CHARACTERIZATION OF PARTICULATE MATTER AT CONSTRUCTION SITE

MASLINA BINTI MOHAMAD

A project report submitted in partial fulfillment of the requirement for the award of the degree of Master of Engineering (Construction Management)

Faculty of Civil Engineering
Universiti Teknologi Malaysia

JANUARY 2018
DEDICATION

To my beloved mother and late father
Sopiah Binti Omar, Mohamad bin Ahmad Amin, my sisters and brothers

To my best friend
Zuliana binti Mamat

To my supervisor and Co supervisor
Dr Eeydzah binti Aminudin & Assoc. Prof. Dr. Rozana Zakaria

Support, tolerance, patient, guidance, advice, criticisms and pray will remain in my heart and millions of thanks for the every scarify done for me.
ACKNOWLEDGEMENT

First at all I would like to thank to Allah for the blessing of health and long life and my beloved mother and late father. In a journey of preparing and completing this thesis, a lot of support and encouragement have taken place. In order to define and determine the best practice and learning process to carry out during the experimental and observation I was exposed in the real world of research and study. However without the guidance of my supervisor Dr Eeydzah Binti Aminudin and co supervisor Assoc. Prof. Dr. Rozana Zakaria the whole process of this report and observation technique will not complete, only Allah can pay the kindness of you two and I pray both of you will success in whatever you are commit to.

I also want to express the appreciation to my company Telford Signature (M) Sdn Bhd for the funding of my Master of Engineering study, not forgotten to all my devoted lecturers and Environmental Lab and Faculty Alam Bina Technician, by supporting me knowledge, instrument and advice throughout of my learning process at Universiti Teknologi Malaysia.

To my fellow postgraduate members Shahir, Abdul Rahman, Mohd Shafid, Shirah, Farah, Anis, Yana and Alya for the assistance, critic and sharing the information

Thank You
ABSTRACT

The presence of Particulate Matter (PM) threatens human life especially when it is exposed to unknown air and are frightened if the air inhaled will result in death and illness. The PM is known to be invisible, floating in the earth atmosphere and can penetrate the respiratory system, blood molecule which later harm to human life. The emission can exist caused by either the debris from the transport, construction site or even during dry weather. This study reveals the construction site located at Johor Baharu. The Malaysian air pollution standard index (API) will be used as a benchmark for PM pollution. This study aims to determine the characterization of particulate matter (PM) produced from construction sites with regard to Particulate Matter 10 μm (PM10) and 2.5 μm (PM2.5). The experimental study was conducted at building construction sites over a period of work days for 8 hour. Portable air samplers were used to collect the particulate matter that used sticky pads collected settle dust and the weather condition such as temperature, wind speed and relative humidity was measured to examine the relation in emission of particulate matter. The finding from this study shows that construction site activity produce emission of Particulate Matter to the environment and exceeding the Malaysia Air Pollution Index (API) standard of 150 μg/m3. There are 6 days beyond API standard level which 277 μg/m3, 2 days of 208.33 μg/m3 and 173 μg/m3 and 243 μg/m3. The concentration of the data beyond 50 percent from the API standard and it is need for urgency in concern of construction site environment communities. Beside that chemical element of PM at construction sites presences of component K, Na, Ca and Al t which indicate from concreting work site activity. Toward the end, the study also shows that’s PM 2.5 is directly proportion with PM 10. Hence this paper provides a valuable knowledge for various real situations and provides a basis for improving the methodology of collecting PM on construction sites and controlling the production of PM.
ABSTRAK

Kehadiran Particulate Matter (PM) mengancam kehidupan manusia udara yang dihirup akan mengakibatkan kematian dan penyakit. PM diketahui tidak dapat dilihat, terapung di atmosfer bumi dan dapat menembus sistem pernapasan, molekul darah yang kemudian menjadi mengancam kehidupan manusia. Pelepasan boleh wujud disebabkan oleh serpihan dari pengangkutan, tapak pembinaan atau semasa cuaca kering. Kajian ini mendedahkan tapak pembinaan di Johor Baharu. Indeks standard pencemaran udara (API) Malaysia akan digunakan sebagai tanda aras untuk pencemaran PM. Tujuan kajian ini adalah untuk menentukan pencirian bahan partikulat (PM) yang dihasilkan dari tapak pembinaan berkaitan dengan Particulate Matter 10 μm (PM10) dan 2.5 μm (PM2.5). Kajian eksperimen dijalankan di tapak pembinaan bangunan selama satu hari kerja selama 8 jam. Pengelup udara udara mudah alih digunakan untuk mengumpul bahan partikulat yang menggunakan pad melekat yang dikumpul menyelesaikan habuk dan keadaan cuaca seperti suhu, kelajuan angin dan kelembapan relatif adalah ukuran untuk memeriksa hubungan dalam pelepasan bahan zarah. Dapatan kajian ini menunjukkan bawah aktiviti tapak pembinaan menghasilkan pelepasan Bahan Partikulat kepada alam sekitar dan melebihi piawaian Indeks Pencemaran Udara Malaysia (API) 150μg/m³. Terdapat 6 hari di luar paras standard API iaitu 277 μg / m³, 2 hari 208.33 μg / m³ dan 173μg / m³ dan 243 μg / m³. Kepekatan data melebihi 50 peratus daripada piawaian API dan ia memerlukan perhatian segera oleh komuniti persekitaran tapak pembinaan. Selain itu unsur kimia PM di tapak pembinaan memperlihatkan komponen K, Na, Ca dan Al yang menunjukkan dari aktiviti tapak kerja konkrit. Menjelang akhir, kajian itu juga menunjukkan bahawa Pm 2.5 adalah secara langsung dengan PM 10. Oleh itu, makalah ini memberikan pengetahuan berharga untuk pelbagai situasi sebenar dan menyediakan asas untuk memperbaiki metodologi pengumpulan PM di tapak pembinaan dan mengawal pengeluaran PM.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DECLARATION</td>
<td>ii</td>
</tr>
<tr>
<td></td>
<td>DEDICATION</td>
<td>iii</td>
</tr>
<tr>
<td></td>
<td>ACKNOWLEDGEMENT</td>
<td>iv</td>
</tr>
<tr>
<td></td>
<td>ABSTRACT</td>
<td>v</td>
</tr>
<tr>
<td></td>
<td>ABSTRAK</td>
<td>vi</td>
</tr>
<tr>
<td></td>
<td>TABLE OF CONTENTS</td>
<td>vii</td>
</tr>
<tr>
<td></td>
<td>LIST OF TABLES</td>
<td>ix</td>
</tr>
<tr>
<td></td>
<td>LIST OF FIGURES</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>LIST OF ABBREVIATIONS</td>
<td>xii</td>
</tr>
</tbody>
</table>

## 1 INTRODUCTION

1.1 Background of Study 1

1.2 Problem Statement 3

1.3 Aim and Objective 7

1.4 Scope and Limitation 8

1.5 Outline of Study 9

1.6 Significant of Study 10

## 2 LITERATURE REVIEW

2.1 Introduction 11

2.2 Dust 14

2.2.1 Characteristic of Dust/Particulate Matter 14

2.2.2 Physical Characteristic 14
2.2.3 Factor that affect the behavior of PM concentration
2.2.3.1 Relative Humidity
2.2.3.2 Temperature and Wind Speed
2.2.3.3 Topography

2.3 Air Pollution Index (API)
2.3.1 Criteria of Air Pollutant

2.4 Mitigation

3 RESEARCH METHODOLOGY
3.1 Introduction
3.2 The Selection of construction site
3.3 Equipment used to sample Particulate Matter
3.3.1 Federal Reference Method Monitor
3.4 The weather condition equipment
3.5 Equation for PM concentration
3.6 Characterization of Particulate Matter

4 RESULTS AND DISCUSSION
4.1 Introduction
4.2 Physical Characterization
4.3 Chemical Characterization for PM 10 and PM 2.5
4.4 Correlation between PM 10 and PM 2.5
4.5 Mitigation of Particulate Matter (PM) at construction site
4.6 Discussion

5 CONCLUSION AND RECOMMENDATION
5.1 Conclusion
5.2 Recommendation

REFERENCES
Appendices A
# LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE NO.</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Probability density function (PDF) and its parameters estimator</td>
<td>22</td>
</tr>
<tr>
<td>2.2</td>
<td>Performance indicator</td>
<td>23</td>
</tr>
<tr>
<td>2.3</td>
<td>Summarizes additional information general human health effects and cautionary statement within each of the API</td>
<td>24</td>
</tr>
<tr>
<td>2.4</td>
<td>Malaysia Air Quality Guidelines, Adopted in Air Pollution Index Calculation</td>
<td>25</td>
</tr>
<tr>
<td>2.5</td>
<td>Data for Primary Federal and State Ambient Air Quality Standards and Associated Health Effect for Valley Ivyglen and Alberhill Projects, California</td>
<td>27</td>
</tr>
<tr>
<td>2.6</td>
<td>Previous research and the finding for Particulate Matter</td>
<td>30</td>
</tr>
<tr>
<td>3.0</td>
<td>The Particle Size Distribution Graph in Micrometer (µm)</td>
<td>44</td>
</tr>
<tr>
<td>3.1</td>
<td>Measurement Specification for Kestrel Pocket Meter</td>
<td>48</td>
</tr>
<tr>
<td>4.0</td>
<td>PM concentration in µg/m³ at Station A and Station B</td>
<td>60</td>
</tr>
<tr>
<td>4.1</td>
<td>Construction work activity and methodology used for dust control at site</td>
<td>63</td>
</tr>
<tr>
<td>4.2</td>
<td>Weather condition for PM10</td>
<td>64</td>
</tr>
<tr>
<td>4.3</td>
<td>Weather condition for PM 2.5</td>
<td>64</td>
</tr>
<tr>
<td>FIGURE NO.</td>
<td>TITLE</td>
<td>PAGE</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>1.0</td>
<td>PM Size compare to Hair and Fine Beach Size</td>
<td>4</td>
</tr>
<tr>
<td>1.1</td>
<td>Deadly air pollution chart and diseases</td>
<td>5</td>
</tr>
<tr>
<td>1.2</td>
<td>Indoors and Outdoor Air Pollution Health Risk Chart</td>
<td>5</td>
</tr>
<tr>
<td>1.3</td>
<td>Research Methodology Process</td>
<td>11</td>
</tr>
<tr>
<td>2.0</td>
<td>Comparison of air quality sub indexes for particulate matter pollutants(PM10 &amp; PM2.5) over EU and API/PSI South Asia Sub Index</td>
<td>25</td>
</tr>
<tr>
<td>3.0</td>
<td>Site Location by (Google Map)</td>
<td>34</td>
</tr>
<tr>
<td>3.1</td>
<td>3D of the construction building</td>
<td>35</td>
</tr>
<tr>
<td>3.2</td>
<td>Station A location</td>
<td>35</td>
</tr>
<tr>
<td>3.3</td>
<td>Station A location</td>
<td>36</td>
</tr>
<tr>
<td>3.4</td>
<td>Station B</td>
<td>36</td>
</tr>
<tr>
<td>3.5</td>
<td>Station B surrounding area</td>
<td>37</td>
</tr>
<tr>
<td>3.6</td>
<td>Petrol Pump beside construction site</td>
<td>37</td>
</tr>
<tr>
<td>3.7</td>
<td>Front view for construction site</td>
<td>37</td>
</tr>
<tr>
<td>3.8</td>
<td>Side view beside of nursery and Puspakom area</td>
<td>38</td>
</tr>
<tr>
<td>3.9</td>
<td>Site activity (unloading material and formwork activity in progress)</td>
<td>38</td>
</tr>
<tr>
<td>3.10</td>
<td>Minivol equipment, PM2.5 impactor, PM10 impactor, manual, battery pack</td>
<td>39</td>
</tr>
<tr>
<td>3.11</td>
<td>The demonstration of the equipment by En. Razali, Lab Technician (UTM)</td>
<td>42</td>
</tr>
<tr>
<td>3.12</td>
<td>Station A equipment setup, filter paper after dust collection to record the weight for concentration</td>
<td>43</td>
</tr>
</tbody>
</table>
3.13 The sketch of the Air Sample Minivol impactor, during collecting the PM (Mini Vols Air Tactical Manual)
3.14 The MiniVol impactor (Mini Vols Air Tactical Manual)
3.14 Filter for Air Sampler Minivol
3.15 Kestrel 4500 Pocket Weather Tracker
3.16 ICP-OES equipment
3.17 ICP-OES Illustration
4.0 PM 10 concentration for sample 1 – sample 8 (Included Station A&B)
4.1 PM 2.5 concentration for sample 1 to sample 7 (Station A&B)
4.2 Wind Rose at 1.53°N 103.79°E for year (SW: Wind blowing from South-West)
4.3 Percentage of Chemical Element
4.4 Plot of PM 2.5 versus PM 10
**LIST OF ABBREVIATIONS**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
<tr>
<td>PM</td>
<td>Particulate Matter</td>
</tr>
<tr>
<td>GDP</td>
<td>Growth domestic product</td>
</tr>
<tr>
<td>RH</td>
<td>Relative Humidity</td>
</tr>
<tr>
<td>API</td>
<td>Air Pollutant Index</td>
</tr>
<tr>
<td>DOE</td>
<td>Department of Environment</td>
</tr>
<tr>
<td>RMG</td>
<td>Recommended Malaysia Air Quality Guideline</td>
</tr>
<tr>
<td>SO2</td>
<td>Sulphur Dioxide</td>
</tr>
<tr>
<td>CO</td>
<td>Carbon Monoxide</td>
</tr>
<tr>
<td>O3</td>
<td>Ozone</td>
</tr>
<tr>
<td>NO2</td>
<td>Nitrogen Dioxide</td>
</tr>
<tr>
<td>FRMs</td>
<td>Federal Reference Method monitor</td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
</tr>
<tr>
<td>NAAQS</td>
<td>National Ambient Air Quality Standard</td>
</tr>
</tbody>
</table>
CHAPTER 1

INTRODUCTION

1.1 Background

The air is a vital requirement for human survival. Healthy air is a requirement for living things. Particulate matter pollutants can cause contamination in the air and harm human health, PM is known to be invisible, floating in the earth atmosphere and can penetrate the respiratory system and blood molecule and will be human killers (Eyu & Alie, 2006; WHO, 2015). This condition is defined as air pollution which inquired to harm to humanity and the universe (Mackenzie, 2016; WHO, 2015).

According to the World Health Organisation (WHO) 3 million premature deaths worldwide per year in 2012 that came from the outdoor air pollution (ambient) in both cities and rural areas. The exposure to the small particulate matter within diameter of 10 microns or less classified (PM10) can become mortality, which can cause to cardiovascular, respiratory disease, and cancers (WHO).
Not long ago the wave of red smoke in Kuantan, Pahang that had made the road, plant, residential, shop, school and almost the entire area including the vehicle wear with the sticky red color jacket. The red air produce by the transportation of material call bauxite and this material is the raw material for aluminium product (Abdullah et al., 2016).

According to (Heo et al., 2017) industrial lead source, construction dust, dust, biomass burning, sea salt, and fuel oil combustion were identified and largely related to local emissions of respective neighborhoods. Meanwhile the construction site activity and material use have been the factor of apperance of particulate matter (de Moraes et al., 2016). PM 2.5 have related to various adverse health effects, mainly due to their ability to penetrate deeply and to convey harmful chemical components, such as metals inside the body. (Ledoux et al., 2017). Air pollutants ambient such as PM2.5, PM 10, NO2, SO2 and CO cause the asthma and respiratory patient number increase (Guo et al., 2018).

(Lamichhane et al., 2018) found that the exposure of emission to prenant women in third trimester will give more impact and severe to the baby and mother. Beside that the possibilities in increasing the respiratory system problem and cancer reported by World Health Organization (WHO, 2015) and every year this problem keep increasing and alarming the people. Dust smaller than 10 micrometer in diameter, known as particulate matter PM10 and PM2.5 are of great health concern because it can be inhaled deep into the respiratory system (Abdullah et al., 2016). People that involve directly and indirect are expose to the air and impossible to determine the air contaminate. The air character that untouchable, cannot be seen by the eye and it also silent killer to almost all living thing (Awang et al., 2000).

The uncomfortable condition and classify as nuisance of dust reduces environmental amenity, contaminates clothes, properties, vegetation and water, and has negative effects on personal comfort and health (Abdullah et al., 2016).
Bauxite case at Kuantan, Pahang during the transportation that material to the collection and subsequent transformation to the buyer country cause a lot of physical and financial problem to the state and country. The observation show that the whole stretch of road along the Kuantan Port is tainted to the dark red color. The tree, vehicles, houses, clothes and food premises along the route of the Lorries transporting bauxite were also contaminated with red dust.

Nuisance dust particles are too large to be inhaled. Apart from causing visual pollution, it has the potential to cause irritation to the eyes, nose and throat (Englert, 2004; Abdullah et al., 2016). It also produces visual impact that can lead to mental health stress especially to those living in proximity to mining sites, particularly when it can be seen from their home (Guo et al., 2018; Abdullah et al., 2016).

Furthermore, the apparent of the dust deposited on premises has the potential to contaminate food sources and clothes because of the lorry pass through the public or local road that included all residential area. This situation of construction site activity related to transportation of material, working methodology, material use and the stages of activity become the source in producing the PM (Mohddin et al., 2014; Araújo et al., 2014; Abualqumboz et al., 2016).

1.2 Problem Statement

Figure 1 show the fine particles illustration of the size difference between human hair and PM. It availability of floating on the earth atmosphere and the most important to keep living thing alive. Fine particles are the cause or an alarm that trigger the occurrence of respiratory and cardiovascular diseases (WHO). According the World Health Organization (WHO, 2015) that there is ‘no safe level’ of fine particulate
air pollution, PM10 and PM2.5. Through the report have been done by (Zivin & Neidell, 2012) impact on worker productivity and air pollution show the positive result. Meanwhile (Xitaodong et al., 2015) clarify that construction dust is the major effect on field worker health at China.

Sources: United States Environmental Protection Agency web page https://www.epa.gov/pm-pollution/particulate-matter-pm-basics#PM

Figure 1.0 PM Size compare to Hair and Fine Beach Size (https://www.epa.gov/pm-pollution/particulate-matter-pm-basics#PM)

Both PM10 and PM2.5 particles which can penetrate deep into the respiratory system and are associated with increased hospital admissions for heart and lung diseases and premature death (Pope III et al., 2002; Pope et al., 2004). It is of great health concern when activity occur in proximity to school area as children is among the most susceptible subpopulations with regards to harmful effects of exposure to particulate matter, PM10 (WHO). As their physiological and immunological systems are still developing, children receive a higher dose of airborne particles relative to the lung size compared to adult.
Deadly air pollution

Air pollution killed around 7 million people worldwide in 2012 according to WHO's latest report.

Air pollution-linked deaths by region in millions

Indoor pollution

Outdoor pollution

Air pollution-linked deaths by disease in thousands

Ischaemic heart disease

Acute lower respiratory disease

Lung Cancer

Chronic obstructive pulmonary disease

Stroke

Indoor pollution is mostly caused by cooking over coal, wood and biomass stoves.

Outdoor pollution is mostly caused by transport, power generation, industrial and agricultural emissions, and residential heating and cooking.

Source: World Health Organization

Figure 1.1 Deadly air pollution chart and diseases (Source: World Health Organization web http://www.globalstewards.org/environmental-issues.htm)

Figure 1.2 Indoors and Outdoor Air Pollution Health Risk Chart (Source web: http://greenplanetethics.com/wordpress/indoor-air-pollution-facts-what-is-indoor-air-pollution-and-how-to-reduce-it/)
Figure 1.1 and figure 1.2 show that the air pollution impact on human health, the numbers of death by diseases and chart of health risk for different region in the world. Particulate Matter is a microscopic particle and affects more people than any other pollutant. The major components of PM are sulphate, nitrates, ammonia, sodium chloride, black carbon, mineral dust and water. It consists of a complex mixture of solid and liquid particles of organic and inorganic substances suspended in the air (WHO, 2015).

The most health-damaging particles are those with a diameter of 10 microns or less, (\(\leq\) PM\(_{10}\)), and it about 1/7 part of the thickness human hair which can penetrate and lodge deep inside the lungs (Kampa, 2008). Chronic exposure to particles contributes to the risk of developing cardiovascular and respiratory diseases, as well as of lung cancer. Workers at construction industry expose directly to the air pollution. The impact more to the women rather than men (Vidya et al., 2015).

Air quality measurements are typically reported in terms of daily or annual mean concentrations of PM\(_{10}\) particles per cubic meter of air volume (m\(^3\)) (WHO, 2012). Routine air quality measurements typically describe such PM concentrations in terms of micrograms per cubic meter (\(\mu g/m^3\)) (DOE).

The characterization of particulate matter (PM) especially the concentration from construction site activities that related to the characteristic of the particle size, particle composition and the concentration of PM (Araújo et al., 2014). Solid particle floating in the air and sometime a very small liquid form the word that identified as Particulate matter (Zaman et al., 2017). According to the research that have been develop by California Environmental Protection Agency located at western United Stated, the major source of PM10 in both urban and rural area including the motor vehicle, wood burning stove and fireplaces, dust form construction, landfill and agriculture, wildfires and brush/waste burning and also industrial sources and not to forgot the windblown dust form open land.
The mixture of material included smoke, soot, dust, salt, acids and metal produce PM (Winckler & Gisela, 2010). It also forms when gases emitted from motor vehicles and industry undergo chemical reactions in atmosphere and often responsible for much of the haze that we think of as smog. This is a problem in cities, government and worldwide.

The contribution of construction industry no doubt to be the measurement tool of develop country (Khan et al., 2014). But by neglecting of environment impact conclude the change of the world wide climax and the unexpected natural disaster that threaten human race. This paper will identify the characterization of particulate matter PM concentration and composition by using the appropriate measurement tool and mitigation method to implemented and develop with follow the improvement of technology nowadays. But in the same time this study is to develop and build the awareness to the impact of dust that construction site produce.

1.3 Aim and Objectives

The aim of the study is to identity the characteristic of Particulate Matter (PM) that contribute most at construction site and to ensure the understanding the particulate matter contribution by the construction sector among anyone who involve in the industry. The lack of information and exposure will result severe impact to the health and environment. In order to achieve this aim, the following objective have been delineated:

i. To identify the PM concentration at construction site that give the significant with regard to the air pollution.
ii. To measure PM characteristic during construction site activity and clarify the most activity that produce major source of Particulate Matter.

iii. To determine the correlation in between PM concentration at construction site.

1.4 Scope and Limitation

The study was focus to the one selected construction site located at Johor Baharu (Taman Daya) area that related to Telford Signature(M) Sdn Bhd that the researcher working currently. The scope of work will be limited as per listed below:

i. To identify the concentration of particulate matter emission at one construction site.

ii. The measurement tool only will be use the Mini Vol Air Tactical Sampler and Kestrel Weather Pocket Meter.

iii. To use the range of PM10- PM2.5 micrometers that recognize harm the human health.

iv. The site was specific to the diameter of 5 meter in radius, which having the normal ambient air of 27°C to 35°C and air velocity range to 1ms⁻¹ to 3ms⁻¹
1.5 Study Outline

By refer to figure 1.3 show the research methodology process to be follow and as the reference. The study covers 6 chapters and focusing to the concentration of particulate matter contributes by construction site. Chapter 1 content will brief the problem statement and also the objective of the study. Beside that the scope of study explained and the limitation of study to formulate the structure of study in order to achieve the objective of the project.

Chapter 2 explained more in theory and the literature review link and related to the research. This chapter also will explain the particulate matter produce by construction site and the characterization that have define by other researcher and the adaption of measurement tool and the development of the study have been introduce by other researcher. The boundary of study will stresses in finding the better understanding of particulate matter. The literature study will go closely and digging more information in determination of characterization of particulate matter in construction site. The factor of location, the weather and the method of work for construction activity that may consider as the factor of characterization of particulate matter that founded less investigated or be the topic to study before.

The methodology of this study will be the pin point of successful of this study. It will discussed and elaborate more detail in chapter 3. The use of measurement tool and the information of equipment will be translated deeper in this chapter. In chapter 4, the collection of data from measurement tool will be explained and discussed. The characterization of particulate matter in selection activity at construction site will determine and the result will be the benchmark to carry out another step in next chapter.
The conclusion from the result given on the chapter 5 will be discussed and analyses. This chapter will prove the identification of characterization particulate matter at construction site is in range on PM2.5- PM10 that harm human health and the action can be taken in order to mitigate and control the sources of particulate matter and finally to recommendation for further study in this subject.

Finally the recommendation concluding the overall chapter and the closing of the research. The purpose of the chapter is to recommend and enhancer the research have been done in order to improve and develop the finding data or result.

1.6 Significant of Study

Particulate matter is the dust smaller than 10 micron meters in diameter and it harm human health. The characteristic of dust must be understood and to identify the source that contribute to the air pollution will be the bench mark and as a guide to develop more methodology to mitigate and as the code to practice in order for future survival and sustainability. The construction site have been familiar as the contributor of the particulate matter and it uncontrolled, predicted and never finding the ending of it, even though all the guideline and the law have been introduced and enforced by government and association. However the study is to investigate the critical activity contributor to the air pollution and that will be a report or base for the improvement of material use, the method of work, the site condition and the safety equipment to be provided during performing the activity.
Research Topic

Defining Study Aim, Objective and Scope

Desk Study
  i) Development of literature study
  ii) Development of Methodology

Selection of site location
  i) Location to be determine at Johor

Stage 1
  Objective 1
  -To identify the activity at construction site that give the significant with regard to the air pollution

Expected finding
  Although the construction site have clarify among the major source in producing the Particulate Matter, the study will define and examination the significant of air pollution.

Equipment Selection
  i) Tactical Air Sample
  ii) Kestrel Weather Pocket
  iii) ICP-OES

Data Collection
  i) During daylight construction activity 8am-5pm
  ii) Laboratory analysis
  iii) Result analysis
  iii) Ms Excel

Stage 2
  Objective 2
  -To measure PM characteristic during construction site activity and clarify the most activity that produce major source of Particulate Matter

Expected finding
  The level of PM will be exposure and identify. The characterization of Particulate matter in concentration of PM2.5 and PM10 will expose.

Stage 3
  Objective 3
  To determine the correlation in between on PM concentration at construction site

Expected finding
  The recommendation will base on the result given in the stage 2 and will be the bench mark in providing new methodology of work and the material to develop.

Figure 1.3 : Research Methodology Process
REFERENCE


Mackenzie, J. (2016). *Air Pollution : Everything You Need to Know : How Smog, soot, greenhouse gases, and other top air pollutant are affecting the planet and your health.*

Mackenzie, J. (2016). *Air pollution Fact. Causes and the Effects of Air Pollution- How smog, soot, soot, greenhouse gases, and other top air pollutants are affecting the planet-and your health.* NRCD.


