Air Pollution Index in Selangor for year 2011

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Abstract— **The purpose of this study is to review the trend of air pollution in Selangor for 2011 which specifically involved five of different places monitoring station. A graph for all the type of parameter like SO_2, NO_2, PM_{10}, CO and O_3 will be plotted against time. Based on this research the suitable relationship for all the parameter with the logically causes that contribute toward the trend concentration need to be determined. Based on analysis of the trend, it can be observed that, the most contribute pollutant toward the air quality in Selangor was PM_{10} followed by CO, O_3, NO_2 and SO_2. Based on the result also, the most populated places in Selangor was observed in Klang followed by Petaling Jaya, Shah Alam, Banting and Kuala Selangor. When comparing with the MAAQG, every type of pollutant still not exceed the limit of level except the PM10 at some particular period of time. For the best of recommendation, this type of analysis can be used for the planner in order to develop more study in term air pollution and also investigate the best relationship between of meteorological condition with the air quality which can explore more understanding toward the air quality in Malaysia.**

Keywords- Air Quality, Monitoring Station

I. INTRODUCTION

.Air pollution can be classified as the infection of the atmosphere in the text of the solid waste, gases and liquid which can be effect toward human health, plant, animal, distance of visibility and smelly from the surrounding is produced (Ashok, 2016). To observe, analysis and report the ambient air quality from time to time, the API was introduced as an index system (Lim Yim Siew, 2008). The API calculated for all those five air pollutants like for example like Sulfur dioxide (SO2), Nitrogen dioxide (NO2), carbon monoxide (CO) the particulate matter which is below than 10 micron size (PM10) and Ozone O3. (Lim Yim Siew, 2008)

The technique used in monitoring air quality in Malaysia is Continuous Ambient Air Monitoring System. For the other countries used different of monitoring station like India, Canada and China used National Air Quality Monitoring Programme (NAMP), National Air Pollution Surveillance (NAPS) and China's National Monitoring System (NAMS) respectively. The reason for the monitoring station is to record the concentration of pollutant at specified place. The guidelines for the monitoring used in Malaysia is recommended Malaysia Ambient Air Quality Guideline (MAAQG). The MAAQG is used as the basis to estimate the status of air quality at specified population

At Selangor, there are few cabin that monitoring air pollution quality like Banting, Kuala Selangor, Shah Alam. Klang and Cheras. The data for the air pollution was provided by Department of Environment (DOE). A lot of reasonable reasons will be provided in order to justify the air problems at Selangor. This research project are study the trend of the graph concentration of the parameters VS data on 2011 which based on places that mentioned above and analysis the sources of the air pollution at that areas.

II. METHODOLOGY

A. Air Pollution Index (API)

In Malaysia the air pollution was determined by the API which indicate about the level of air pollution quality in Malaysia. Malaysia's system of the API need to follow the Pollutant Standard Index (PSI) system of the United State (USA) as show table 10 below (Amir, 2007).

B. Method to Monitor Parameter and Instrumentation

Different pollutants have difference the method. The method measurement for O_3, CO, NO_2, SO_2, PM_{10} is AS 2524 - Direct-reading instrumental method, AS 2695 - Direct-reading instrumental method, AS 2447 - Chemiluminescence method, AS 2523 - Direct-reading instrumental method, AS 2724.6 - Gravimetric method respectively

III. RESULTS AND DISCUSSION

A. NO2 Trend

From Figure 1,it show that the concentration for the Petaling Jaya were the highest compare to other three places like Klang, Shah Alam and Banting that monitor NO2. As it can be observe that, the trend was fluctuating throughout the year and the overall high concentration for this trend during the months of January until June 2011. So trend of NO2 for Petaling Jaya might be high due to surrounded by commercial, residential and the monitoring station was installed at Sek Keb Bandar Utama. So the pollution of SO2 can be related to the number of vehicles on the road especially during the peak hour like 7am-9am (A. Rahman, 2015). The concentration decreasing during October until December. This is because most of children having the school break for the primary and secondary school students which cause the congestion on the road during the peak hour can be reduced.

From Figure 1, the high pollution of NO2 at Klang occur between the months of April until June 2011. This was because related toward to the high number of vehicles. So the NO2 most produce when the peak value from 7a.m to 9 a.m as the number of vehicle keep on busy on the road. Other sources that contribute to the NO2 level were domestic fuel, long range transport and open burning. During the November until December 2011, it was the season break for the elementary school and also the high school student. So the number of vehicles on the road will be decreased during morning and evening for those parents who sent their kids to the school.

From Figure 1, the high concentration for Shah Alam was during April until August 2011.So usually, a significant peak of NO_2 concentration during 10 am before it will decrease toward midday. These kind of fluctuation of concentration can be recognized as the movement of motor vehicles which around the Shah Alam's residential area where the most of the resident travel the motor vehicles out of the Shah Alam (Azmi, Latif, & Ismail, 2009). The trend also show low concentration during September until December 2011 at Shah Alam. This was because a lot of primary and high school students having the school break. So

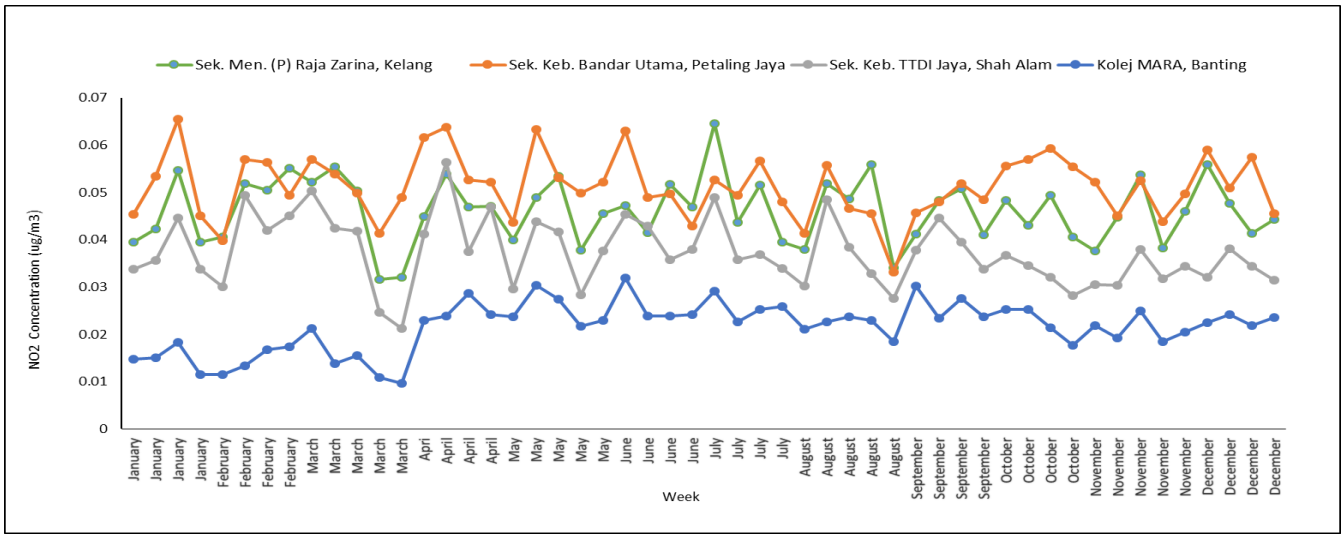

Figure 1: Graph of NO_2 Concentration versus Time

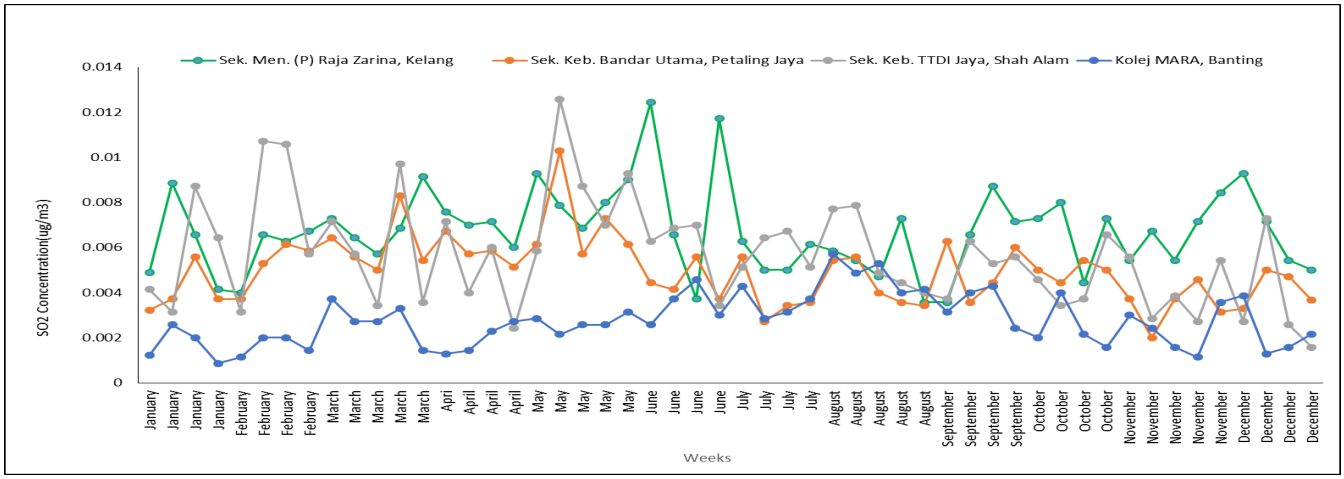

Figure 2: Graph of SO_2 Concentration versus Time

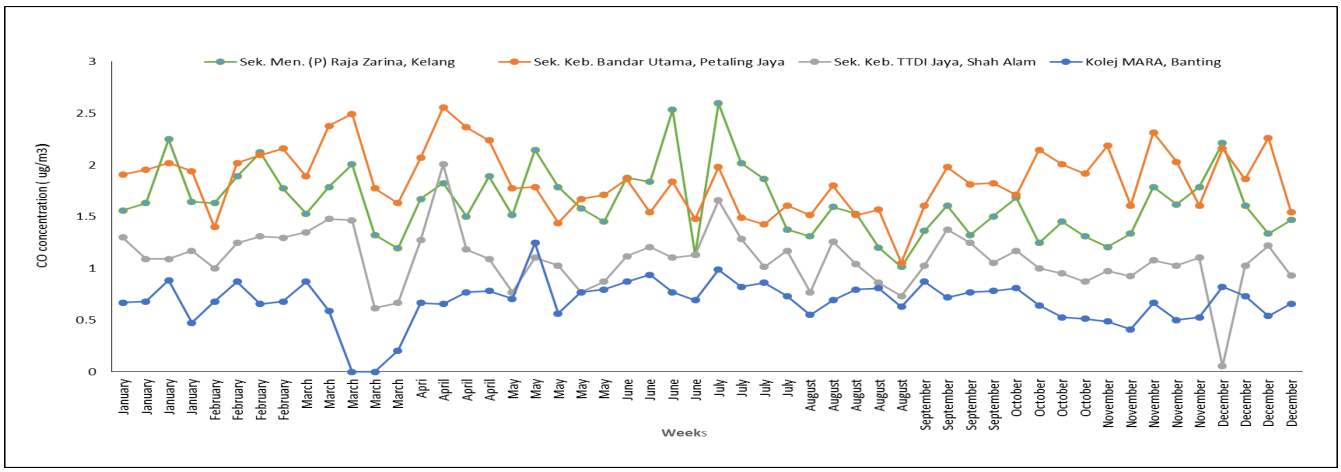

Figure 3: Graph of CO Concentration versus Time

parents will not sent their children to the school and the congestion on the road can be reduced.

From Figure 1 at Banting, It show that the concentration of the NO_2 was the lowest than the other three places. When the radius for 2-3 km around the monitoring station, it was just consisting of school, housing area, green area and no industrial areas. The low NO_2 concentration can be related to the number low number of vehicles and also the road was not congested especially during the peak hour

From Figure 1, for Kuala Selangor, there is no record for the NO_2 pollution. It was because the wind from the coast side of Malaysia and the wind from Indonesian side cause the monitoring cannot detect the air pollution for NO_2

B. SO2 trend

From Figure 2, the trend for the concentration of SO_2 for the Klang show an abrupt change during Januay, February and June 2011 as the highest concentration of SO_2. The high emission of the SO_2 concentration does not only due to of industrialization but also the population of people are very crowded which mean that a lot of people used the car, buses and motorcycle to travel from one location to another location (Ahmad, Ihsan, & Faris, 2012).From Figure 2, the values of SO_2 concentration were decreasing during June until December. It can be related to the school season break for primary and high school students.

From Figure 2, the trend for the SO_2 at Petaling Jaya was below the level of concentration compare to Klang. The high

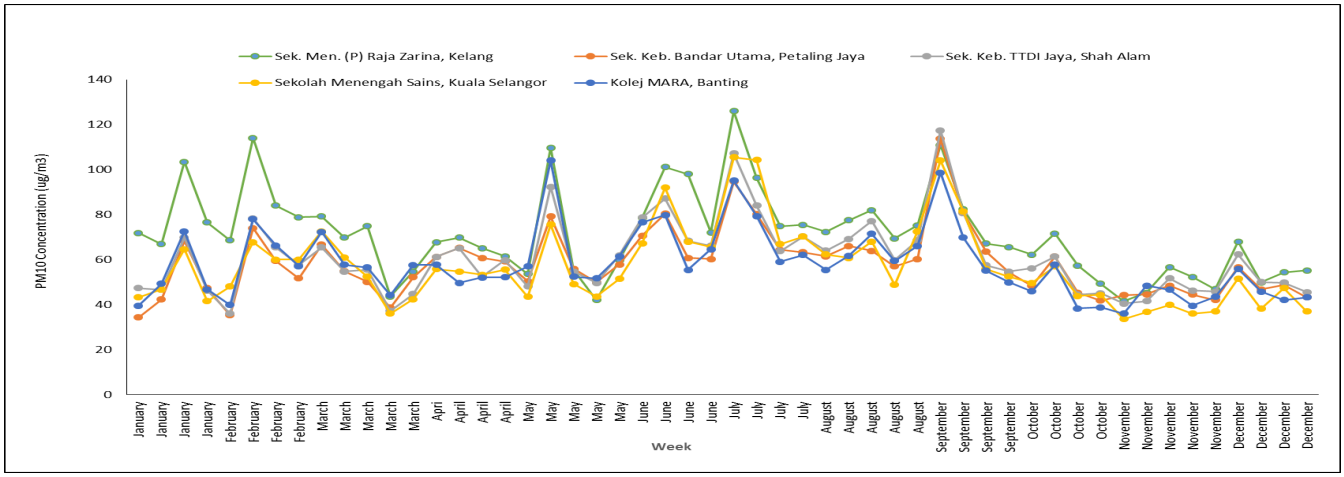

Figure 4: Graph of PM_{10} Concentration versus Time

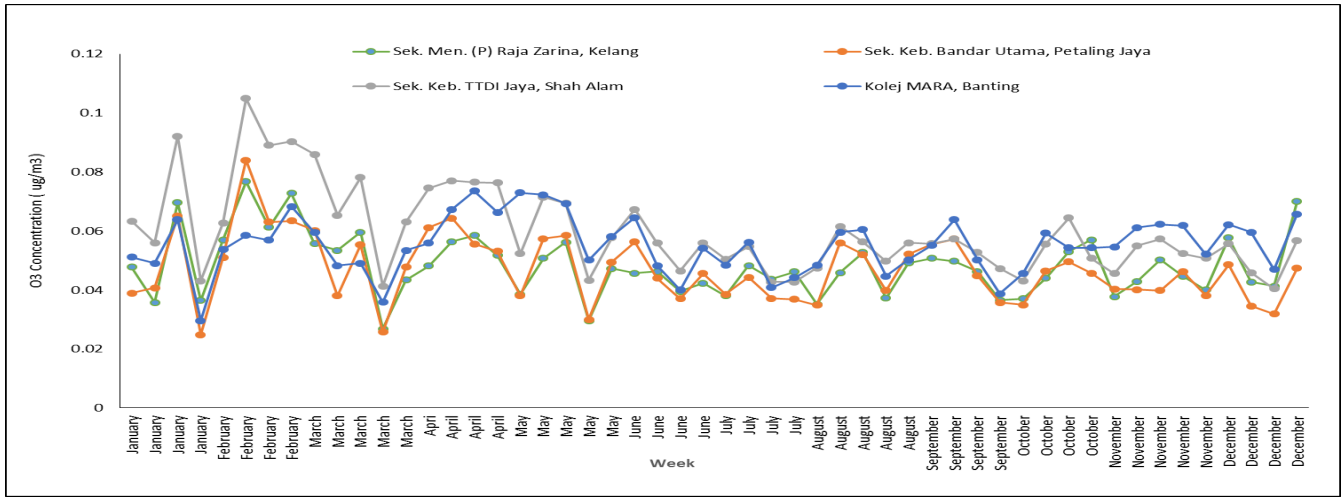

Figure 5: Graph of O_3 Concentration versus Time

concentration of SO_2 at Petaling Jaya can be observed that during January until June 2011. The reason is because of dry season. Dry season is the period when the rainfall at very low particularly in the tropics. The concentration show at low level during November until December 2011. The wet season will be occur which supposedly the air quality should be clean compare to other months.

From Figure 2, it was show that the highest concentration for SO_2 trend at Shah Alam during January until May 2011. It was because has the dense population of people as around the TTDI Jaya School, there were a lot of residential, commercial and near with the industries which making the main road of Shah Alam always busy. The SO_2 for the Shah Alam trend also showing a decreasing value of concentration during November until December 2011. The reason it could be the north east monsoon as the pollutants will be carry to the earth by precipitation of rain (Rahman, S. Ismail, & Raml, 2015).

From Figure 2, for SO_2 concentration at Banting, their level of concentration were the lowest compare to other three places like Shah Alam, Klang and Petaling Jaya. It can be related to the environment factor as surrounding of Kolej Mara Banting has a lot of green place and the population of people do not dense compare to other places.

From Figure 2, there is no record for the SO_2 pollution at Kuala Selangor. This is because the wind from the Indonesia and the wind from west of Malaysia collide each other which cause the monitoring cannot detect the air pollution for SO_2.

C. CO trend

From Figure 3, the high concentration of CO for Klang was during January until May 2011.The poor condition of the road, the increasing number of vehicles and inefficiency of public transport cause contribute a lot of CO emission (Abdullah, Abu Samah, & Jun, 2012). From Figure 3, during on November until December 2011 the concentration of CO were at low level. During school season break, all the primary and high school students will not go to the school which eventually cause the congested on the road can be reduced.

From Figure 3, for the Petaling Jaya, the concentration were high during March to April 2011. The factor can be related for the high concentration was increasing number of vehicles (A. Rahman, 2015).From Figure 3, during November until December 2011 for Petaling Jaya, the concentration fall at the low level. It can be related to the north east monsoon. . The precipitation of rain will carry the pollutant to the earth which eventually reduce the pollutant.

From Figure 3, the concentration of the CO at Shah Alam was high during April and July 2011. It can be related to the number of vehicle and inefficiency of public transport (Abdullah, Abu Samah, & Jun, 2012). From Figure 3, the trend also look very low at the end of the year particularly during November until December 2011. It can be related to north east monsoon (Rahman, Ismail, & Abidin, 2015). This monsoon naturally coming from north pacific and China which bring the heavy rainfall to the region of Selangor (Rahman, S. Ismail, & Raml, 2015).

From Figure 3, the concentration for Banting was the lowest compare to other three places like Klang, Petaling Jaya and Shah Alam. It was because less the number of vehicles because of the area of banting consist a lot of the green areas, less of development commercial and also no industrial park

From Figure 3, there no record for the emission of CO at Kuala Selangor. This is because the wind that carry pollution from west of Malaysia and the wind that carry pollution from Indonesia cause them to collide which the monitoring cannot detect CO pollution

D. PM10 trend

From Figure 4, Klang show an abrupt change concentration during January, February, May, July and September 2011. It was because was the haze due to the forest fires from neighbouring countries especially from Indonesia (Abdullah, Abu Samah, & Jun, 2012). It was also recorded that, high concentration of PM_{10} was during the haze episodes which PM_{10} was transported by south west monsoon wind from Sumatera to west coast of Peninsular Malaysia (Abdullah, Abu Samah, & Jun, 2012). From Figure 4, the trend also show at low concentration during November until December. It was because of north east monsoon (Rahman, Ismail, & Abidin, 2015). The monsoon was originally come from China and south pacific which bring the heavy rainfall to the Selangor region (Rahman, Ismail, & Abidin, 2015).

From Figure 4, the an abrupt change concentration at Shah Alam for PM_{10} during May, July and September 2011.The emission of PM_{10} at Shah Alam was due to the number of vehicles. As the number of vehicle increase, the emission of PM_{10} to the environment also increase. The concentration of PM_{10} at Shah Alam show at low level during November until December 2011 from Figure 4. It was because of north east monsoon (Rahman, Ismail, & Abidin, 2015). The heavy rainfall will fall to the region of Selangor as the monsoon was originally come from China and south pacific (Rahman, Ismail, & Abidin, 2015)

. From Figure 4, the high concentration was during May, July and August 2011 for Petaling Jaya. It was because of number of vehicles. A lot of vehicles on the road particularly during the peak hour. The peak hour usually occurred from 7am- 9am. The low concentration of PM_{10} from Figure 4 show especially during November until December 2011. It was because of school season break. During that time, most of primary and high school students will not have to attend to the school and the congestion on the road can be decrease.

From Figure 4, the concentration of PM_{10} for Banting were high during May, July and September 2011. It was because south west monsoon during the haze episode (Abdullah, Abu Samah, & Jun, 2012). So this monsoon will transport the emission of PM_{10} from the Sumatera to the west coast Peninsular Malaysia (Abdullah, Abu Samah, & Jun, 2012). The low concentration of PM_{10} at Banting was occurred during November and December 2011. It was because north east monsoon (Rahman, Ismail, & Abidin, 2015). The monsoon was originally come from China and south pacific which bring the heavy rainfall to the region of Selangor (Rahman, Ismail, & Abidin, 2015).

From Figure 4, it was show the high concentration of PM_{10} for Kuala Selangor was during July and September. The high concentration obviously come from transportation. Usually the transportation can be related to the congested road during the peak hour from 7am-9am.The low concentration of PM_{10} was occurred during November and December 2011 from Figure 4. This is because due to the school season break. During those periods, the number of the vehicles on the road can be reduce as the student from the primary and secondary school will not have to attend to the school.

E. O3 trend

From Figure 5, the concentration of O_3 at Shah Alam show at a peak during January, February and March 2011. The concentration at Shah Alam was found increasing in the morning especially during the peak hour like 7am-9am.The concentration of O_3 at Shah Alam was decreasing during November until December 2011 from Figure 5. The concentration of O_3 is decreased because of south east monsoon (Rahman, Ismail, & Abidin, 2015). This kind of monsoon was originally come from south pacific and China which will bring the heavy rainfall to the region of Selangor.

At Klang, the high concentration of O_3 was occur during February from Figure 5. The high concentration was because of high number of vehicles on the road. This was usually occurred during the peak hour like 7am- 9am (A. Rahman, 2015). From Figure 5, the concentration of O_3 at Klang is low during December 2011. It was because of south west monsoon (Rahman, Ismail, & Abidin, 2015). This kind of monsoon was originally come from south pacific and china which cause the heavy rainfall to the area of Selangor (Rahman, Ismail, & Abidin, 2015).

From Figure 5, it was show that the concentration of O_3 for Petaling Jaya was high during February and April 2011. It was because of a lot of traffic light and the time taken for the each traffic light to change from the red color to the green color is quite long. From Figure 5, the low concentration of O_3 occurred during December 2011. It was because of school season break. During that time most of primary and high school students will not have to attend to the school and the congestion on the road can be reduced.

Banting is isolated place and from Figure 5, the high concentration of O_3 occur during April and May 2011. It was because of congested in the morning as people tend to send their children to the school particularly peak hour like 7am-9am (A. Rahman, 2015). From Figure 5, the concentration of O_3 seem at low level particularly on December and January 2011. It was because of south west monsoon (Rahman, Ismail, & Abidin, 2015). The precipitation of rain can reduce the pollutant of O_3 (Rahman, Ismail, & Abidin, 2015). So the concentration of O_3 will reduce during particular of time.

From Figure 5, there is no record for the O_3 pollution for Kuala Selangor. This is because the wind that carry with the pollution from west side of Selangor and the wind side from Indonesia that also carry pollution had been collide together which cause the monitoring cannot detect the O_3 pollution

IV. Conclusion

The parameter of pollutants that take place are NO_2, O_3, PM_{10}, CO and SO_2. Based on the trend, it can conclude that the highest and lowest concentration for SO_2 parameter were observed in Shah Alam and Banting respectively. The values for Shah Alam was 0.01 ug/m^3 during May 2011 and the values for Banting was 0.001ug/m^3 during January 2011. For NO_2 parameter, the highest and lowest concentration were observed in Petaling Jaya and Banting respectively. The values for Petaling Jaya was 0.06ng/m^3 during January 2011 and the values for Banting was 0.009ng/m^3 during March 2011. For CO parameter, the highest and lowest concentration were observed in Petaling Jaya and Banting respectively. The values for Petaling Jaya was 2.55ug/m^3 during April 2011 and the values for Banting was 0ug/m^3. Next for PM_{10} parameter, the highest and lowest concentration were observed in Klang and Kuala Selangor respectively. The values for Klang was 126ug/m^3 during July 2011 and for Kuala Selangor was 33.57ug/m^3 during November 2011. For O_3 parameter, the highest and lowest concentration were observed in Shah Alam and Petaling Jaya respectively. The values for Shah Alam 0.10ug/m^3 during February 2011 and values for Petaling Jaya was 0.02ug/m^3 during November 2011.

Based on the result of the trend, it can be observe that, the air pollution that occurred in Selangor was PM_{10} and by CO, O_3, NO_2 and SO_2. It was strongly believe that, the most polluted place in Klang and Petaling Jaya, followed by Shah Alam, Banting and Kuala Selangor. When the data were compared with the MAAQG, it show that the level of pollutant still not exceed over except for a certain month toward PM_{10} pollution. This is strongly believe that, it can relate to the have episode that occur during that period of time. This research paper is the best place for understanding toward the air pollution that occurred in Selangor which reviewing the trend for all the pollutant. Based on analysis of the result, the air pollution show a great different between for all monitoring that install for each specifies places. This type of analysis can be used for the scientist in order to develop more study in term of air pollution and also investigate the relationship between of meteorological condition with the air quality which can explore more understanding of the air quality in Malaysia.

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