

STUDY ON CONCENTRATION OF PM10 AND PM2.5 PARTICULATE MATTER IN UTHM CAMPUS BY USING E-SAMPLER

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ABSTRACT

Particulate matters are emitted from a wide range of man-made and natural sources. Small particles less than 10 micrometers in diameter pose the greatest problems to human health. UTHM are surrounding by industrial and construction area. Due to awareness of the student's health this study was performed. The samples had been collected at five sampling point around UTHM by using E-Sampler apparatus in order to determined the concentration of PM10 and PM2.5. It was found that the highest concentration of PM10 and PM2.5 obtained was 33.08 $\mu\text{g}/\text{m}^3$ and 0.72 $\mu\text{g}/\text{m}^3$. Both values are less then the permitted value stated in the Air Quality Standard.

Keywords: PM10, PM2.5, E-Sampler

INTRODUCTION

Air pollution is a major problem that has been recognized throughout the world for hundreds of years. It has been proven that poor air quality has negative effects on the environment. The sources of air pollution are from human and nature. Air pollution is caused by the existence of air pollutant in it. Air pollutant can be divided into gases and particulate. The major gases pollutants are carbon monoxide, hydrocarbon, hydrogen sulfide, nitrogen oxide, ozone and hydro-oxides. Particulate pollutants are particle within size 0.002 μm to 500 μm [1].

Particulate matter (PM) also known as particle pollution is a complex mixture of extremely small particles and liquid droplets which can be divided into fine and coarse particulate matter. Size of fine particulate is less then 2.5 μm . While coarse particulate matter are more then 2.5 μm to 10 μm . Both primary as well as secondary particulate matter in the respirable size-range was taken into account The size of particles is directly linked to their potential for causing health problems. Environmental Protection Agency (EPA) concerned about particles that are 10 micrometers in diameter or smaller because those are the particles that generally pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs and cause serious health effects. Particulate matter can caused toxicity in human lung [2]. The range of particle size between 2.5 μm to 10 μm are also known as the respirable size range[3].

Particulate matter comes from diverse sources such as factory and utility smokestacks, vehicle exhaust, wood burning, mining, construction activity, and agriculture. The effects of

particulate matter to human health are depending on its concentration, the existence of others pollutant and time of exposure [4].

Nowadays the abrupt growth of factories and facilities in Malaysia has caused problems towards air pollution. Due to improper town planning some factory located nearby the residence and academic institution. Universiti Tun Hussein Onn Malaysia (UTHM) is located near a factory. The residence in UTHM campus is facing serious level of air pollution. Everyday the factory emitted smoke that maybe contains dangerous compounds. Due to awareness of the student's health this study was performed to determine the concentration of fine particulate matter (PM_{2.5} and PM₁₀) and to compare the data obtained from this study with the allowable and approval standard of ambient air.

MATERIALS AND METHODS

Data was collected by using E-SAMPLER. E-SAMPLER is a dual technology instrument that combines the unequalled real time measurement of light scatter with the accuracy standard of filter methods. The simple filter loading process testifies to the seamless blending of both technologies. Filters can be extracted and replaced in less than one minute and filter medium can be selected based on laboratory analysis. Particulate loading on the filter does not reduce performance due to the Met One actual flow control protocol. Ambient temperature and pressure are measured and actual flow is calculated and controlled by the E-SAMPLER microprocessor independent of filter loading change.

E-SAMPLER were located at five sampling locations around UTHM; block G (FKEE building), Tun Dr. Ismail Hostel, material engineering lab, stadium and block D (*refer figure 1*). The locations were selected base on the most area used by the students and the distance from the factory and construction site.

The data that were collected by E-SAMPLER were mass of particulate matters (PM₁₀ and PM_{2.5}) which were convert into unit of concentration microgram per meter cube ($\mu\text{g}/\text{m}^3$), characteristics of particulate matters and data meteorological factor such as temperature, humidity, wind speed and wind direction.

RESULTS AND DISCUSSION

Based on Table 1 the highest concentration of PM₁₀ detected was at stadium sampling location which was $33.08 \mu\text{g}/\text{m}^3$. The lowest value of PM₁₀ was at Tun Dr. Ismail Hostel and Material Engineering Lab which was $12.04 \mu\text{g}/\text{m}^3$. For PM_{2.5} the highest concentration detected was also at stadium sampling location, while the lowest value was at block G (FKEE building). Most of lower values of PM₁₀ and PM_{2.5}, were recorded at sampling location near to the nearest factory. The factory is producing medium density fiberboard (MDF) [5]. During MDF manufacturing there are a lot of wood burning and grinding. Maybe due to inappropriate work process some of the wood particulate released to the air. Due to the light weight of this particulate, it will be settle far from the factory. This is why the highest concentration of PM₁₀ and PM_{2.5} was located at stadium.

As shown in Table 2, all the value obtained for PM₁₀, was complying with the Recommended Malaysian Air Quality Standards (RMG). Based on RMG, the limit of PM₁₀ concentration is $150 \mu\text{g}/\text{m}^3$ for averaging time 24 hours. The highest PM₁₀ concentration detected by E-Sampler was at the Stadium $33.08 \mu\text{g}/\text{m}^3$, which was recorded for the second sampling day. Due to unavailable Malaysian standard for PM_{2.5}, the concentration of PM_{2.5} was compared with Recommended United State of Environmental Protection Agency (USEPA) standard for 24

hours sampling. The allowable standard for the concentration of PM_{2.5} is 65 µg/m³. All the values obtained for PM_{2.5} were within the permitted limit.

The value of particulate concentration were fluctuate from one location to others location due to the factors of wind speed and wind direction, which caused the settlement of the particulate in each sampling location were different.

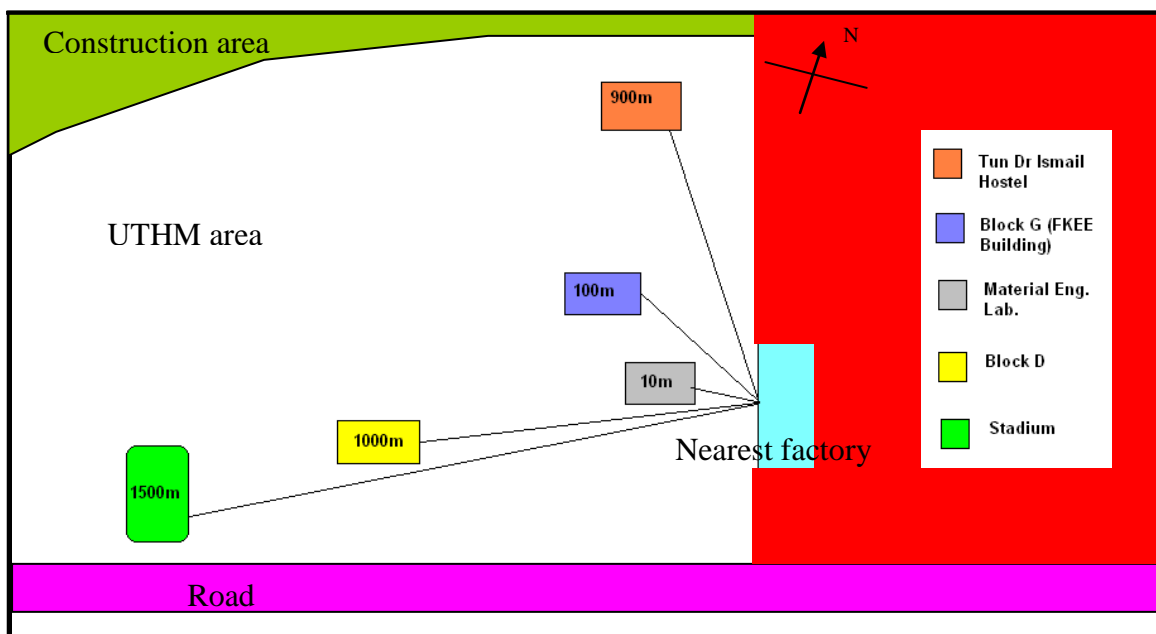


Figure 1: The Distance of Sampling Location from the nearest factory.

Table 1: Concentration of PM₁₀ and PM_{2.5} (µg/m³)

Bil	Sampling day Particulate type Location	Day 1		Day 2		Day 3	
		PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}
1	Blok G (FKEE building)	7.042	0	3.292	0.178	18	0
2	Tun Dr. Ismail Hostel	6.167	0.166	12.04	0.241	1	0.013
3	Material engineering lab	7.25	0	19.042	0.548	2.875	0.102
4	Stadium	1	0	33.08	0.72	11.708	0.253
5	Blok D	8.125	0.13	17.708	0.22	3.548	0.035

Table 2: Average Concentration of PM10 and PM2.5 ($\mu\text{g}/\text{m}^3$)

Bil	Location	wind speed (m/s)	wind direction	humidity (%RH)	temperature ($^{\circ}\text{C}$)	PM10 highest concentration ($\mu\text{g}/\text{m}^3$)	PM2.5 highest concentration ($\mu\text{g}/\text{m}^3$)
1	Blok G (FKEE building)	0.554	SE	83.38	27.4	18	0.178
2	Tun Dr. Ismail Hostel	0.533	SE	82.46	28.3	12.04	0.241
3	Material engineering lab	1.000	SW	69.75	31.2	12.04	0.548
4	Stadium	0.733	SW	71.17	31.5	33.08	0.720
5	Blok D	0.725	SW	72.25	28.2	27.708	0.222

CONCLUSION

As a conclusion, there is detection of PM10 and PM2.5 in area around UTHM. However all the concentration of PM10 and PM2.5 are complying with the RMG and USEPA standard for air quality.

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