaimanapun, hubungan yang signifikan ($p \leq 0.001$) didapati antara pengetahuan dan jantina responden. **Kesimpulan:** Ringkasnya, banyak individu mempunyai persepsi yang baik mengenai tanaman rumah dapat membantu menjaga kualiti udara dalaman yang baik. Pelaksanaan memiliki tanaman rumah di pejabat boleh dipertimbangkan semula kerana tanaman rumah juga dapat membantu meningkatkan produktiviti pekerja.

Kata kunci: *Volatile Organic Compound (VOC)*, *Tumbuhan Golden Pothos*, *KAP*, *Pekerja Pejabat*.

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LIST OF ABBREVIATIONS

UPM	Universiti Putra Malaysia
VOC	Volatile Organic Compund
IAQ	Indoor Air Quality
SBS	Sick Building Syndrome



CHAPTER 1

INTRODUCTION

1.1 Study Background

Malaysia is one of Asia's fastest-growing economies. After its independence in 1957, the Malaysian economy has moved from agriculture to further different type of industries and export-oriented. The development is one of the things that can be measured of growing the economy demanded as industries increasing rapidly and keep expanding. Use of chemicals in the production, indoor air quality of the working environment is one of the important things in this issue. Since the rapid growth of economic development in the country, the Occupational safety and health issues among employees should be prioritized as it might direct and indirectly affecting one's work performance and job productivity.

United State Environmental Protection Agency (1989) state that in general, office workers spend between 80-90% of their time at the workplace to get their job completed. The indoor air quality (IAQ) in the work environment plays the biggest role in affecting human health and work efficiency. Temperature, humidity, air movement, ventilation, particulate contaminants, biological pollutants, and gaseous pollutants are the main factors influencing the indoor environment. Gaseous pollutant or chemicals sources include tobacco smoke, the unintentional spill of chemicals, and

gasses like carbon dioxides and nitrogen dioxide, which are combustion products, emission from products used in the office working environment such as office equipment; furniture, flooring and wall cleaning products and consumer products. In view of this, gaseous pollutants is the most severe of all factor.

Gaseous pollutants can be divided into two groups, primary and secondary. Primary gaseous contaminants including Volatile Organic Compounds (VOCs) are chemicals that have commonly used indoors. A few examples of VOCs are formaldehyde, benzene, hexanal, and phenol. VOC sources are household items such as paintings, paint strippers and other solvents, wood preservatives, aerosol sprays, moth repellents and air refreshers, stored fuels and car products, supplies of hobbies, dry cleaned clothing and pesticide. Home goods are the source. Other products, including fabrics, furniture, office equipment, copiers and printers, correction fluids and carbon-free copy papers, printer and art materials such as glues, adhesives, photos and permanent signage (EPA, 2017). VOCs can cause many symptoms, including migraine, eye nose, and throat irritation, dry cough, dizziness vomiting, and fatigue. VOCs also have adverse effects on respiratory systems, blood vessel, and nervous systems (Yu, et al., 2008).

Knowledge, Attitude and Practice (KAP) survey is to examine the respondents' knowledge which is their ability to retain and use information, attitude which is their affinity towards certain behavior and finally the practice pointing and focusing on their actions or applications of the knowledge (Kaliyaperumal, 2004). This study will be on the KAP among office workers regarding Golden Photos plant in reducing indoor air pollutant (Volatile Organic Compounds (VOCs)). This help to examine whether the

office workers have the knowledge or right understanding to the effectiveness of houseplant in reducing indoor pollutants, possess the proper attitude and actions towards creating a safe and healthy environment in workplace.

1.2 Problem Statement

1.2.1 Factors contributing to VOC levels

Indoor air may be contaminated by two or three times as much as poor outdoor air, IAQ could lead to or worsen up to 50% of all illness (EPA, 1987). The risk of disease may rise with pollutants in indoor environment. Several studies created as an important environmental health problem by EPA. While most workplaces do not have many issues with air quality indoors, there may be incidents of poor air quality. The air being contaminated is affected by irritation of the eye, nose, throat, headaches, dizziness, and fatigue. VOCs are a wide range of chemicals found in a variety of products for the production and repair of our homes. When they are released in our houses, or "off gas" is released into the air we breathe. Smelling is a bad health risk measure that can or cannot detect gasses.

The main causes of VOC in a office building have been described as wet-process office system pollution and underground parking garage vehicle exhaust emissions. VOCs are gasses that are released by many indoor sources. Indoor air levels are higher than outdoor air levels for most volatile organic compounds. In some linens and fabrics and in certain kinds of foam isolation, formaldehyde can also be found. VOCs can also come from products for personal care such as perfume and hair spray, purifiers, dry cleaning fluid, paints, lacquers, lacquers, hobbies and machines. During use or even during storage, VOCs may released from products. Though, as the product

ages, the number of VOCs emitted from products tends to decrease (British Columbia, 2019).

Besides humidity and mold, interior materials may release VOCs into the indoor environment in addition to building enclosures. Many carpets, paints, adhesives and other products emit incredibly damaging VOC such as formaldehyde, which may be directly harmful to those in the area. VOC could also found inventilation systems, harmful aerosols, cleaning products, new computers, photocopying machines, printing equipment, and new paint. The typical symptoms of VOC emission are similar to the sick building syndrome (Mendell et al., 2002).

In office buildings, there are so many sources of a broad range of VOCs (e.g. building and interior finishing materials, furnishings, office products, cleaning agents, and office machines). It is known that any VOC levels produced within a building pose a potential health hazard, however, the concentrations can be decreased to some degree by increasing the ventilation level. Source regulation, though, would be a more effective and energy-efficient approach in many situations. A major impediment to enforcing control measures is that the essential origins of VOC in a building must first be defined and recognized (Hodgson, et al., 2012).

1.2.2 VOC levels affecting SBS symptoms

One of the main causes of indoor air pollution problems is chemical contaminants. Indoor concentrations are found to be two to five times higher than outdoor levels of around a dozen common organic contaminants. VOCs constitute an environmental pollutant subgroup. VOCs are industrial compounds dependent on wood that are visible at room temperature as vapours. In many building materials like plywood, particulates and glues formaldehyde is frequently used. Burning of fuels such as gas, timber and kerosene and tobacco products are also emit VOCs (British Columbia, 2019). There is a wide variety of indoor VOCs including ketones, aromatics, alkylbenzene, aliphatics, chlorinated and polycyclic hydrocarbons, and derivatives of hydrocarbons.

Those who believe it to be a syndrome of the real disease have only conjectured that it is due to multiple causes and depend on the health status of the patient (e.g., asthma, COPD) and how the building compounds such as cigarette smoke, chemical exhaust from structural components such as formaldehyde, paint odors and radon or biologics such as bacteria and fungi, black molds or houseplants can be found (Davis, 2016).

1.2.3 Office workers as the vulnerable group

The global economic change from the manufacturing to the service and information sectors operating in indoor office environments has been important. The quality of indoor air is of great importance to enterprises, building managers, residents and employees since it can affect the health, comfort, wellness and productivity of workers. Indoor air pollution is caused by the existence, throughout office work environment, of limited fresh air (tight building syndrome), air circulation too quickly in working

places, the presence of toxic substances in the office environment or contamination of outdoor air into the workplace (CWA, 2017). In office buildings, there are so many sources of a broad range of VOCs (e.g. building and interior finishing materials, furnishings, office products, cleaning agents, and office machines). If it is known that any VOC levels produced within a building pose a potential health hazard, by increasing the ventilation level, concentrations can be decreased to some degree.

We have found a surprisingly strong relationship between daily air pollution levels and the productivity of employees by analyzing Ctrip's staff records. The Air Quality Index (AQI) has a 10-unit increase, leading on average to a decline of 0.35 percent of calls processed by a Ctrip employee. The conclusion shows that employees are 5%–6% more productive in air pollution ratings as good by the Environmental Protection Agency (AQI 0–50) compared with unhealthy (AQI 150–200). Our study is the first to show how air pollution affects the white-collar work, to our knowledge (Chang, Zivin, Gross, & Neidell, 2016).

Contaminant sources are emitted from a variety of sources. An investigation was performed and found that employees have too high exposure to risk. Building workers, in general, indoor office workers, are exposed in their working environment to very high concentrations of VOCs. In addition, the methods of painting and exposure-related activity in construction industries are not only exposed to contaminants damaging to interior workers, but also to others (Chun et al., 2010).

1.3 Study Justification

1.3.1 Effectiveness of Golden Pothos

The safety risk associated with indoor air pollution is not the same for developing and developed nations, since people in advanced countries spend about 80 to 90 percent of their time indoors. (Orwell et al., 2004). The Commonwealth Science Council of Australia has stated 9 of 10 in-door air deaths to the developing world (Brennan and Withgott, 2005). Since indoor air pollution is a public health problem, cost-effective and easy-to-use approaches are required to minimize or reduce rates of air pollution. Activated carbon filters minimize air emissions, but they can be very expensive to mount and operate. (Wolverton, 1997).

Alternatively, leaf plants may be used for sequestering other kinds of air emissions, but their efficacy tends to rely on plants and air pollutants (Wolverton, 1986). The use of specific indoor plants for indoor air purifying Golden Pothos is one of the top three plants in addition to the philodron and spider plants that have the most effective in eliminating formaldehyde. Plant species (snake plant, spider plant and golden pothos) assessed in the study were successful at reducing ozone in CSTR chambers used to simulate the regulated interior climate (compared to control plant free) in the study. (Papinchak, Holcomb, Best, & Decoteau, 2018).

1.3.2 SBS Symptoms

The amount of indoor air emissions will also rise with new office facilities (e.g. photocopiers, laser printers, laptops, cleaning supplies and outdoor air pollution). Such pollutants have contributed to the Sick Building Syndrome (SBS) phenomenon. There are so many working environment factors affecting SBS symptoms such as bio aerosols, VOC, dust, thermal parameters, lighting and sound and vibration. In this view, VOC levels in the office environment play the main role as a detailed review was conducted of pollution levels from office equipment such as desktops, notebooks, printers and photocopying machines for VOCs, SVOCs, carbonyl compounds, Ozone and particulate matter (Destailats H. et al., 2008).

Chao and Chan (2008) recorded that quantified indoor VOCs in buildings of specific age scale mechanical ventilation in Hong Kong, such as customer care centers and shopping malls, like offices and public areas. Benzene, ethylbenzene, toluene, xylene, and dichloromethane were the most common VOCs found in indoor collections from modern office buildings. (C. Cacho et al., 2013)

According to EPA (2017), health effects may cause swelling of the eye, nose and mouth, fatigue, lack of balance and diarrhea, hepatic, renal and central nervous system disorders. Several organic compounds can cause cancer in animals, others are known and have been seen to lead to human cancer. Irritation of conjunctiva, nose and throat pain, migraine, allergic skin reaction, dyspnea, skin allergic reaction, vomiting, emesis, epistaxis, tiredness or dizziness are primary symptoms and indications consistent with VOC exposure.

Organic chemicals are highly toxic to humans without any known health effects, and can cause health impacts to vary significantly. As with other contaminants, concentrations and exposure duration, are the degree and magnitude of the health effect. Immediate signs, including eye and nasal pain, vomiting, dizziness, vision disturbances, cognitive loss, were encountered by certain people immediately after exposure to organic compounds.

1.4 Conceptual Framework

Figure 1.1 shows the conceptual framework which shows summary of this study. These conceptual framework is the summarization of the study on knowledge, attitude and practice level among office workers in UPM regarding Golden Photos plant in reducing indoor air pollutant (Volatile Organic Compounds (VOCs)). This is used to assists the researcher in conducting the study.

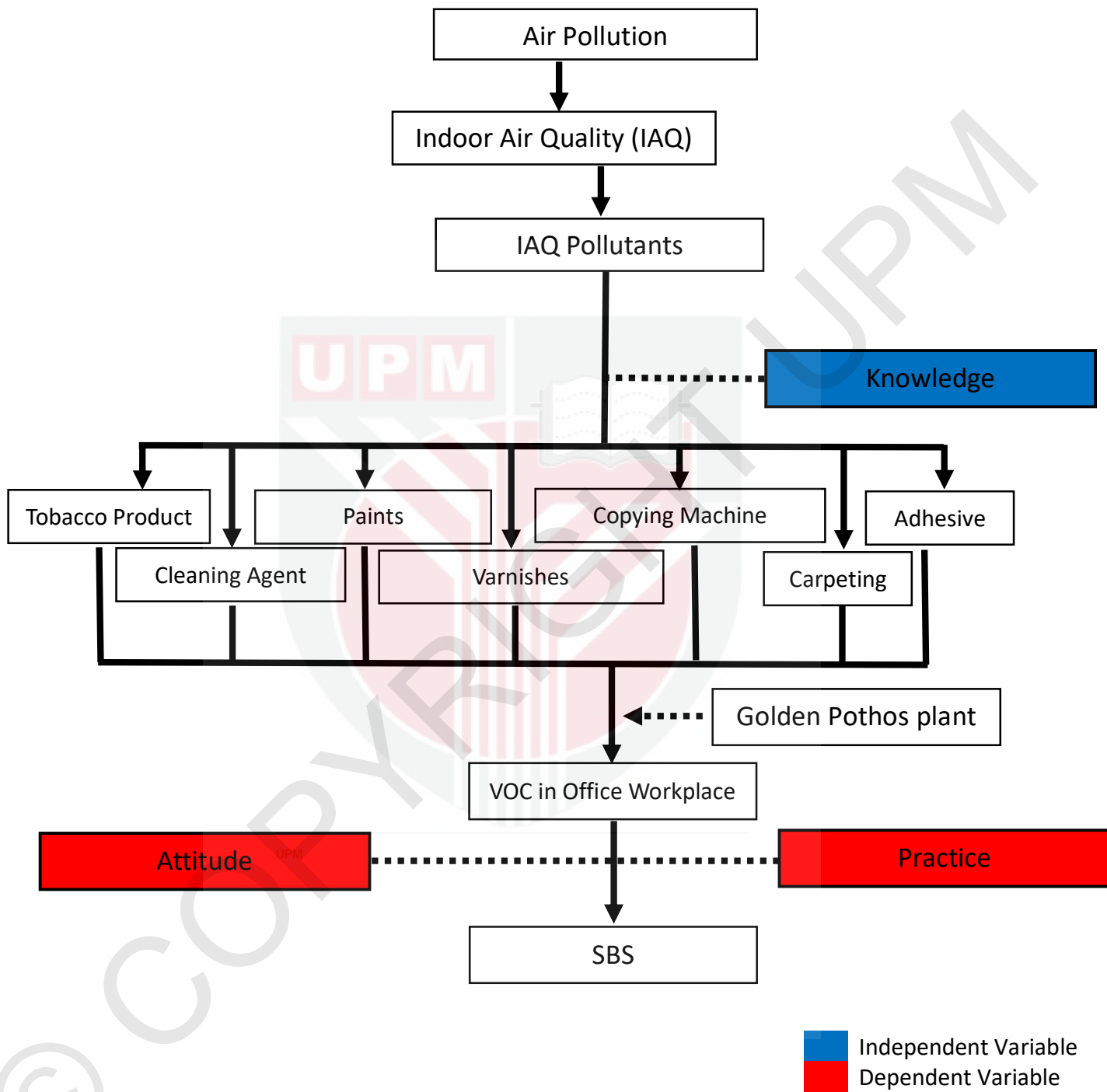


Figure 1.1: Conceptual framework

1.5 Research Question

These are the research questions for this study:

1. What is the office workers' knowledge, attitude and practice on Golden Pothos Plant in Reducing Volatile Organic Compounds (VOCs) Level
2. What is the association between knowledge and attitude on Golden Pothos Plant in Reducing Volatile Organic Compounds (VOCs) Level among office workers?
3. What is the association between knowledge and practice on Golden Pothos Plant in Reducing Volatile Organic Compounds (VOCs) Level among office workers?
4. What is the association between attitude and practice on Golden Pothos Plant in Reducing Volatile Organic Compounds (VOCs) Level among office workers?

1.6 Definition

1.6.1 Conceptual Definition

Volatile Organic Compound

VOC are all carbon compounds that engage in atmospheric photochemical reactions, excluding metallic carbides, carbon dioxide, carbonic acid, carbon monoxide or carbonate, and ammonium carbonate, other than those described by EPA as having reduced photochemical reactivity (EPA, 2017).

Sick Building Syndrome

SBS is a condition that happens when a variety of construction workers experience a set of non-specific symptoms of no clear origin, including diarrhea, eye pain, nose and mouth, emotional weakness, headaches, skin discomfort, and dizziness (E. Hooker, 2019).

Office Worker

According to Cambridge Dictionary (2019), office worker is an individual doing their job in an office instead of a factory, etc.

Pothos

According to Merriam Webster (2019), pothos is the Arum family of the South-East Asia escalating plant (*Scindapsus aureus*, *Epipremnum aureum*) is widely grown, particularly as a leather or waxy green heart-shape plant, which is found in gold yellow or white or is striped with gold.

Knowledge

The truth or state of understanding a thing with familiarity acquired by knowledge or interaction (Merriam-Webster, 2020).

Awareness

A tendency to react to other entities, individuals or items in a sensible manner that has been trained and has been one's usual style of action (Rashmi Sharma, 2013).

Practice

Practice as 'methods in which they illustrate their knowledge and attitude through their actions' (Kaliyaperumal, 2004)

Knowledge, Attitude and Practice

A representative sample of a given community with the intention of gathering data about what is understood, believed and achieved in relation to a particular topic (Rui Wang et al., 2015)

1.6.2 Operational Definition

Volatile Organic Compound (VOC)

VOC is the gaseous that emits to indoor environment and affecting the building occupants. It is known that any VOC levels produced within a building pose a potential health hazard

Sick Building Syndrome (SBS)

A syndrome that may cause workers less productive in doing their works by several symptoms and one of the affect from VOC.

Office Worker

Office worker in Universiti Putra Malaysia, Serdang that only work in indoor environment that willingly to be part of study as respondent.

Pothos

A plant that effective in reducing indoor air pollutants and most suitable as it term of cost effective, and have a large foliage.

Knowledge

The knowledge among office workers in UPM regarding houseplant (Golden Photos plant) in reducing indoor air pollutant (Volatile Organic Compounds (VOCs)). The knowledge tested will be on general or basic understanding on the effectiveness of houseplant in reducing indoor air pollutants and indoor air quality.

Attitude

The attitude will be on the office workers' perception or mind set involving the attitude to having houseplant and their perception of its function to indoor quality.

Practice

Practice is defined as any actions intended or executed by the office workers' practice to maintain indoor quality, besides houseplants

1.7 Objective

1.7.1 General Objective

To determine the level of knowledge, attitude and practices among office workers in UPM regarding Golden Photos plant in reducing indoor air pollutant (Volatile Organic Compounds (VOCs)).

1.7.2 Specific Objective

1. To identify the socio-demographic information among the office workers in UPM, Serdang.
2. To determine the level of knowledge, attitude and practice among office workers in UPM regarding Golden Photos plant in reducing indoor air pollutant (Volatile Organic Compounds (VOCs)).
3. To determine the association of knowledge, attitude and practice level among office workers in UPM regarding Golden Photos plant in reducing indoor air pollutant (Volatile Organic Compounds (VOCs)).
4. To determine the association of socio-demographic variables of the office workers with the knowledge, attitude and practices regarding Golden Photos plant in reducing indoor air pollutant (Volatile Organic Compounds (VOCs)).

1.8 Hypothesis

1. There is association of knowledge, attitude and practices among office workers in UPM regarding Golden Photos plant in reducing indoor air pollutant (Volatile Organic Compounds (VOCs)).
2. There is association of selected socio-demographic variables of knowledge, attitude and practices among office workers in UPM regarding Golden Photos plant in reducing indoor air pollutant (Volatile Organic Compounds (VOCs)).

CHAPTER 2

LITRATURE REVIEW

2.1 Indoor Air Quality

According to the United States Environmental Protection Agency (USEPA) (2016), the environmental condition of the buildings and infrastructure in and around them contributes to environmental security, in particular with respect to the health and comfort of the inhabitants of the buildings. Most residents find environmental pollution to be outside — smog, smoke, fog in the breeze, or scent from a nearby chemical plant. However, the fact is that indoor air in homes , workplaces and other buildings may be more contaminated than in the outdoor environment (Books and Davis, 1992). Great IAQ provides a number of valuable advantages. Which will help enhance the well-being, productivity and happiness of residents, minimize absenteeism , increase student success and learning levels and create positive consumer engagement (Lennox, 2016).

Every day almost 90% of time people spend indoors at home, in work or at school. (Klepeis et al., 2001, Jacobs et al., 2007). Equally, according to USEPA test, pollutant levels are 2 to 5 times higher for indoors compare to outdoors, either the buildings are located in rural or highly industrial areas.

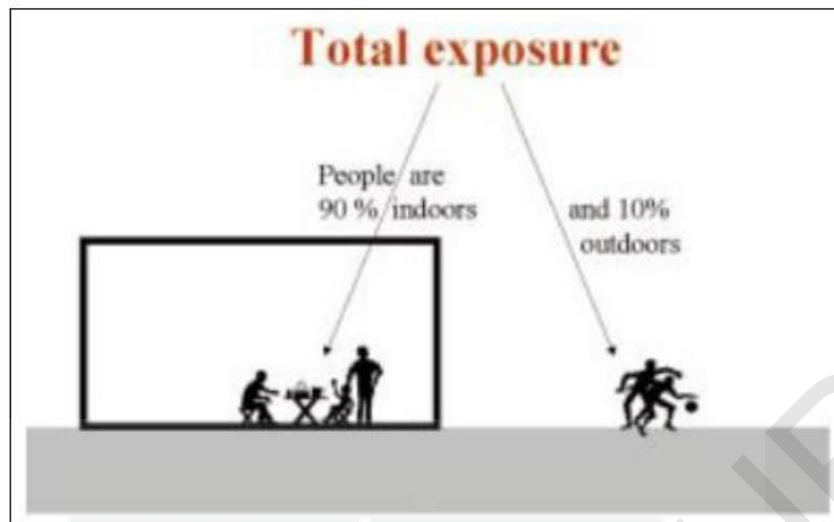


Figure 2.1: Time typically spent indoors and outdoors.

One of the sources of pollutants can naturally be a source of indoor contaminants from the outdoor environment. The other sources may also derive from indoor air pollutants such as building materials, fuel combustion, clothing and fabrics, consumer goods, oil products, soil, herbicides and pesticides, human beings, pets, bugs, plants, microorganisms, etc. These contaminants may be either volatile or non-volatile, for examples, radon or formaldehyde and asbestos or cigarette smoke particulates respectively. There are several indoor air pollutants; this study will only deal with the most damaging people welfare (Cooke, 1991). In the last 50 years , the growing production of modern building materials, furniture and consumer goods has contributed to a greater growth of new chemicals in the built environment. The amount of chemicals used and used in domestic and building products, including architectural materials, interior finishing materials, cleaning agents, appliances , computers and office devices, printing and machinery, has dramatically risen (Weschler, 2009).

2.2 Volatile Organic Compound (VOCs)

Over weeks or years, VOCs are emitted which theoretically result in poor air quality from building or furnishing materials. VOCs from product, like electronic goods such as printers and computers, as well as cleaning devices and air refreshers, are becoming increasingly common. ETS includes a diverse blend of organic compounds and although smoking at offices and public facilities is banned in many nations, it is a significant cause of air contamination in many households (ASHRAE, 2009).

VOCs are significant air pollutants created by atmospheric evaporation from a variety of sources, including building materials, paints, cleanings, furniture, adhesives, combustion material, floor and wall coverings, derived from indoor air pollutant (Nurmatov et al., 2015). Greater use VOC-containing products and reduced indoor ventilation in modern buildings lead to increasing the exposure of VOCs. Although VOCs in the manufacturing and workplace setting are known to be associated with respiratory symptoms, the effects of low airway emissions on the general indoor everyday conditions are not known. (Jang et al., 2007).

Workers in sectors like spray painting industries involve in increasing concentrations of the VOCs. Today, it is becoming a problem in which employees are involved. Thus painting is also used for other things, such as wood metals and others. Such practice will have long term consumption impacts on the employees' health. One of the main causes of problems with indoor air quality are chemical contaminants.

Indoor concentrations are two to five times higher than outdoor levels of about a dozen common organic contaminants.

2.3 Health Effect due to VOCs

Exposure to VOCs causes harmful effects on health, in addition to adverse environmental impacts. Previous studies have shown that VOCs can raise the risk of asthma, allergic sensitivity, acute and chronic respiratory diseases, lung and gene mutation damages (Hua et al., 2018; Kwon et al., 2018). VOC rates, on the other hand, are closely associated with brain cancer, immune system, endocrine system, and skin disease (Sarigiannis et al., 2011). Benzene, the primary element of VOC, raises the likelihood of tumors, skin and other diseases, birth defects and neurocognitive impairment. In addition, exposure to low levels of VOCs in normal life may increase the risk of rhinitis and asthma (Jang et al., 2007).

Indoor pollutants, in particular VOCs, are detrimental to human safety. The best approach for reducing VOC pollution sources and developing IAQ is to enhance the chemical pollutant emission characteristics of construction materials and decorative goods and to produce innovative technologies without the release of chemical pollutants. Indoor cleaning is an important way in which indoor emissions can be eliminated and IAQ enhanced in situations where pollutant sources cannot be ventilated or managed (Yu et al., 2008).

Many of the indoor organic volatile compounds are neurotoxic; however, the indoor concentrations are usually much lower than the levels that are considered harmful to humans. The result of a combination of volatile organic compounds causes a loss in memory and perceptual distress similar to a 'sick' building condition and general malaise that is frequently found in newly renovated houses and structures. Some are carcinogenic, and many of these are mutagenic (Cooke, 1991).

2.4 Sick Building Syndrome

SBS is usually distinguished from the term "building-related illnesses" (BRI) (e.g. Kreiss, 1989; Ryan and Morrow, 1992). Contrary to SBS, BRI is known for its etiology and definitive symptoms and can be detected, for example, in the serum of infected individuals, with different anticorruption. On the other hand, SBS experiments have not found any single cause that could trigger health problems. Recent research has shown that SBS is simply a multifactorial problem. Some studies have illustrated possible and key causes of SBS (Lahtinen et al., 1998).

Symptoms prevailed in workers who work in air-conditioned buildings than most naturally ventilated ones, according to Hedge and Erickson (1995). In the case of office buildings, in particular schools, clinics, medical centers, homes and hotels, notes that SBS symptoms occur (Burge, 2003). The primarily affected communities include these office staff, who are long-term employers at the same location (Hedge and Erickson 1995). Throughout recent decades concerns of dysfunction and health effects throughout non-industrial industries have increased (Skov et al., 1990).

SBS is a major problem in many organisations because of these results. Skov et al. (1990) reported that concerns about occupational distress and health effects and the incidence of workplaces causing disorders have increased rapidly. The key factors influencing SBS, as described in the previous report, are: personal factors, job status, form of employment, psychological factors, building factors, similar factors such as high internal temperatures, limited to no external ventilation, low personal temperature and lighting controls, climate control and, in particular, inadequate cleaning, weak workplace sanitation systems, and water damage (Wijerathne et al., 2012).

CHAPTER 3

METHODOLOGY

3.1 Study Location

The study will be conducted at selected office in Universiti Putra Malaysia (UPM), Serdang, Selangor. This location is selected based on several reasons. There are more than 888 numbers of supporting staff who are office workers.

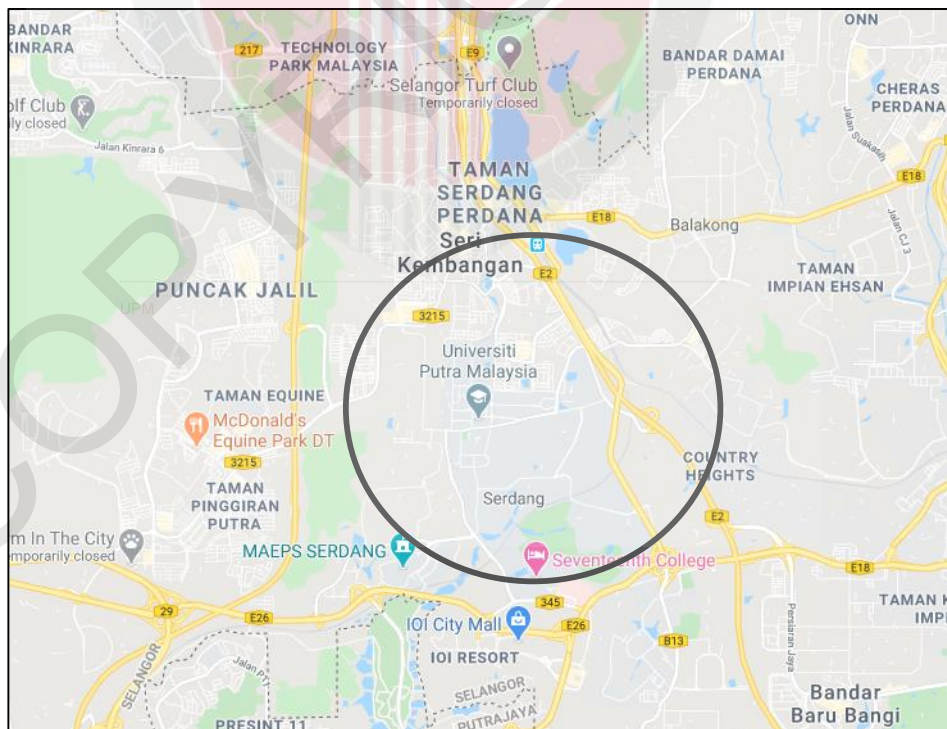


Figure 3.1: The map of Universiti Putra Malaysia (UPM)

3.2 Study design

The study design is a cross-sectional study which to determine the level of knowledge, attitude and practices among office workers in UPM regarding Golden Photos plant in reducing indoor air pollutant (Volatile Organic Compounds (VOCs)).

3.3 Study sampling

3.3.1 Sampling population

The respondent of this study will be office workers in Universiti Putra Malaysia (UPM).

3.3.2 Sampling frame

The sampling of the study will be obtained from office workers of Universiti Putra Malaysia.

3.3.3 Sample size

For the sample size, two proportion sampling will be used. The formula of sample size calculation used by referring Lemeshow and Lipsey (1990). In summary,

Formula:

$$n = \frac{2 \times 2 \sigma^2 (Z_{1-\frac{\alpha}{2}} + Z_{1-\beta})^2}{(\mu_1 - \mu_2)^2}$$

Where;

n	=	Sample size
σ^2	=	Estimated pooled standard deviation (assumed to be equal to each group)
μ_1	=	Highest mean of VOC reading rate = 492.8 (Tham et al, 2004)
μ_2	=	Lowest mean of VOC reading rate = 318.8 (Tham et al, 2004)
$Z_{1-\beta}$	=	Standard error associated with confidential interval, 95% C1= 1.96
$Z_{1-\alpha/2}$	=	Standard error associated with power, 80% of power = 0.84

$$n = \frac{4(250.9)^2 (1.96 + 0.84)^2}{(492.8 - 318.8)^2}$$

$$n = 65.2046 \approx 65 \text{ Respondents}$$

3.4 Study instrument

Questionnaire

The questionnaire that will be used to gather the data on level of knowledge, attitude and practice level among office workers in UPM regarding Golden Photos plant in reducing indoor air pollutant (Volatile Organic Compounds (VOCs)) and developed by the researcher. The questionnaire is consist of four distinct parts; section A: demographic characteristics of the participants, section B: participants' knowledge on

houseplant and the indoor air quality, section C: participants' attitude to having houseplant and your perception of its function to indoor quality and section D: actual practices practice to maintain indoor quality. For section B and C, the points of 4-Likert scale is used to interpret items in the questionnaire that indicate strongly disagree (1), disagree (2), agree (3), strongly agree (4). Section D, the 4-Likert point use are never (1), not often (2), often (3) and very often (4).

3.5 Study Method

Questionnaires Distribution

Using UPM intranet email as a questionnaire delivery platform, a total of 64 office workers who meet the inclusive criteria and agree to the research consent participate in this study. Questionnaires will be distributed to the office workers in Universiti Putra Malaysia. Before distributing the questionnaires, respondents will be informed and briefed on the purpose of this study. All of the respondents' responses will remain anonymous which been protected by researcher. The questionnaires will be given to every respondent to be answered and those questionnaires will be collected at the end of the survey. The respondents will be assigned a code and is given 15-20 minutes to fill in the questionnaires. The questionnaires are used to collect all the information needed in this research.

3.6 Quality Control

The questionnaire of this study will go through pilot study by distributing the questionnaires to 10 respondents among food vendors to test on its reliability and validity. The Cronbach's Alpha test was used to test the reliability of the questionnaire.

3.7 Data Analysis

All the analysis below will be analysed by using the statistical analysis by performing Statistical Package for Social Science (SPSS) version 22.0 and Microsoft Excel 2013.

Specific Objective	Hypothesis	Data Analysis
To identify the socio-demographic information among the office workers in UPM, Serdang.	-	Descriptive Analysis
To determine the level of knowledge, attitude and practice among office workers in UPM regarding Golden Photos plant in reducing indoor air pollutant (Volatile Organic Compounds (VOCs)).	-	Descriptive Analysis

<p>To determine the association of knowledge, attitude and practice level among office workers in UPM regarding Golden Photos plant in reducing indoor air pollutant (Volatile Organic Compounds (VOCs)).</p>	<p>There is association of knowledge, attitude and practices among office workers in UPM regarding Golden Photos plant in reducing indoor air pollutant (Volatile Organic Compounds (VOCs)).</p>	<p>Spearman Correlation</p>
<p>To determine the association of socio-demographic variables of the office workers with the knowledge, attitude and practices regarding Golden Photos plant in reducing indoor air pollutant (Volatile Organic Compounds (VOCs)).</p>	<p>There is association of selected socio-demographic variables of knowledge, attitude and practices among office workers in UPM regarding Golden Photos plant in reducing indoor air pollutant (Volatile Organic Compounds (VOCs)).</p>	<p>Spearman Correlation</p>

3.8 Ethical Consideration

The permission to conducting this study was obtained from the board of Ethics Committee for Research Involving Human Subjects (JKEUPM) of Universiti Putra Malaysia. All personal data and the identity of the respondent of this study will be remained as Private and Confidential and is stated in any parts of the study or publication.



CHAPTER 4

RESULTS

4.1 Socio-demographic information of respondents.

A total of 64 respondents were recruited among office workers from the Universiti Putra Malaysia, Serdang, Selangor. The socio-demographic background is summarized in Table 4.1. Among the 64 office workers, 20.3% are male officers and 79.7% are female officers. Most (93.8%) of them are Malay, followed by 4.7% Chinese, and Others at 1.6%. The respondents are between 20-29 years old (39.1%), 30-39 years old (37.5%), 40-49 years old (17.2%) and 50-59 years old (6.2%).

Table 4.1: The socio demographic of respondents (N=64)

		n (%)
Gender	Male	13 (20.3%)
	Female	51 (79.7%)
Age	20-29 years old	25 (39.1%)
	30-39 years old	24 (37.5%)
	40-49 years old	11 (17.2%)
	50-59 years old	4 (6.2%)
Race	Malay	60 (93.8%)
	Chinese	3 (4.7%)
	Others	1 (1.6%)

4.2 The level of knowledge, attitude and practice (KAP) among office workers in UPM regarding Golden Photos plant in reducing indoor air pollutant (Volatile Organic Compounds (VOCs)).

Self-administered questionnaire was used to examine the level of KAP for office workers as tabulated in Table 4.2. The knowledge category is divided into three sections: good knowledge (7-10marks), moderate knowledge (4-6 marks) and low knowledge (≤ 3 marks). At least 64 respondents (96.9%) were at a good knowledge level and 3.1% of respondents are at moderate knowledge level. (3.1%). The category of attitude is also divided in three sections: good attitude (34-50marks), moderate attitude (17-33 marks), and low attitude (≤ 16 marks). At least 64.1% of respondents have good attitude, and the rest of 35.9% has moderate attitude. The category for practice is divided into two sections: good practice and bad practice. This study shows that all respondents reported to have good practices in response to the role of indoor plant in indoor air quality.

Table 4.2: The level of KAP regarding Golden Pothos plant in reducing indoor air pollutant among respondents (N=64)

	n (%)		
	Good	Moderate	Low
	(7-10marks)	(4-6marks)	(≤3marks)
Knowledge	62 (96.9%)	2 (3.1%)	0 (0%)
(Total marks=10 marks)			
	Good	Moderate	Low
	(34-50marks)	(17-33marks)	(≤16marks)
Attitude	41 (64.1%)	23 (35.9%)	0 (0%)
Total marks=50 marks)			
	Good	Bad	
	(26-50marks)	(≤25marks)	
Practice	64 (100%)	0 (0%)	
(Total marks=50 marks)			

4.3 The association of knowledge, attitude and practice level among office workers in UPM regarding Golden Photos plant in reducing indoor air pollutant (Volatile Organic Compounds (VOCs)).

Spearman correlation was used in this section to evaluate the possible association between knowledge-attitudes (K-A), knowledge-practices (K-P), and attitudes-practices (A-P) level among office workers in UPM. There were low positive correlations between K-A, K-P and A-P (Spearman rank correlation coefficients were 0.40, 0.37 and 0.31 respectively, $p < 0.01$). As tabulated in Table 4.3, there is no significant association between knowledge, attitude and practice among the respondents.

Table 4.3: The association between KAP level regarding Golden Pothos plant in reducing indoor air pollutant among respondents (N=64)

	r^2	p - value
Knowledge with Attitude	0.111	0.381
Knowledge with Practice	0.156	0.218
Attitude with Practice	0.225	0.074
Spearman Association test		

4.4 The association of socio-demographic variables of the office workers with the knowledge, attitude and practices regarding Golden Photos plant in reducing indoor air pollutant (Volatile Organic Compounds (VOCs)).

Spearman correlation was use to analyse this data. As tabulated in Table 4.4, there is significant association ($p \leq 0.05$) between the knowledge and race of the respondents.

Table 4.4: The association between the KAP regarding Golden Pothos plant in reducing indoor air pollutant with socio-demographic variables among respondents (N=64)

Variables	r ²	p-value
<u>Knowledge</u>		
Gender	0.394**	0.001
Age	0.125	0.327
Race	-0.007	0.953
<u>Attitude</u>		
Gender	0.122	0.338
Age	-0.012	0.926
Race	0.076	0.549
<u>Practice</u>		
Gender	0.136	0.284
Age	-0.008	0.947
Race	-0.103	0.419

Spearman Association test

** . Correlation is significant at the 0.01 level (2-tailed).

CHAPTER 5

DISCUSSIONS

Malaysia rapid growth in economy urge industrial spacing that led in current worsening IAQ. IAQ became the focus of many studies due to a growing interest within the science community about the health consequences of IAQ, particularly as people continue to spend more time indoors than outdoors (Canha et al., 2010). Over 2 million early deaths a year are due to urban outdoor air emissions and indoor air pollution (WHO, 2005).

As per a study led by Nippon Paint Malaysia Group, about 60% of Malaysians are enduring a direct result of poor indoor air quality. The Indoor Wellness Survey, which included 511 respondents, was given an Indoor Wellness Score in the accompanying classes: Healthy, Unhealthy, and Very Unhealthy. The most beneficial gathering of respondents were those matured between 25 to 34 years of age (37% Healthy), while the unhealthiest were matured from 18 to 24 years of age (45% Very Unhealthy). About 75% of respondents who live in urban regions will in general have unhealthier homes, while staying 25% rehearsed great propensities for more beneficial indoor air quality (Lun, 2019).

The result showed that majority of the respondents among the UPM office workers were females. The president of Bursa Malaysia Bhd, Datuk Shireen Ann Zaharah Muhiudeen, says Malaysian women remain dynamic, always ranked high in education, and have already exceeded men as a tertiary education figure (Goh, 2020). Many factors, including gender, age, education or respiratory symptoms have been linked in previous studies but have not always been correlated with discomfort due to air pollution (Jacquemin et al., 2007).

5.1 Socio-demographic information of respondents.

According to WHO (2020), health is a condition of full physical, emotional and social well-being rather than just a lack of sickness or disease. A healthy office could be defined as a workplace which does not harm the well-being of employees at least and ideally supports them actively (Colenberg, Jylhä, & Arkesteijn, 2020). Health risks that lead to decreased productivity by workers by exposure to air pollution at indoor level may be higher than those presented by air pollution at outside. Thus, IAQ should obviously be as good as possible (P. Putra, 2015).

In view of this, study conducted among office, which located at Universiti Putra Malaysia. Among these offices selected have as the place is urbanised area and the workers are living nearby also live in urbanised area. Most people spend their time indoors and the amount of population worldwide stay and work in an office setting in urban areas (Al Horr et al., 2016).

In this study, the fact that female respondents is greater than male respondents is because the number of female workers is greater than male workers. Datuk Shamsuddin Bardan said, women are more open to fill vacancies in the ever-expanding service sector in the country (Husain, 2019). The respondent mostly Malay, followed by Chinese and the lowest is Others. According to Department of Statistics Malaysia, the total population was 28.3 million, of them 91.8% Malaysian and 8.2% non-Malaysian. The population of Malaysia is composed of Bumiputera ethnic groups (67.4%), Chinese (24.6%), Indians (7.3%) and Other ethnic groups (0.7%).

5.2 The level of knowledge, attitude and practice (KAP) among office workers in UPM regarding Golden Photos plant in reducing indoor air pollutant (Volatile Organic Compounds (VOCs)).

Our result showed that 96.9% of the respondents were classified as “high knowledge” level, having basic knowledge about indoor air quality and the houseplant that can help in reducing indoor air pollutants. Indoor air quality ventilation is key to good health. Indoors, most Americans spend much time in their homes, workplaces or other buildings where gasses, chemicals or other contaminants are prone to headaches, irritation of the skin, and tiredness. Severe contaminants can cause certain cancers and other health problems in the long term (Fasulo, 2018).

At least 64.1% of respondents have good attitude, and the rest of 35.9% has moderate attitude. Plants may appear to be helping to enhance indoor air quality. They work like a natural air purifier. Plants with soil and activated carbon were found to be able to effectively remove the VOCs tested. All this is not enough but appropriate for

scientists to suggest that plants are "one of the best ways to reduce air pollution at home (Yusup, 2019).

This study shows that all respondents reported to have good practices in response to the role of indoor plant in indoor air quality. Plants may have a significant effect on the psychological well-being and serenity of people in an office or in a home. Plants in living and working areas have been shown to have a measurable benefit for people. The benefits of introducing plants to work have been reported, including enhanced workplace morale, higher efficiency and decreased absenteeism. Besides plants that add elegance to the house, making it a place for living and working, research has shown that people feel comfortable and happy if they are close to or tend plants. When indoor plants were present, health and pain symptoms were shown to be lower (Kobayashi et. al, 2007).

5.3 The association of knowledge, attitude and practice level among office workers in UPM regarding Golden Photos plant in reducing indoor air pollutant (Volatile Organic Compounds (VOCs)).

My result have shown that approximately 96.9% of the respondents were classified into "high knowledge" levels, basic indoor air quality, houseplant and correlates between them. Awareness of health behaviour that is seen as advantageous does not, however, mean that this action is practiced automatically (Wang et al., 2015). The number of respondents in this study is limited as the number of office workers who willingly to take part in the study is not enough (n=64). That is why there is no

significant correlation between knowledge, attitude and practice of Golden Pothos plant in reducing VOC levels among the office workers in this study.

5.4 The association of socio-demographic variables of the office workers with the knowledge, attitude and practices regarding Golden Photos plant in reducing indoor air pollutant (Volatile Organic Compounds (VOCs)).

Office workers are vulnerable group as the worse scenario case that would be impossible to protect them from all the adverse effects of the VOC levels in their workplace. Involving them in this study would increase their perception IAQ. They have capacities to communicate effectively on the risk and advantages to the wider community.

The Golden Pothos or *Epipremnum aureum sp.* is a plant that can improve the IAQ level, and is really suitable to be placed indoor. In plant, transpiration process can help in maintaining humidity in the environment, meanwhile photosynthesis process help maintaining the good levels of oxygen inside the workplace depending on the plant's condition, light intensity, the water absorption and minerals.

The result is based on the question about the IAQ and the houseplant itself. The finding of this study showed that there is the significant correlation ($p \leq 0.05$) between the knowledge and gender of the respondents. The respondents consist of 64 office workers, 20.3% are male officers and 79.7% are female officers. The huge difference of the number may attribute to this significant correlation. Women score more in good

knowledge and attitude rather than men. They are more concerned about indoor air quality as they are facing it in the real-time. The belief is women in certain cities may spend more hours at home (Schweizer et al., 2006). Therefore get a better understanding of the home atmosphere (Jacquemin et al., 2007).

Several studies have shown that women are more responsive in general to environmental threats and higher levels of discomfort among them. It is believed that women have greater awareness of the world, and some scholars claim that women's sense of smell usually better than men. The belief is women in certain cities may spend more hours at home (Schweizer et al., 2006). Therefore get a better understanding of the home atmosphere (Jacquemin et al., 2007).

Many factors, including gender, age, education or respiratory symptoms have been linked in previous studies but have not always been correlated with discomfort due to air pollution (Jacquemin et al., 2007).

CHAPTER 6

CONCLUSION AND RECOMMENDATION

6.1 Conclusion

The hypothesis of the study, there is no association of K-A, K-P, and A-P among office workers in UPM regarding Golden Photos plant in reducing indoor air pollutant (VOC). There is association between gender variables and knowledge among office workers in UPM regarding Golden Photos plant in reducing indoor air pollutant (VOC). There is no association between other variable (Age and Race) with K,A,P among the respondents.

There are some limitation from conducting this study. The population number of respondent is low. Due to pandemic outbreak, the questionnaire need to be self-administered by the respondents, increase the misinformation compare to conducted at the field. The time limitation of the study conducted may resulting in questionable good practice level among the respondent, whether they actually practising this good practice in their workplace.

In conclusion, the finding in this study is respondents are mostly in high knowledge level, slightly half of the good in attitude and all of them have good practice regarding Golden Pothos plant can help in reducing VOC levels. Considering the good practice level among the respondent, they should apply by having houseplant in their

workplace as houseplant can help maintaining good IAQ and improve productivity of the workers.

6.2 Recommendation

For future study, the researcher should increase the study population to avoid any mistake in data analysis. The questionnaire should be conducted at the field, as this study is self-administered by the respondent, resulting in low number of study population and may have some information mistake as they did not completely understand the question.

REFERENCES

- Al Horr, Y., Arif, M., Kaushik, A., Mazroei, A., Katafygiotou, M., & Elsarrag, E. (2016). Occupant productivity and office indoor environment quality: A review of the literature. *Building and Environment*, 105, 369–389. <https://doi.org/10.1016/j.buildenv.2016.06.001>
- An Office Building Occupants Guide to Indoor Air Quality. (2019, October 3). Retrieved from <https://www.epa.gov/indoor-air-quality-iaq/office-building-occupants-guide-indoor-air-quality#management>
- An Office Building Occupants Guide to Indoor Air Quality. (2019, October 03). Retrieved July 15, 2020, from <https://www.epa.gov/indoor-air-quality-iaq/office-building-occupants-guide-indoor-air-quality>
- Bengtsson S, Berglund H, Gulyas B, Cohen E, Savic I. Brain activation during odor perception in males and females. *Neuroreport* 2001;12:2027–33.
- Canha, N., Freitas, M. C., Almeida, S. M., Almeida, M., Ribeiro, M., Galinha, C., & Wolterbeek, H. T. (2010). Indoor school environment: Easy and low cost to assess inorganic pollutants. *Journal of Radioanalytical and Nuclear Chemistry*, 286(2), 495-500. doi:10.1007/s10967-010-0781-4
- Chang, T. Y., Zivin, J. G., Gross, T., & Neidell, M. (2016, September 29). Air Pollution Is Making Office Workers Less Productive. Retrieved from <https://hbr.org/2016/09/air-pollution-is-making-office-workers-less-productive>
- Chun, C., Sung, K., Kim, E., & Park, J. (2010). Self-reported multiple chemical sensitivity symptoms and personal volatile organic compounds exposure

concentrations in construction workers. *Building and Environment*, 45, 901-906.

Colenberg, S., Jylhä, T., & Arkesteijn, M. (2020). The relationship between interior office space and employee health and well-being – a literature review. *Building Research & Information*, 1-15. doi:10.1080/09613218.2019.1710098

Cooke, T. F. (1991). Indoor Air Pollutants: A Literature Review. *Reviews on Environmental Health*, 9(3). doi:10.1515/reveh.1991.9.3.137

Davis, C. P. (2016, September 8). Sick Building Syndrome Symptoms & Prevention. Retrieved from https://www.medicinenet.com/sick_building_syndrome/article.htm#what_causes_sick_building_syndrome

Destailats H., Randy L.M., Singer B.C., Hodgson A.T. and McKone T.E. (2008) Indoor pollutants emitted by office equipment: A review of reported data and information needs. *Atmos Environ* 42: 1371-1388.

Fasulo, N. (n.d.). Why Indoor Air Quality Is So Important. Retrieved July 19, 2020, from <https://www.ultimateair.com/blog/bid/47758/why-indoor-air-quality-is-so-important>

Flynn J, Slovic P, Mertz CK. Gender, Race, and Perception of Environmental-Health Risks. *Risk Anal* 1994;14:1101–08.

Forsberg B, Stjernberg N, Wall S. People can detect poor air quality well below guideline concentrations: a prevalence study of annoyance reactions and air pollution from traffic. *Occup Environ Med* 1997;54:44–48

Global Research Trends in Health Effects of Volatile Organic Compounds during the Last 16 Years: A Bibliometric Analysis. (2019). *Aerosol and Air Quality Research*.

- Goh, J. (2020, March 08). 2010 2019: Decade of Disruption - Pushing women to the forefront. Retrieved July 19, 2020, from <https://www.theedgemarkets.com/article/2010-2019-decade-disruption-pushing-women-forefront>
- Gumucio, S., Merica, M., Luhmann, N., Fauvel, G., Zompi, S., Ronsse, A., ... & Cheminat, O. (2011). Data collection quantitative methods, the KAP survey model (knowledge, attitude and practices). IGC communigraphie: Saint Etienne, France, 4-7.
- Hedge, A., and Erickson, W.A. (1996). Predicting sick building syndrome at the individual and aggregate levels. *Environment International*, 22(1), 3-19.
- Hodgson, M., Levin, H., & Wolkoff, P. (1994). Volatile organic compounds and indoor air. *Journal of Allergy and Clinical Immunology*, 94(2), 296–303. doi:10.1053/ai.1994.v94.a56008
- Husain, N. (2019). Perutusan siswazah wanita bekerja lebih tinggi tidak memranjatkan. *Sinar Harian*. Retrieved July 25, 2020, from <https://www.sinarharian.com.my/article/61814/BERITA/Nasional/Perutusan-siswazah-wanita-bekerja-lebih-tinggi-tidak-memranjatkan>
- Improving Indoor Air Quality (IAQ) in Kuwaiti Housing Developments at Design, Construction, and Occupancy Stages. (2016).
- Indoor Air Quality and the Workplace. (2017, December 22). Retrieved from <https://cwa-union.org/national-issues/health-and-safety/health-and-safety-fact-sheets/indoor-air-quality-and-workplace>
- Indoor Air Quality: Volatile Organic Compounds (VOCs). (2019, March 6). Retrieved from <https://www.healthlinkbc.ca/healthlinkbc-files/air-quality-VOCs>

- Jacquemin, B., Sunyer, J., Forsberg, B., Götschi, T., Bayer-Oglesby, L., Ackermann-Liebrich, U., . . . Künzli, N. (2007). Annoyance due to air pollution in Europe. *International Journal of Epidemiology*, 36(4), 809-820. doi:10.1093/ije/dym042
- Kaliyaperumal, K. (2004). IEC; Expert, Diabetic Retinopathy Project. Guideline for Conducting a Knowledge, Attitude, and Practice (KAP) Study. *Community Ophthalmology*, vol. 4, pp. 7-9
- Kobayashi, K. D., Kaufman, A. J., Griffis, J., & McConnell, J. (2007). Using houseplants to clean indoor air.
- Lahtinen, M., Huuhtanen, P., & Reijula, K. (1998). Sick Building Syndrome and Psychosocial Factors - a Literature Review. *Indoor Air*, 8(S4), 71–80. doi:10.1111/j.1600-0668.1998.tb00012.x
- Lun, C. (2019, October 16). More than half of Malaysians affected by poor indoor air quality. Retrieved July 12, 2020, from <https://www.theedgemarkets.com/article/more-half-malaysians-affected-poor-indoor-air-quality>
- Norbäck, D., Hashim, J. H., Hashim, Z., & Ali, F. (2017). Volatile organic compounds (VOC), formaldehyde and nitrogen dioxide (NO₂) in schools in Johor Bahru, Malaysia: Associations with rhinitis, ocular, throat and dermal symptoms, headache and fatigue. *Science of The Total Environment*, 592, 153–160. doi:10.1016/j.scitotenv.2017.02.215
- Nurmatov UB, Tagiyeva N, Semple S, Devereux G, Sheikh A. Volatile organic compounds and risk of asthma and allergy: a systematic review. *Eur Respir Rev*. 2015;24:92–101.

Oanh, N. K., & Hung, T. Y. (2005). Handbook of Environmental Engineering, Volume 2: Advanced Air and Noise Pollution Control (Vol. 2). (L. Wang, N. Pereira, & Y. Hung, Eds.) Totowa, NJ: The Humana Press, Inc.

Orwell R.L. Wood R.L. Tarran J. Torpy F. Burchett M.D. 2004 Removal of benzene by the indoor plant/substrate microcosm and implications for air quality Water Air Soil Pollut. 157:193-207

Papinchak, H. L., Holcomb, E. J., Best, T. O., & Decoteau, D. R. (2018, December 12). Effectiveness of Houseplants in Reducing the Indoor Air Pollutant Ozone in: HortTechnology Volume 19 Issue 2 (2009). Retrieved from <https://journals.ashs.org/horttech/view/journals/horttech/19/2/article-p286.xml#B14>

Population Distribution and Basic Demographic Characteristic Report 2010. (2015). Retrieved July 25, 2020, from https://www.dosm.gov.my/v1/index.php?r=column/cthemeByCat&cat=117&bul_id=MDMxdHZjWTk1SjFzTzNkRXYzcVZjdz09&menu_id=L0pheU43NWJwRWVSZklWdzQ4TlhUUT09

Pratama Putra, J. C. (2015). Effects of indoor air quality on the occupant's health and productivity in an office building (Doctoral dissertation, Universiti Tun Hussein Onn Malaysia).

Rotko T, Oglesby L, Kunzli N, Carrer P, Nieuwenhuijsen MJ, Jantunen M. Determinants of perceived air pollution annoyance and association between annoyance scores and air pollution (PM_{2.5}, NO₂) concentrations in the European EXPOLIS study. Atmos Env 2002;36:4593–602.

Rotko T. Social Aspects of Air Pollution: Sociodemographic Differences in Exposure, Perceived Annoyance and Concern about Air Pollution Laboratory of Air

Hygiene, Department of Environmental Health, National Public Health Institute, Kuopio, Finland, 2004.

Schweizer, C., Edwards, R. D., Bayer-Oglesby, L., Gauderman, W. J., Ilacqua, V., Jantunen, M. J., . . . Künzli, N. (2006). Indoor time–microenvironment–activity patterns in seven regions of Europe. *Journal of Exposure Science & Environmental Epidemiology*, 17(2), 170-181. doi:10.1038/sj.jes.7500490

Ship JA, Weiffenbach JM. Age, gender, medical treatment, and medication effects on smell identification. *J Gerontol* 1993;48:M26–M32.

Skov, P., Valbjorn, O., and Pedersen, B.V. (1990). Influence of personal characteristics, job-related factors and psychosocial factors on the sick building syndrome. *Scand Journal of Work Environmental Health*, 15, 286-295.

Volatile Organic Compounds' Impact on Indoor Air Quality. (2017, November 6). Retrieved from <https://www.epa.gov/indoor-air-quality-iaq/volatile-organic-compounds-impact-indoor-air-quality#Sources>

Wang, R., Yang, Y., Chen, R., Kan, H., Wu, J., Wang, K., Maddock, J. E., & Lu, Y. (2015). Knowledge, attitudes, and practices (KAP) of the relationship between air pollution and children's respiratory health in shanghai, china. *International Journal of Environmental Research and Public Health*, 12(2), 1834–1848. <https://doi.org/10.3390/ijerph120201834>

What is the WHO definition of health? (2020). Retrieved July 26, 2020, from <https://www.who.int/about/who-we-are/frequently-asked-questions>

Wijerathne, H & Karunasena, Gayani & Mallawarachchi, Harshani. (2012). STUDY ON SICK BUILDING SYNDROME IN OFFICE ENVIRONMENT.

Williams ID, Bird A. Public perceptions of air quality and quality of life in urban and suburban areas of London. *J Environ Monit* 2003;5:253–59

Wolverton B.C. 1986 Houseplants, indoor air pollutants, and allergic reactions Natl. Aeronautics Space Admin., Natl. Space Technol. Lab Stennis Space Center, MS

Wolverton B.C. 1997 How to grow fresh air Penguin New York

World Health Organization Press. (2005). WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide.

Yu, B. F., Hu, Z. B., Liu, M., Yang, H. L., Kong, Q. X., & Liu, Y. H. (2008, May 15). Review of research on air-conditioning systems and indoor air quality control for human health. Retrieved from https://www.sciencedirect.com/science/article/pii/S0140700708000984?casa_token=btAopibNSQ8AAAAA:MrO_MZONEv4M0VwTKlygdGKV12WE9u_3IkeSNFkvgZbW2NWRXbXJVfYcq45cwtKL64KG3eC3C1ld

Yusup, A. (2019, October 22). Do indoor plants improve air quality?: New Straits Times. Retrieved July 19, 2020, from <https://www.nst.com.my/lifestyle/heal/2019/10/532224/do-indoor-plants-improve-air-quality>

Zuraimi, M. S., Roulet, C.-A., Tham, K. W., Sekhar, S. C., David Cheong, K. W., Wong, N. H., & Lee, K. H. (2006). A comparative study of VOCs in Singapore and European office buildings. *Building and Environment*, 41(3), 316–329. doi:10.1016/j.buildenv.2005.01.028



APPENDIX

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**ETHICS COMMITTEE FOR RESEARCH INVOLVING HUMAN SUBJECTS
(JKEUPM)
UNIVERSITI PUTRA MALAYSIA**

Research title	: Association of Volatile Organic Compounds (VOCs) Level and Sick Building Syndrome (SBS) Among Office Workers With Golden Pothos Plant at Close Ventilated Office in Kajang, Selangor.
Study Site	: Kajang, Selangor
JKEUPM Ref No.	: Jkeupm-2019-427
Researcher	: Muhd Fathehi Helmi Saidudin
Supervisor	: Dr. Viven How

Documents received and reviewed with reference to the above study:

1. Ethics Application Form, Version 1 dated 25/10/2019
2. Respondent Information Sheet & Consent (English), Version 1 dated 25/10/2019
3. Respondent Information Sheet & Consent (Malay), Version 1 dated 25/10/2019
4. Proposal (English), Version 1 dated 25/10/2019
5. Questionnaires/ Interviews (English), Version 1 dated 25/10/2019
6. Curriculum Vitae of:
 - a. Dr. Vivien How

The University Research Ethics Committee, Universiti Putra Malaysia (JKEUPM) operates in accordance to the ICH-GCP Guidelines.

Decision by JKEUPM:

- Approved
- Permission MUST BE OBTAINED from the respective hospitals/ institutions before conducting the research**
- Disapproved

Please note that the approval is **VALID UNTIL 19 NOVEMBER 2020**

Researchers should comply with the following:

- I. Complete a Study Final Report upon study completion (Form 3.2).
- II. Ethical approval is required in the case of amendments/ changes to the study documents/ study sites/ study team.
- III. Applicable for Clinical Trial Studies and Clinical interventional Studies only: Progress Report has to be submitted to JKEUPM at every 6 months from the date of approval (Form 3.1). Report



**FORM 2.4: RESPONDENT'S INFORMATION SHEET AND INFORMED CONSENT
FORM**

Please read the following information carefully and do not hesitate to discuss any questions you may have with the researcher.

1. STUDY TITLE :

Association of Volatile Organic Compounds (VOCs) Level and Sick Building Syndrome (SBS) Among Office Worker with Golden Pothos Plant at Closed Ventilated Office in Kajang, Selangor.

2. INTRODUCTION:

According to EPA (2017), indoor air may be contaminated by two or three times as much as poor outdoor air IAQ could lead to or worsen up to 50% of all illness. The eye, nose and throat irritation, headaches, dizziness and fatigue are affected by contaminated air. VOCs are a large group of chemicals found in a variety of products which are used for the manufacture and repair of our homes.

3. WHAT WILL YOU HAVE TO DO?

You will be interview and required to answer a questionnaire and following a series of monitorings will be conducted by researcher in your workplace. You need to give back the questionnaire to the researcher.

4. WHO SHOULD NOT PARTICIPATE IN THE STUDY?

Subject who do not meet the inclusive criteria of this study should not participate in this study. The inclusive criteria of the study are the respondent must has been working at least 5 years in the current office building, age range 20-50 year old and do not consume medical treatment, for examples, asthmatic problem and migraine.

5. WHAT WILL BE THE BENEFITS OF THE STUDY:

(a) TO YOU AS THE SUBJECT?

The result of the study will be used to enhance the knowledge of office workers about their exposure to indoor air pollutants, the level of VOCs in their workplace. In addition, this study also will enhance the knowledge of workers about the Golden Pothos plant in reducing the level of VOCs in the close ventilated office. Sick Building Syndrome (SBS) symptoms questionnaire also helps the workers to identify wether the workers affected with SBS.

(b) TO THE INVESTIGATOR?

The study may help researcher to determine the levels of VOCs in the close ventilated office before and after placing the Golden Pothos plant. The researcher also may know about the effectiveness of Golden Pothos plant in reducing the VOC levels in the area.

6. WHAT ARE THE POSSIBLE RISKS?

The study will not involve any risk of accident, infections, injury and so on. All of the research process will be conducted in safe area.

7. WILL THE INFORMATION THAT YOU PROVIDE AND YOUR IDENTITY REMAIN CONFIDENTIAL?

All of the information gathered from you will be treated very confidentially and will be known as researcher study. No individual information from any aspects will be discuss.

8. WHO SHOULD YOU CONTACT IF YOU HAVE ADDITIONAL QUESTIONS DURING THE COURSE OF THE RESEARCH?

Any problem or questions about the study can be directed to the following officers either meet in person or by phone:

- **Project leader** : Dr. Vivien How
Contact no. : +6016-6193697
Email : vivienhow1022@gmail.com
Office address : Department of Environmental and Occupational Health, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400, Selangor.

- **Researcher** : Muhammad Fathehi Helmi bin Saidudin
Contact no. : +6014-8043114
Email : helmifathehii@gmail.com
Office address : Department of Environmental and Occupational Health, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400, Selangor.

Please initial here if you have read and understood the contents of this page_____

9. CONSENT

I Identity Card No.
address.....
.....hereby voluntarily agree to take
part in the research stated above *(clinical /drug trial/video recording/ focus group/interview-
based/ questionnaire-based).

I have been informed about the nature of the research in terms of methodology, possible adverse
effects and complications (as written in the Respondent’s Information Sheet). I understand that
I have the right to withdraw from this research at any time without giving any reason
whatsoever. I also understand that this study is confidential and all information provided with
regard to my identity will remain private and confidential.

I* wish / do not wish to know the results related to my participation in the research

I agree/do not agree that the images/photos/video recordings/voice recordings related to me be
used in any form of publication or presentation (if applicable)

* delete where necessary

Signature Signature
(Respondent) (Witness)

Date : Name :

I/C No. :

I confirm that I have explained to the respondent the nature and purpose of the above-mentioned
research.

Date Signature
(Researcher)



BORANG 2.4: PENERANGAN DAN PERSETUJUAN RESPONDEN

Sila baca maklumat berikut dengan teliti. Sekiranya anda mempunyai sebarang pertanyaan, sila kemukakan kepada penyelidik.

1. TAJUK KAJIAN

Perhubungan antara tahap Volatile Organic Compounds (VOC) dan Syndrome Sick Building (SBS) antara Pekerja Pejabat dengan tumbuhan Golden Pothos di Pejabat Pengudaraan Tertutup di Kajang, Selangor.

2. PENGENALAN

Menurut EPA (2017), Udara dalaman mungkin tercemar dua atau tiga kali ganda kerana IAQ udara luar yang lemah boleh menyebabkan atau memburukkan sehingga 50% daripada semua penyakit. Keradangan mata, hidung dan kerongkong, sakit kepala, pening dan keletihan terjejas oleh udara yang tercemar. VOC adalah sekumpulan besar bahan kimia yang terdapat dalam pelbagai produk yang digunakan untuk pembuatan dan pembaikan rumah kita.

3. APAKAH YANG PERLU ANDA LAKUKAN?

Anda akan terlibat dalam wawancara dan diperlukan untuk menjawab borang soal selidik dan mengikuti satu siri pemantauan yang akan dijalankan oleh penyelidik di tempat kerja anda. Anda perlu memulangkan kembali borang soal selidik kepada penyelidik.

4. SIAPA YANG TIDAK BOLEH MENYERTAI KAJIAN INI?

Subjek yang tidak memenuhi kriteria inklusif dalam kajian ini tidak boleh mengambil bahagian dalam kajian ini. Kriteria yang inklusif dalam kajian ini adalah responden mestilah

bekerja sekurang-kurangnya 5 tahun di bangunan pejabat semasa, umur berumur 20-50 tahun dan tidak mengambil rawatan perubatan, contohnya, masalah asma dan migrain.

5. APAKAH FAEDAH MENYERTAI KAJIAN INI?

a) KEPADA ANDA SEBAGAI PESERTA?

Hasil dari kajian ini akan digunakan untuk meningkatkan pengetahuan pekerja di pejabat tentang pendedahan mereka terhadap pencemar udara dalam ruangan, tahap VOC di tempat kerja mereka. Di samping itu, kajian ini juga akan menimbulkan pengetahuan pekerja mengenai tumbuhan Golden Pothos dalam mengurangkan tahap VOC di pejabat pengudaraan yang tertutup. Borang soal selidik tentang simptom Sick Building Syndrome (SBS) juga membantu para pekerja untuk mengenal pasti mereka yang terlibat dengan SBS.

b) KEPADA PENYELIDIK?

Kajian ini boleh membantu penyelidik menentukan tahap VOC di pejabat pengudaraan yang tertutup sebelum dan selepas meletakkan tumbuhan Golden Pothos. Penyelidik juga mungkin tahu tentang keberkesanan tumbuhan Golden Pothos dalam mengurangkan tahap VOC di kawasan tersebut.

6. ADAKAH IA BERISIKO?

Kajian ini tidak akan melibatkan sebarang risiko kemalangan, jangkitan, kecederaan dan sebagainya. Semua proses penyelidikan akan dijalankan di kawasan selamat.

7. ADAKAH MAKLUMAT DAN IDENTITI SAYA KEKAL RAHSIA?

Semua maklumat yang dikumpulkan dari anda akan dikendalikan dengan sangat rahsia dan akan dikenali sebagai kajian penyelidikan. Tiada maklumat individu dari mana-mana aspek akan dibincangkan.

8. SIAPA YANG SAYA PERLU HUBUNGI SEKIRANYA SAYA MEMPUNYAI SOALAN TAMBAHAN SEMASA MENGIKUTI PENYELIDIKAN INI?

Mana-mana masalah atau soalan mengenai kajian boleh diarahkan kepada pegawai berikut sama ada bertemu secara peribadi atau melalui telefon:

- **Ketua projek** : Dr. Vivien How
Hubungi : + 6016-6193697
E-mel : vivienhow1022@gmail.com
Alamat pejabat : Jabatan Kesihatan dan Keselamatan Pekerjaan, Fakulti Perubatan dan Sains Kesihatan, Universiti Putra Malaysia, 43400, Selangor.

- **Penyelidik** : Muhammad Fathehi Helmi bin Saidudin
Hubungi : + 6014-8043114
E-mel : helmifathehii@gmail.com
Alamat pejabat : Jabatan Kesihatan dan Keselamatan Pekerjaan, Fakulti Perubatan dan Sains Kesihatan, Universiti Putra Malaysia, 43400, Selangor.

Sila tandatangan di sini sekiranya anda telah membaca dan memahami kandungan halaman ini

9. PERSETUJUAN

Saya..... No Kad Pengenalan.
beralamat.....
.....dengan ini bersetuju untuk mengambil bahagian secara sukarela dalam penyelidikan yang tersebut di atas *(kajian klinikal/percubaan ubat-ubatan/rakaman video/kumpulan sasaran/temuduga/ soal selidik).

Saya telah diberi penjelasan secara menyeluruh mengenai penyelidikan ini dari segi metodologi, risiko dan komplikasi (seperti tertulis pada Helaian Penerangan Responden). Saya memahami bahawa saya berhak menarik diri dari penyelidikan ini pada bila-bila masa tanpa memberi sebarang alasan. Saya juga memahami bahawa sebarang maklumat yang berkaitan identiti saya akan dirahsiakan.

Saya* berminat / tidak berminat untuk mengetahui keputusan kajian yang melibatkan saya.

I setuju/tidak bersetuju untuk imei/gambar/rakaman video/ rakaman suara digunakan dalam apa jua bentuk penerbitan atau pembentangan. (sekiranya berkaitan).

*potong yang tidak berkenaan

Tandatangan
(Responden)

Tandatangan
(Saksi)

Tarikh :

Nama :

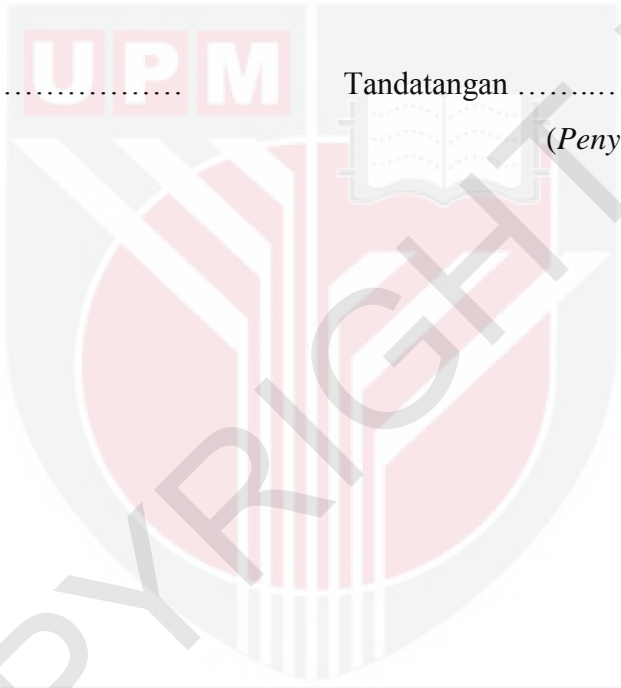
No. K/P:

Saya mengesahkan bahawa saya telah menerangkan kepada responden ini sifat dan tujuan penyelidikan yang tersebut di atas.

Tarikh

Tandatangan

(Penyelidik)





FORM 2.4: RESPONDENT'S INFORMATION SHEET AND INFORMED CONSENT FORM

Please read the following information carefully and do not hesitate to discuss any questions you may have with the researcher.

1. STUDY TITLE :

Knowledge, Attitude and Practice on Golden Pothos Plant in Reducing Volatile Organic Compounds (VOCs) Level among Office Workers in Universiti Putra Malaysia

2. INTRODUCTION:

Knowledge, Attitude and Practice (KAP) survey is to examine the respondents' knowledge which is their ability to retain and use information, attitude which is their affinity towards certain behavior and finally the practice pointing and focusing on their actions or applications of the knowledge (Kaliyaperumal, 2004). This study will be on the KAP among office workers regarding Golden Photos plant in reducing indoor air pollutant (Volatile Organic Compounds (VOCs)). **This will help to examine whether the office workers have the knowledge or right understanding to the effectiveness of houseplant in reducing indoor pollutants, possess the proper attitude and actions towards creating a safe and healthy environment in workplace.**

3. WHAT WILL YOU HAVE TO DO?

You are required to answer a questionnaire about Knowledge, Attitude and Practice on indoor air quality and the effectiveness of houseplant in maintaining the air quality conducted by researcher. The questionnaire is in digital form that requires you to have a device and internet. You need to fill in all the questionnaire and submit once it is completed. The questionnaire is basically about your knowledge, attitude on indoor air quality and houseplant use to maintain the air quality, and practice regarding the use and effectiveness of houseplant in maintaining the quality of indoor air. Your participation is voluntary and you have the rights to withdraw yourself anytime during the study.

4. WHO SHOULD NOT PARTICIPATE IN THE STUDY?

Subject who do not meet the criteria of this study should not participate in this study. The criteria of the study are the respondent must UPM Office Workers, and Office workers who gave their consent to participate in this study and who are present during the sampling time.

5. WHAT WILL BE THE BENEFITS OF THE STUDY:

(a) TO YOU AS THE SUBJECT?

The result of the study will be used to enhance the knowledge of office workers about their exposure to indoor air pollutants. **In addition, this study also will enhance the knowledge of workers about the Golden Pothos plant in reducing the level of VOCs in the close ventilated office.** Knowledge, attitude and practice questionnaire regarding the study also helps the workers to identify whether they have a healthy working environment.

(b) TO THE INVESTIGATOR?

The study may help the researcher to identify the general community's understanding regarding indoor air quality issue and helps them to control the indoor air pollution by using Golden Pothos plant.

6. WHAT ARE THE POSSIBLE RISKS?

The study will not involve any risk of accident, infections, injury and so on. All of the research process will be conducted in safe area.

7. WILL THE INFORMATION THAT YOU PROVIDE AND YOUR IDENTITY REMAIN CONFIDENTIAL?

All of the information gathered from you will be treated very confidentially and will be known as researcher study. No individual information from any aspects will be discuss.

8. WHO SHOULD YOU CONTACT IF YOU HAVE ADDITIONAL QUESTIONS DURING THE COURSE OF THE RESEARCH?

Any problem or questions about the study can be directed to the following officers either meet in person or by phone:

- **Project leader : Dr. Vivien How**
Contact no. : +6016-6193697
Email : vivien@upm.edu.my
Office address : Department of Environmental and Occupational Health, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400, Selangor.

- **Researcher : Muhammad Fathehi Helmi bin Saidudin**
Contact no. : +6014-8043114
Email : helmifathehi@gmail.com
Office address : Department of Environmental and Occupational Health, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400, Selangor.

Please initial here if you have read and understood the contents of this page _____

9. CONSENT

I Identity Card No.
address.....
.....hereby voluntarily agree to take part in the research stated
above *(clinical /drug trial/video recording/ focus group/interview-based/ questionnaire-based).

I have been informed about the nature of the research in terms of methodology, possible adverse effects and complications (as written in the Respondent's Information Sheet). I understand that I have the right to withdraw from this research at any time without giving any reason whatsoever. I also understand that this study is confidential and all information provided with regard to my identity will remain private and confidential.

I* wish / do not wish to know the results related to my participation in the research

I agree/do not agree that the images/photos/video recordings/voice recordings related to me be used in any form of publication or presentation (if applicable)

* delete where necessary

Signature
(Respondent)

Signature
(Witness)

Date :.....

Name :.....

I/C No. :.....

I confirm that I have explained to the respondent the nature and purpose of the above-mentioned research.

Date

Signature

(Researcher)



Questionnaire

Knowledge, Attitude, and Practice on Houseplant on Indoor Air Quality among Office Worker

Section A: Demographic Characteristic of Respondent

Direction: Please read each statement carefully and tick (✓) or fill in your answer.

1. Gender : Male
: Female
2. Age : _____
3. Ethnicity : Malay Chin
Indian Others

Section B: This section is to evaluate your knowledge on houseplant and the indoor air quality

Knowledge Statement	True	False	Not sure	Never heard of
1) Poor indoor environmental quality is creating health problems today and impairs the ability of occupants to work and learn				
2) Houseplants represent a sustainable solution to enhance indoor air quality				
3) Houseplant can help to remove airborne pollutant				
4) Overcrowding may contribute to increases indoor CO2 levels				
5) Indoor air pollutants emitted from indoor sources will increase indoors where the air-conditioning system is installed				

6) Climate Change may worsen existing indoor environmental problems				
7) Houseplant is a mitigating measures to improve indoor environmental quality induced climate change				
8) Indoor air quality includes the biological microorganism which grows unchecked by most occupants.				
9) Indoor air quality is often worse than outdoor air				
10) Most AC are fuelled by electricity and use a refrigerant that results in gaseous emissions that contribute to GHG				

Section C: This section is to evaluate your attitude to having houseplant and your perception of its function to indoor quality

Attitude statements	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
1) Houseplant can spruce up a home or office space					
2) Mechanical ventilation is more effective than placing houseplant indoor					
3) Interaction with indoors plants may reduce psychological and physiological stress					
4) Watering houseplants in my office would burden my routine workload					

5) Houseplant are far too demanding and difficult to keep alive					
6) Adding houseplant indoors would take up my office space					
7) I would practice to water the houseplant daily if I have one in my office					
8) Poor indoor air quality can lead to discomfort, ill health, and, in the workplace, absenteeism and lower productivity.					
9) Inadequate ventilation can increase indoor pollutant levels by not bringing in enough outdoor air to dilute emissions from indoor sources and by not carrying indoor air pollutants out of the area.					
10) Usually the most effective way to improve indoor air quality is to eliminate individual sources of pollution or to reduce their emissions.					



Section D: This section is to check one's practice to maintain indoor quality, besides houseplants

Practice statements	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
1) I places houseplant at home or in office to improve indoor air quality					
2) I would rather spend time in indoor gym/sports than natural settings surrounded with green environment					
3) I would clean-up the AC system regularly					
4) I keep my office carpets clean and dry at all times					
5) I placed an air purifier in my work desk to freshen the air					
6) I would choose eco-friendly cooling technology for my AC system at home/office					
7) I would practice to water the houseplant daily if I have one in my office					
8) I would choose to have an adequate indoor ventilation to dilute emissions from indoor soures.					
9) I would eliminate the source that contribute to the indoor pollution or to reduce their emissions.					

10) I would water houseplant in my office frequently.					
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