Statistical r-Pearson Regression for Air Quality Monitoring

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Statistical r-Pearson Regression for Air Quality Monitoring

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Abstract

Kuala Lumpur Air qualities are depending on wind, temperature, humidity, the sun light, radiation, photons, energy, and rotational of the earth which drives atmospheric circulation (M.R.R., 2022). Particle matters (PM) are found by Air pressure through the movement of the Air as it goes through the process of transport, dispersion and transformation. In this study, PM2.5 | CO2 of Power Plant in micron were selected where the mitigation have been determine for Air Pollution Qualities Index at the 17.76 km distance. The Method Descriptive Analysis with additional Statistical r-Pearson Regression had been used for Cumulative Data Analysis. 4hrs Integral Data had shown AQI in a Good Quality Index while Integrated Cumulative Air Pollution Index mixed for the long run of PM2.5 and CO2 emphasis the particles at 1073.5 ppm which is at Unsatisfactory Level of particles emissions.

Keywords: Particles Matters | PM2.5 | CO2 | Air Quality Sampling | Descriptive Analysis.

1. Introduction

2022's, Kuala Lumpur territory was known due to Domestic and International Business Activities together with City Board of Council. The site district was located at the East of city province where has had estimated about 243.65 km^2 governed by UMNO Selangor and Kuala Lumpur. The MRR2 ring route has been the first access road around the Kuala Lumpur City area needs Major upgrading civil works. The temperature of the area ranges from 28°C to 37°C. The Kuala Lumpur is at the altitude of 94m above sea level. (M.R.R., 2022)

1.1 Earth Science

Kuala Lumpur City location had a planned irrigation through its Smart Tunnel System channeling water from inner linked of Central Kuala Lumpur City into South outer linked integrated with expressway managed by MMC Corporation Sdn. Bhd. Sg.Gombak and Sg.Besi flows into Kuala which known as Kuala Lumpur thru Concrete River Blocks. Feasibility study of the environmental; Infrastructures, Water Qualities and Air Qualities Indexes at this area are necessary to enhanced Abatement and Policy Development for Environmental Quality. The Restriction of Land Trespassed protected under National Environmental Law Land Protection Policy as published by Pemuda UMNO Pandan Member as City Representative. (M.R.R., 2022)

1.2 Air Quality and Particles Matter

Particle Matters or PM is a mixture of solid particles in the atmosphere. Typically, Particle matters in this study come from two compartments namely PM2.5 and CO2 in a microscopic scale and part per millions. Dust, dirt, soot or smokes are among those examples of particles (USEPA, 2021).

1.3 Air Pollution Index

The Air Qualities Index is a generalized way to describe the air quality, which is used in Malaysia. It is a continuing effort from Malaysian Air Quality Index which was developed after a study done by UPM in 1993. It is calculated from several sets of air pollution data before indexing (Wikipedia, 2022). The Malaysian AQI system closely follows the Pollutant Standard Index developed by the United States Environmental Protection Agency (USEPA, 2021).

2. Research Objectives

This study is conducted at Kuala Lumpur City Ring 17.76km from Coal Power Plant on 15 September 2022.

3. Methodology

3.1 Method Development of the Data Screening & Selection thru application of Digital Particles Mitigation Measure Device.

The Digital Particles Counter Device (Figure Not Inclusive) is a new device which suitable for Air Sampling Quality and Particles Matter. The distance is selected at 17.76km at KL City from Site Study which is within 50km compulsory EIA coverage requirement area with the tolerance of other factors. This Digital Particles Counter Device having features to mitigate PM 2.5 | TVOC | CO2 | HCHO | Temp. | H |. The prescribed steps for the device are as follows;

1. User need confirmation of the air quality detector in a good condition once received the Create of Detector Set and Instructions.

2. Make sure the Screen protected by Protective Film.

3. Auto detection and calibration once running button pressed thru 3sec Power On for the current Air Quality Parameters.

4. The Test data being display at the TFT color Screen; PM2.5 | TVOC | CO2 | HCHO | Temp. | H |

5. New Features of the Device; Sampling Timer | Rechargeable Battery Lithium Ion | Interface | Flashing | Electric Quantity Indicator |

6. The Product Descriptive as per descriptive Data and Parameters.

Parameters	Data
PM2.5 Measuring Range	0-9999ug/m3
PM2.5 Resolution Ratio	1ug/m3
TVOC Measuring Range	0-3mg/m3
TVOC Resolution Ratio	0.001mg/m3
CO2 Measuring Range	400-5000PPM
HCHO Measuring Range	0-3mg/m3
HCHO Resolution Ratio	0.001mg/m3
GAS Measuring Range	0-3mg/m3
TEMP Measuring Range	0-60°C
HUMIDITIES Measuring Range	0-99%RH
CHARGING INTERFACE	Type C
BAT	1200MAH The Lithium Battery
WEIGHT	250g
SIZE	90*70*50mm
PACKAGING	120*110*50mm | Neutral Pack
CERTIFICATION	CE | FCC | EMC | Export Std.

3.2 Method Validation of Relative Percentage Difference RPD for PM2.5.

Particles Matter 2.5 µm Mean XA = 31 + 29 + 31 + 195 + 31 + 22 / 6 = 56.5 µm

X; 31 | 29 | 31 | 195 | 31 | 22 |

$\Sigma|X\text{-}X1|^2 = |56.5\text{-}31|^2 + |56.5\text{-}29|^2 + |56.5\text{-}31|^2 + |56.5\text{-}195|^2 + |56.5\text{-}31|^2 + |56.5\text{-}22|^2$
$= 650.25 + 756.25 + 650.25 + 19182.25 + 650.25 + 1190.25$
$= 23079.5$ µm

$\sigma = \Sigma|XA\text{-}X|^2 / N - 1$
$= 23079.5 / 5$
$= 4615.9$ µm

Relative Percentage Difference RPD
$|X2\text{-}X1| / |X2+X1| / 2 * 100\% = |195\text{-}22| / |195+22| / 2 * 100\% = 173 / 108.5 * 100\% = 159.45\ \%$

RPD > 10% Data is Valid & Peak at 195 µg / m3

3.3 Method Validation of Relative Percentage Difference RPD for CO2.

Gaseous Molecules CO2 ppm Mean XB = 420 + 420 + 420 + 4000 + 420 + 420 / 6 = 1017 ppm

X; 420 | 420 | 420 | 4000 | 420 | 420 |

$\Sigma|XB\text{-}X|^2 = |1017\text{-}420|^2 + |1017\text{-}420|^2 + |1017\text{-}420|^2 + |1017\text{-}4000|^2 + |1017\text{-}420|^2 + |1017\text{-}420|^2$
$= 356409 + 356409 + 356409 + 8898289 + 356409 + 356409$
$= 10680334$ ppm

$\sigma = \Sigma|XB\text{-}X1|^2 / N - 1$
$= 10680334 / 5$
$= 2136066.8$ ppm

Relative Percentage Difference RPD
$|X2\text{-}X1| / |X2+X1| / 2 * 100\% = |4000\text{-}420| / |4000+420| / 2 * 100\% = 3580 / 2210 * 100\% = 161.99\%$

RPD > 10% Data is Valid & Peak at 4000 ppm

Associated to Air Sampling method data; ambient wind and humidity present in the data results section.

3.4 Statistical Advanced r-Pearson Regression Analysis

X	Y
31	420
195	4000
31	420
22	420

$r = \Sigma XY - (\Sigma X \Sigma Y / n) / \Sigma X^2 - \Sigma(X)^2 / n = 21.38$

4. Result and Data Analysis

4.1 Particle Matters PM2.5& Gaseous Molecules CO2

Table 17							Cumulative	
Time	PM2.5	TVOC	CO2	HCHO	T	H	PM2.5	CO2
7:30	31	0.075	420	0.005	31	55%	31	420
11:30	29	0.075	420	0.005	34	50%	60	840
15:30	31	0.066	420	0.004	37	39%	91	1260
19:30	195	0.675	4000	0.003	32	55%	286	5260
23:30	31	0.076	420	0.004	32	57%	317	5680
3:30	22	0.085	420	0.002	28	67%	339	6100

Total Suspended Particulate matters of 2.5 µm are calculated by differentiated between the final and initial weight of PM 2.5 over the volume in cubic meters. Cumulative Data trend Air Data Qualities for PM 2.5 and CO2 shown significance increment.

At 7:30 Mitigation Study Start with Gentle Wind and Equilibrium till 15:30 where Swift Wind Change direction North > South > North and Breeze Wind at 19:30 with Series of Athan for Prayer. At 23:30 till 3:30 the Wind returns at Normal Equilibrium.

4.2 Qualitative Data Graph PM2.5

Date: 15 September 2022

Time: 7:30 till 3:30

Site Distance: 17.76km

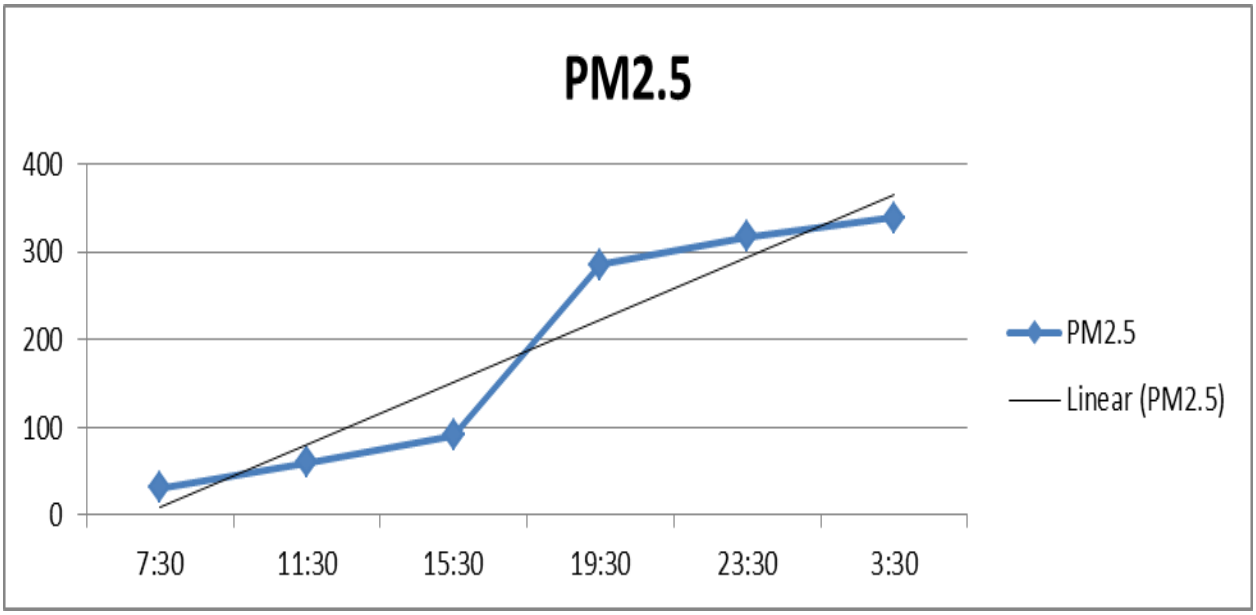

Figure 1; Cumulative Data PM2.5

The initial metamorphose for PM2.5 Cumulative Data of Power Station at 17.76 km distance were mitigating at 31 ug/m3 increased in significance and end at 339 ug/m3 as in Figure 1.

4.3 Qualitative Data Graph CO2

Date: 15 September 2022

Time: 7:30 till 3:30

Site Distance: 17.76km

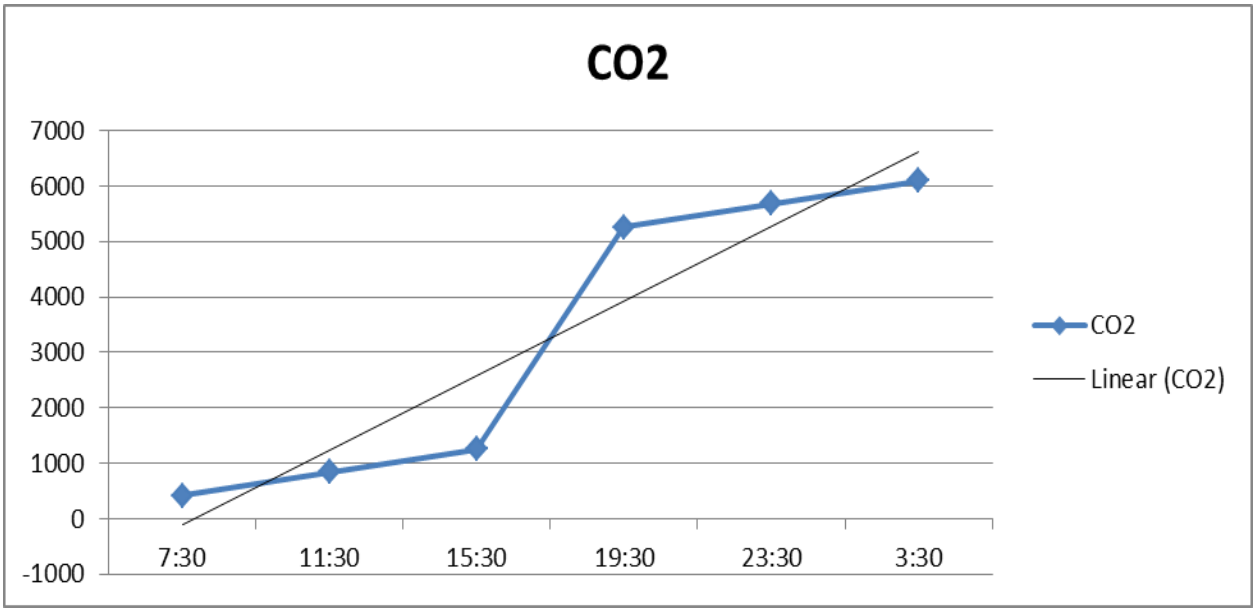

Figure 2; Cumulative Data CO2

The initial metamorphose for CO2 Cumulative Data of Power Station at 17.76 km distance were mitigating at 420 ppm increased in significance and end at 6100 ppm as in Figure 2.

4.4 Descriptive Analysis for Air Sampling

During this study, Air sampling device was running for about 24 hours which resulting into two division of data set which is Data A for PM2.5 and Data B for CO2. Data were verified thru mean, variance, and relative percent difference. Despite the common way of descriptive data analysis for large quantification, we only focus on few integrated data thru automatic analysis.

5. Conclusion

The mean of Data A PM2.5 & Data B CO2 is XA = 56.5 µg/m3 and X2 = 1017 ppm. The variance for Particle Matter of 2.5 µm about 4615.9 µm and CO2 about 2136066.8 ppm. The Relative Percentage Difference RPD for PM2.5 equal 159.45% Valid & Peak at 195µg / m3 while RPD for CO2 equal 161.99% Valid & Peak at 4000 ppm accepted for automation data mitigation measure. The Cumulative Air Quality Data both PM2.5 & CO2 presented tremendous significant increase in uptrends. The Statistical r-Pearson Regression Coefficient Relation Data between two set of Air Quality Particles Parameter data equal 21.38.

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