AIR QUALITY ASSESSMENT OF YANGON CITY (CASE STUDY ON YANKIN TOWNSHIP)

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ABSTRACT: Nowadays, Air Pollution Problem is becoming one of the most important environmental challenges affecting the harmful effects on human health and the environment. Air pollution generated by vehicles (Transportation) plays as a critical issue all over the world. Yangon, densely populated and rapid urbanization area, is the old capital city of Myanmar. Yankin Township is densely populated and traffic jam area of the Yangon City. The main causes of air pollution include transport, domestic combustion and business industrial activities. The main aim of this study is to measure the levels of air quality assessment of the weekday and weekend conditions in Yankin Township. Primary Particulate Matter (PM) values Air Quality Index (AQI) are measured from the field survey by using HT 9600 particle counters. The ground survey for data collection took two days of weekday and weekend from 27th December 2018 to 30th December 2018 respectively. Total sampling location for this paper is 25 points. Interpolation of spatial analysis and relationship of location and AQI values are higher at the junction points of the road network and surroundings of super markets. This study can be pointed out the air pollution levels in Yankin Township of Yangon City.

1. INTRODUCTION

During the last year, concentrations of urban air pollution have increased globally. According to the World Health Organization (WHO), this increase can be estimated at 8% from 2008 to 2013 and more than 80% of people living in urban areas, where air pollution is monitored, are exposed to levels that exceed the limits given by WHO (Wilks, D.S., 2011). Urban air pollution is a serious environmental problem, and as urban air quality declines, the risk of stroke, heart diseases, lung cancer, and chronic and acute respiratory diseases, including asthma, increases. In addition, it contributes to damaging building materials and cultural objects (Hamilton R.K.V, Johan. T, and Watt. J., 2009). A wide variety of air pollutants are emitted by vehicles with petrol-derivatives engines being the most important of them; nitrogen oxides, carbon monoxide, volatile organic compounds (VOCs), and particulate matter have an important impact on air quality in the urban areas (Batterman, S., Jia, C., and Hatzivasilis, G., 2007, Bosco, M.L., Varrica, D., and Dongarra, G., 2005, Emami, F., Masiol, M., and Hopke, P.K., 2018, Marc, M., Bielawska, M., Simeonov, V., Namiesnik, J., and Zabiegała, B., 2016 and Wu, J., Wilhelm, M., Chung J., and Ritz, B., 2011). Air pollution in big cities and close to the main roadways is dominated by road traffic but the pollution levels are very variable because air pollution is severely influenced by multiple environmental or meteorological factors as well as traffic patterns, size, and orientation of buildings or land use (Abernethy, R.C., Allen, R.W., McKendry, I.G., and Brauer, M., 2013, Farrell, W.J., Deville Cavellin, L., Weichenthal, S., Goldberg, M., and Hatzopoulou, M., 2015 and Rivera, M., Basagaña, X., Aguilera, I. et al., 2012). Harmful effects of air pollution and its causes are widely studied (Adam, M, Schikowski, T, Carsin, A.E. et al., 2014, Franklin, B.A, Brook, R. and Arden Pope, C., 2015 and Maynard, R.L., 2009) and, the urban quality declines are mainly related to the increase in traffic emissions, transport-related

emissions being the main component of air pollution. Consequently, determining population exposures is essential to study and understand the causes of these variations prior to the development of interventions and policy recommendation aiming at reduction exposures. There are different methods of dealing with this extensive amount of data, being one of the most interesting to treat all data by means of the application of multivariate analysis methods. The main objective is aimed at grouping and classification of objects, as well as modelling relationships between the different environmental data. The methods of multidimensional analysis have made it possible to establish some relationship between different parameters (Perez-Arribas, L.V., Le´ on-Gonz´ alez, M.E., and Rosales-´ Conrado, N., 2017). Many multivariate methods can be used in environmental studies because they provide information about association, interpretation, and modelling from large environmental datasets (Tiwari A.K. and Singh, A.K., 2014 and Zhu, G., Guo, Q., Xiao, H., Chen, T. and Yang, J., 2017). Yankin is one of the densely populated and traffic jam area of Yangon City. That is why this study investigated for the assessment of air quality measurement.

1.1 Study Area

Yankin Township area is located between north latitude 16º 49' 30" N and 16º 51' 00" N and east longitude 96º 9' 30" E and 96º 10' 30" E in the north-central part of Yangon. The township has many shopping centers, construction sites, small industrial businesses, morning and evening markets and bazaars. Yankin is very close with the downtown area, including one of the most traffic jam area of Yangon City and ever full of the seasonal and traditional festivals nearly the whole year. The reason why selecting the area was that it is not only one of the main infrastructures for transportation networks but also notorious for big traffic problem in Yangon. (Fig 1.1).

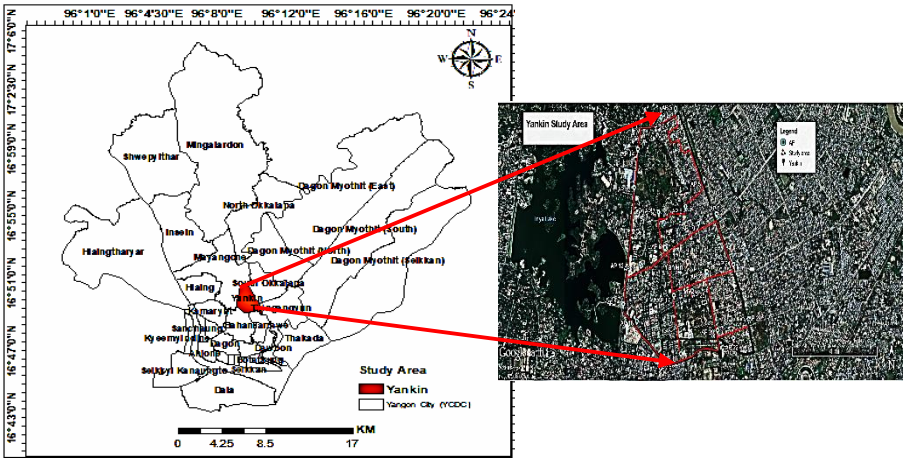

Figure 1.1 Location of Yankin Township

2. INSTUMET, DATA AND METHODOLOGY

HT 9600 Particle Counter (Fig 2.1) was used to measure particulate matter (PM) for 2 days (weekday and weekend) for 25 locations in the study area was used to measure AQI. This handheld dust quick detector is the special detecting instrument used to measure the value of PM 2.5 (repairable particles) and PM 10 (inhalable particle) in the air. It is a high-tech product developed independently and integrating gas dynamics, digital signal processing and optical-mechanical-electrical integration on the basis of absorbing oversea advanced high sensitivity micro laser sensor technology. The device is characterized by high test precision, stable performance, strong multiple functions and easy and convenient operation and can be used widely for determination of indoor and outdoor public environment and atmospheric environment, PM 2.5 air quality detection and PM 10 dust particle amount.

Figure 2.1 HT 9600 Particle Counters

An air quality index (AQI) is a number used by government agencies to communicate to the public how polluted the air currently is or how polluted it is forecast to become. As the AQI increases is likely to experience increasingly severe adverse health effects. Table 2 shows the values of AQI, levels of health condition and colour respectively.

Table 2.1 Air Quality Index

Air Quality Index (AQI) Values	Levels of Health Concern	Colors
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

Source: United States Environmental Protection Agency (EPA)

The United States Environmental Protection Agency (EPA) has developed an Air Quality Index that is used to report air quality. This AQI is divided into six categories indicating increasing levels of health concern. An AQI value over 300 represents hazardous air quality and below 50 the air quality is good.

Ground Survey measured four times per day in weekday and weekend. AQI measurements are 6:00 am - 9:00am, 12:00 pm - 3:00pm, 6:00pm - 9:00pm and 12:00 am - 2:00am with the systematic Sampling Method was used to identify the sampling location. In order to get the required data to produce air quality maps of the study area, the air quality level measuring devices (HT 9600 Particle Counters) were set out at 25 permanent points along the study area. (Fig 2.2).

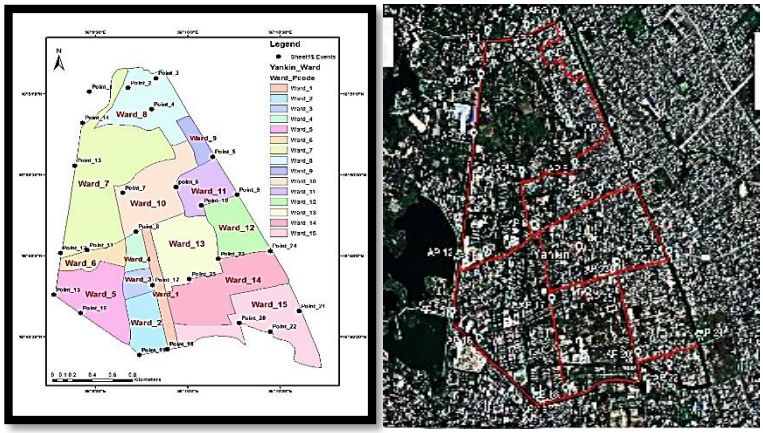

Figure 2.2 Location of sample points

For the spatial AQI assessment, the interpolation of spatial analysis tools in ArcMap 10.4 software is applied for the AQI distribution in Yankin Township.

3. RESULTS AND DISCUSSION

4.1 Air Quality Assessment of Yankin Township

Fig 3.1 show the spatial distribution of PM 2.5 and PM 10 in morning and evening condition of weekday and weekend in Yankin Township. The value of PM 10 is higher than PM 2.5. PM 2.5 of the air quality can be found green, yellow, orange and red levels. Most levels of air quality covers yellow levels (nearly healthy) and red levels (unhealthy for sensitive level). PM 10 levels of Yankin Township shows from yellow to maroon. This conditions are unhealthy level to hazardous situations. Weekend can be found is higher AQI values than weekday condition because of the shopping centers and markets. Most of the urban people go to shopping at the weekend time. At the weekdays, the rush hours (9: 00 am and 6:00 pm) are higher polluted condition of air quality. and Unhealthy condition of air quality can be found very traffic jam and construction sites area of Yankin Township.

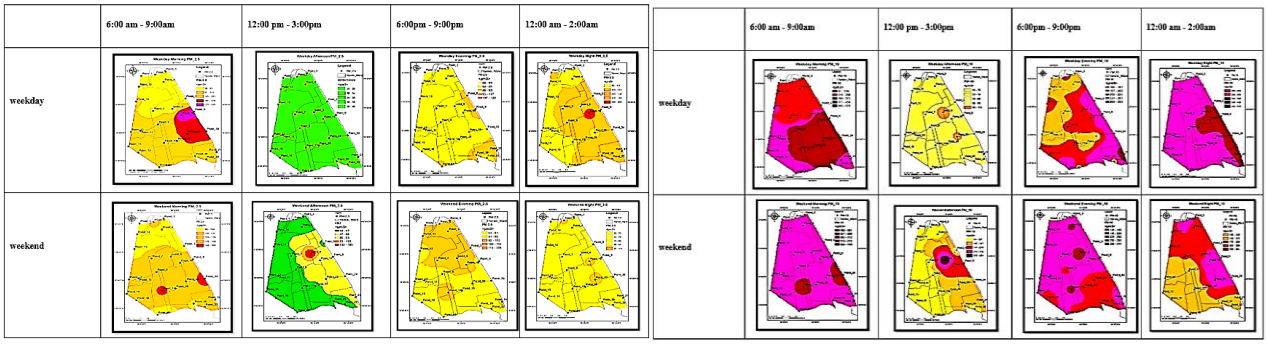

Figure 3.1 Spatial distribution of PM 2.5 and PM 10 in Yankin Township
Source: Based on Field Observation

4.2 Weekday Air Quality Assessment of Yankin Township

Mornings experience the worst air pollution in Yankin Township, according to an analysis of particulate matter 2.5 data on 27th December 2018.The worst air quality was at 7 am, as PM 2.5 concentrations peaked at 226 micrograms per cubic metre of air (µg/m3). The air quality improved as the day wore on, reaching a late evening high at 6pm (130 µg/m3) and midnight high at 12am (207 µg/m3) in afternoon, when PM 2.5 levels fell as low to 26 µg/m3. The best air quality was recorded in the afternoon, at 3 pm, with PM 2.5 levels reaching as low as 24µg/ m3.

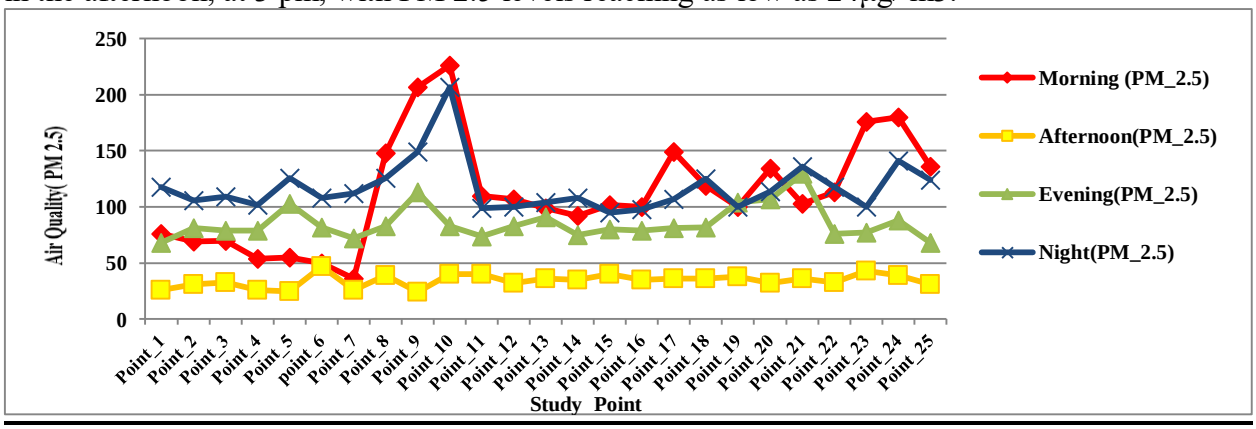

Figure 4.5 Weekday Air Quality Assessment PM 2.5
Source: Field data observation

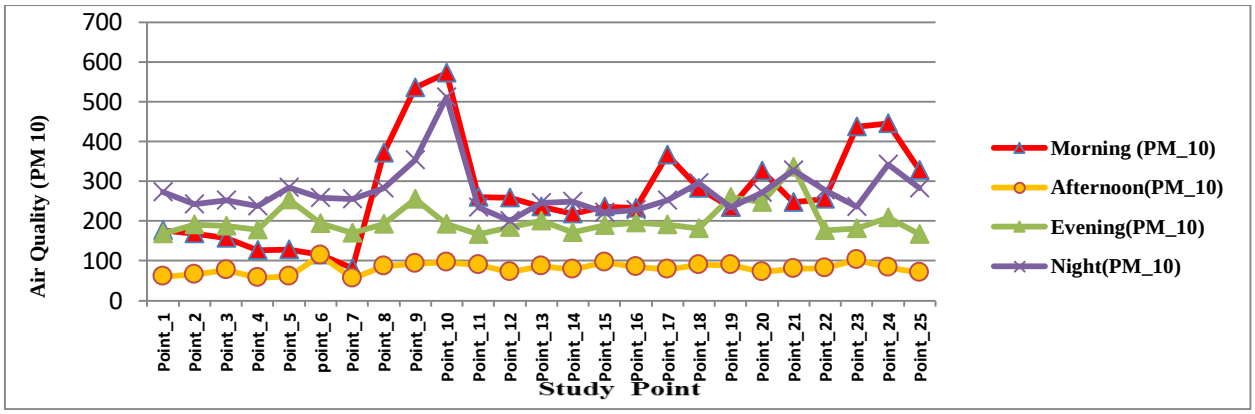

Figure 4.6 Weekday Air Quality Assessment PM 10
Source: Field data observation

4.3 Weekend Air Quality Assessment of Yankin Township

The highest values of PM 10 were at 1:00 am and concentrations peaked at 452 micrograms per cubic meter of air (µg/m3). The study of daytime pattern of PM10 concentration and elemental composition in relation to the influence of atmospheric stability conditions. Depending on fuels, vehicles and many other factors, is very complex and often of local character. The best air quality was registered at 2:00 pm, when PM 10 levels were 54 µg/m3.

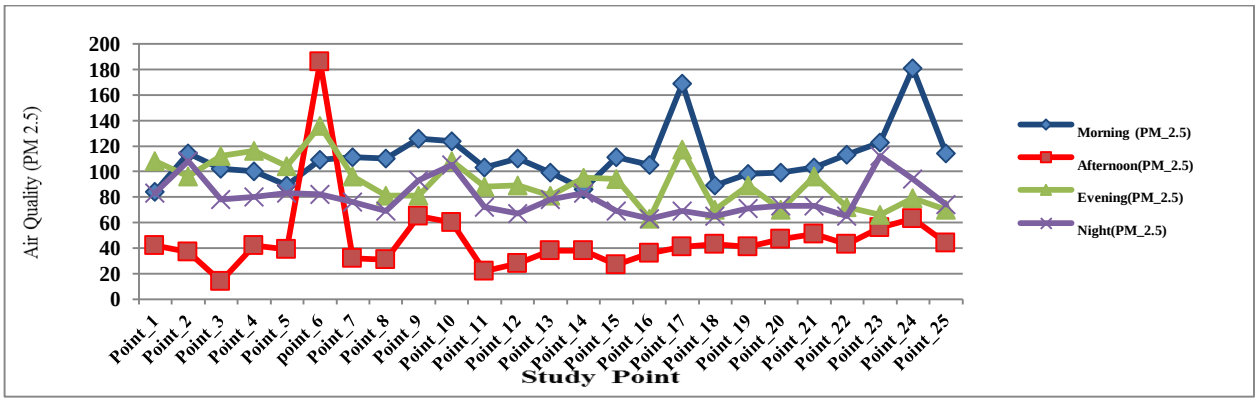

Figure 4.7 Weekend Air Quality Assessment PM 2.5
Source: Field data observation

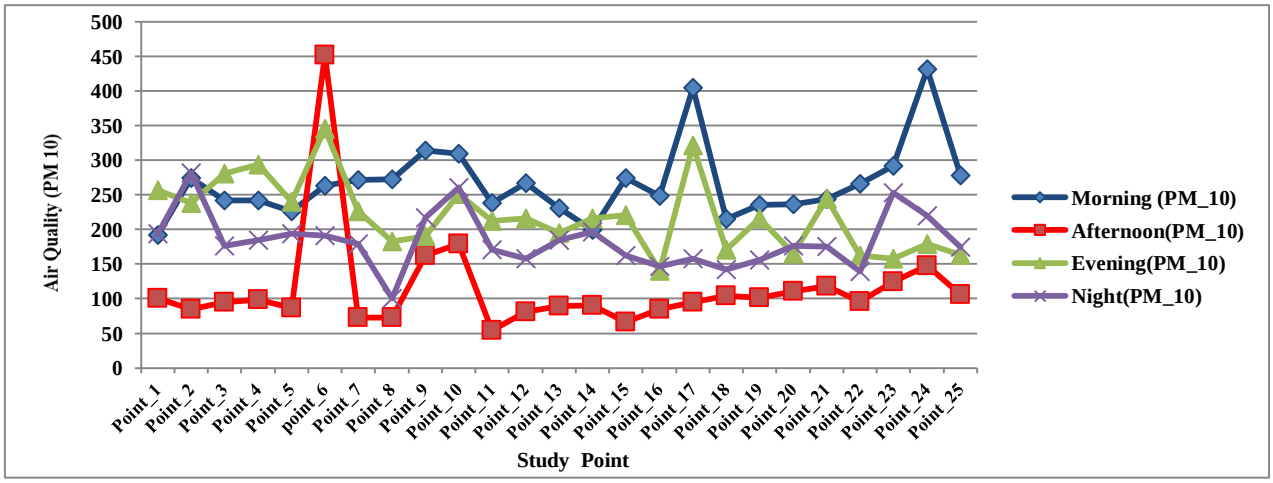

Figure 4.8 Weekend Air Quality Assessment PM 10
Source: Field data observation

CONCLUSION

According to the above weekday air quality assessment, the maximum AQI value of PM2.5 is 226 in the morning at 7am, the values are in the range of 201 to 300. When the AQI value is between these ranges, the air quality condition is very unhealthy and is symbolized by purple color.

The AQI value is within the range of 51-100, the air quality condition is moderate for the level of health concern and is symbolized by the yellow color. This air quality is acceptable, however for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution. This condition is recorded in the afternoon at 3pm.

In the late evening at 6pm, as the result of AQI value is in the range of 101-150, the air quality condition is deemed as unhealthy for Sensitive Groups and is symbolized by orange color. Although general public is not likely to be affected at this AQI range, people with lung disease, older adults and children are at a greater risk from the presence of particles in the air. The air quality remains unhealthy until midnight.

The weekend air quality assessment shows similar results to the weekday air quality assessment. The air quality is in the worst situation in the morning at 7am with value of 536(μg/m3) and in the midnight with the value of 511(μg/m3). These air qualities are regarded as Hazardous with AQI greater than 300. This would trigger health warnings of emergency conditions. The entire population is more likely to be affected. The good air quality is measured in the afternoon at 2:00 pm.

Based on the result, the pattern of air population in Yankin Township is the same both in the weekday and weekend. The AQI value is highest in the morning at rush hours. The air quality is good in the late afternoon around 2 to 3 pm when there is less traffic. And the air quality becomes worsen in the late evening because of the heavy traffic.

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