COMMUNITY CHALLENGES, AWARENESS AND ADAPTATION TOWARD PM_{10} POLLUTION

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ABSTRACT: *Ipoh City development activities focused on urban development with cement and quarry-related industrial activities. Recognizing the problem of dust pollution, this section takes into account the perception and adaptation of the community towards dust problem from Ipoh City area in silver. Overall, it can be explained that out of 400 people who have been selected as respondents to represent the perception of the population against dust pollution in Ipoh area. 313 respondents or 78 per cent are consists of Malay respondents The analysis is limited to descriptive statistics to show the respondents' challenges, awareness and adaptation of PM_{10} pollution. Descriptive statistics by percentage is used in this paper to illustrate the respondents' challenges, awareness and adaptation toward PM_{10} pollution. Majority of the respondents has agreed with this statement and the respondents are aware of the factors that cause PM_{10} pollution. However, higher concentrations of PM10 also affect some of the respondents in terms of the health-related problem and this raise awareness the residents in this study area about their impact on their lives. Obviously, the impact of PM_{10} pollution is causing residential dwellers in several areas in Ipoh to adapt to their lives with this condition. Based on the score for community attitude modification to PM_{10} pollution is at a high level based on the assessment conducted by 400 respondents in their daily lives. Apart from that, the results of the mean score analysis also show that there is no difference between Ipoh city centre and the suburbs residents of Ipoh regarding their daily lifestyle influenced by PM_{10} concentrations.*

Keywords: PM_{10}, Awareness, Adaption, Urban, Development

1. INTRODUCTION

The problem of air pollution is one of the serious phenomena faced in all areas, especially in developed and developing countries. Air quality problem mainly caused by the development process of a country especially in the process of urbanization and the development of industrial activities. Although the development of this industry improving the socio-economic status of the population, it is indirectly contributing to the problem of air pollution [1-2]. This is because the intensification of the industrial sector will lead to environmental problems especially in relation to the declining of air quality as well as affecting the preservation of other natural resources. In addition, this situation will affect the climate elements in a region where the operation of this industry being implemented without emphasizing environmental sustainability.

Air pollution defined as the presence of one or more pollutants in the atmosphere with certain quantities and duration that may cause injury and damage to humans, plants, animals, property and at the same time may interfere with comfort [3]. This is because the continuously deteriorating air quality can affect the health of residents in the neighbourhood due to exposure to air pollutants. Typically, there are five observed pollutants, which is PM_{10}, carbon monoxide (CO), nitrogen monoxide (NO), sodium dioxide (SO_2), and ozone (O_3). According to the report, the PM_{10} concentration is more concentrated than other pollutants (JASM 2013). Afroz et al. [4-5] and Awang et al. [6-7] found that PM_{10} is among the major pollutants affecting air quality in Malaysia.

The World Health Organization (WHO) estimates that one over four of the world's population exposed to an unhealthy environment due to the intensity of air pollutants such as carbon dioxide, sulphur dioxide, suspended solids and various other pollutants [8]. Based on the data collected by the U.S. Environmental Protection Agency, activities such as forest fires and construction are the major contributors to increased PM_{10} concentration in the air [9]. Data in Malaysia showed that the main source of PM_{10} is from the non-controlling development activities and the increase in the number of vehicles [10-11]. PM10 or suspended particulate matter less than 10 microns is also known as airborne particulate matter according to World Health Organization (WHO) [12].

According to Expert Panel on Air Quality Standards of United Kingdom, permissible level of PM10 emission is at concentrations of 50 ug/m-3, measured as a rolling 24-hour average [13]. In Malaysia, the standard for air quality employed by the Department of Environment is at concentrations of 150 ugs/m-3 measured as 24-hour average and an annual means of 50 ug/m-3.

2. CHALLENGES OF PM_{10} POLLUTION

The problem of air pollution is not a foreign phenomenon occurring in Malaysia. The rapid development process will become a catalyst in opening more industrial and manufacturing areas. Development activities that being carried out include the construction of industries, residential units, businesses and transportation facilities such as the increase and widening of the lane to meet the demands and needs of the population. The situation will worsen if the air pollution affects human health.

Ipoh City development activities focused on urban development with cement and quarry-related industrial activities. This activity led to the release of fine dust and smoke that polluted the air in the area. The situation worsen when cement factories and pottery industries developed in several areas in Ipoh City. This situation can lead to the haze phenomenon that can reduce the visibility of the population

around the area near the source of pollutants. This is because pollutants such as dust, ash and smoke that emitted will suspend in the atmosphere and will increase PM_{10} concentrations around the city with wind gusts. As a result, the quality of air around the area including residential areas will be affected by the PM_{10} concentration. This will give health risks due to very fine particles, especially particles less than 10 micrometres that able to reach the lung portion during respiration. This will create symptoms such as coughing, breathing difficulties and phlegm when they are exposed to the environment. Therefore, the problem of air pollution needs to be taken care because it can bring impact on the health of the population.

The suspended particles are the most dominant air pollutants of human health that affected visibility and respiratory systems. According to Department of Environmental Malaysia [14], the main source of PM_{10} is from uncontrolled development activities, industrial and vehicle. The quality of the housing environment should be observed whether it transcends the boundaries of an individual housing development area. Observation should be given to external environment in the private development as well as to its internal environment so that the development will relate to the surrounding environment [15], Whereas, an industrial development located inappropriate location and area will give importance to the industry as well as the surrounding development. If industrial development such as heavy industry located in an inappropriate location, it will risk other development such as pollution. This risk will reduce the quality of the environment in the area due to the release of pollutants from vehicles and industrial activities that will contribute to PM_{10} [16].

The industrial area near the residential area indirectly affects the deterioration of air quality in the residential area. The industrial activity also influenced by the increase in the use of vehicles that contributed to PM_{10} suspended particles. The content of PM_{10} can affect human health as it is a very delicate particle that can enter the lungs through human inhalation process [9]. PM_{10} has the potential to cause health impact in terms of respiratory diseases, especially among children and the elderly [17-18].

Air pollution in Malaysia can be divided into two sources, which is mobile sources and fixed sources. Mobile sources refer to vehicles while fixed sources are industrial buildings and domestic activities such as open pollution. This condition will cause the release of dust particles and smoke into the atmosphere. Smoke is gas borne particles and typically less than 0.5 microns while dust is composed of solid particles exceeding 10 microns. These fine particles also categorized as suspended particles.

Malaysia is also one of the countries that also receive direct impacts of air pollution from forest fires in neighbouring countries. This is related to the occurrence of haze in Southeast Asia in 1983, 1984, 1991, 1994, 1997, 1998 and 2005 [19]. This situation has affected the economic and health of the population in the affected country. This situation includes the severe haze took place in August 2005 where the west coast of Peninsular Malaysia was declared an emergency in two areas, which is Kuala Selangor and Port Klang [20-21].

Previous studies that conducted by researchers show that air pollution is caused by the human activity itself, especially from industrial areas. This statement is consistent with the study conducted by Mahmud and Hanifiah [20] to see the extent of the haze phenomenon that occurred in August 2005 that influencing air quality in Perai, Penang. The results of the study have shown that the haze phenomenon that occurred at that time did not have a severe impact on the area of Perai. The rapid growth of industrial activity is the main source of the release of harmful gases and pollutants such as carbon monoxide (CO), nitrogen dioxide (NO_2), fine dust (PM_{10}), sulphur dioxide (SO_2) and ozone (O_3) in the atmosphere. The levels of pollutant concentrations in the air are further increased by other factors such as domestic burning activity and vehicle. As a result, the pollutants have affected the air quality in the area.

The severe haze that struck Peninsular Malaysia in August 2005 also attracted [22] to analyze the haze hazard to humans and the environment in Malaysia. The results of this study have shown that the concentration of PM_{10} pollutants by area changes in line with the change in the number of hotspots in Sumatra [23]. However, the wind factor especially the influence of the Southwest monsoon is moving the pollutants to the east coast of the peninsula of Malaysia but with the presence of the Titiwangsa range acts as a barrier to dust and pollution into the area. Additionally, researchers did not reject local factors such as open burning and motorized activities which contribute to the significant increase in PM_{10} pollutant concentrations as well as the underlying cause of the dry condition during the month, especially in the Klang Valley.

Exposure to air pollution will not only affect the health of children, but it also will affect the adults. For example, the occurrence of forest fires in Kalimantan and Sumatra, Indonesia in late July to early October 1997 has caused most Southeast Asian countries to experience haze phenomena [7, 24]. This incident has increased PM_{10} concentration levels to a dangerous level. Because of this incident, respiratory diseases such as cardiorespiratory have increased dramatically during that time. Additionally, according to a report released by Singapore also showed an increase in the number of asthma and rhinitis patients which shown 19% and 26% when PM_{10} concentrations increased from 50 µg/m3 to 150 µg/m3.

The suspended particles are the most dominant air pollutants of human health that affected visibility and respiratory systems. According to Malaysia Department of Environment (1995), the main source of PM_{10} is from uncontrolled development activities, industrial and vehicle. The quality of the housing environment should be observed whether it transcends the boundaries of an individual housing development area. Observation should be given to external environment in the private development as well as to its internal environment so that the development will be related to the surrounding environment. Whereas, an industrial development located inappropriate location and area will give importance to the industry as well as the surrounding development. If industrial development such as heavy industry located in an inappropriate location, it will risk other

development such as pollution. This risk will reduce the quality of the environment in the area due to the release of pollutants from vehicles and industrial activities that will contribute to PM_{10} [25]. Studies have shown that the increase in the suspended particulate matter in the environment can adversely affect human health [26] and physical health of the ecosystem [19, 27-29]. This puts at risk resident and a non-resident population of 3226 cities in the world [30].

3. METODOLOGY

This study uses primary data from field work of a questionnaire survey on residents of Ipoh, Perak in April 2017. The study involved 400 selected respondents through stratified random sampling, according to the Ipoh planning development block. The number of respondents was sufficient based on the number of population of the study (633,160). The analysis is limited to descriptive statistics to show the respondents' challenges, awareness and adaptation of PM_{10} pollution. Descriptive statistics by percentage is used in this paper to illustrate the respondents' challenges, awareness and adaptation toward PM_{10} pollution. Overall, it can be explained that out of 400 people who have been selected as respondents to represent the perception of the population against dust pollution in Ipoh area. 313 respondents or 78 per cent consisted of Malay respondents. The number of Malay respondents is higher compared to Chinese and Indian respondents. The number of each study location has been set to see the average and the difference in community perceptions on pm_{10} pollution for their residential location

4. RESULTS AND DISCUSSION

Four hundred respondents who have been interviewed involving four residential areas representing urban, suburban and suburbs areas represented the awareness of residents in several residential areas in Ipoh on PM_{10} pollution. The respondents selected to give the perception to the resident's awareness of dust pollution are strong. This shows that residents in Ipoh are actually aware of PM_{10} pollution problems in their residential areas.

With the public's awareness of PM_{10} pollution, the questions of causal factors that contributed to dust emissions have been proposed to them. Among the factors that cause PM10 pollution in Ipoh is the result of cement and quarry industry near their residence. Majority of the respondents has agreed with this statement and the respondents are aware of the factors that cause PM10 pollution.

In the face of PM_{10} pollution in the residential areas, several effects have affected their lives and the quality of their lives. The results showed that respondents faced some of the effects of a PM_{10} increase in their residential areas. It has affected some respondents in this study. However, based on the total score of the mean score conducted by questionnaire in identifying the PM_{10} pollution effect, the average of all 400 respondents placed PM_{10} pollution only at the uncertain mean score. This shows that the situation in their residential areas does not have a very significant effect if based on the answers obtained from this study.

However, higher concentrations of PM_{10} also affect some of the respondents in terms of the health-related problem and this raise awareness the residents in this study area about their impact on their lives. This is because respondents agree that the health of the respondents and their family members is disturbed by the presence of high PM_{10} in their home area. PM_{10} pollution in urban centres, as well as suburbs, has no significant impact on their lives based on the calculated mean score. However, this situation still affects some respondents in terms of respiratory health problems.

Respondents have made changes in their daily life in facing PM_{10} pollution in their residential areas. Consequently, the results of this study are to see how far the life and daily activities change over time from the PM_{10} pollution. Obviously, the impact of PM_{10} pollution is causing residential dwellers in several areas in Ipoh to adapt to their lives with this condition. Based on the score for community attitude modification to PM_{10} pollution is at a high level based on the assessment conducted by 400 respondents in their daily lives. Apart from that, the results of the mean score analysis also show that there is no difference between Ipoh city centre and the suburbs residents of Ipoh regarding their daily lifestyle influenced by PM_{10} concentrations. Therefore, based on this analysis conducted, the suburban and urban centre residents have adjusted and made some changes in their daily activities in the face of PM_{10} pollution at their homes.

The support and cooperation of urban residents in sustainable planning and development in Ipoh are crucial in establishing cooperation between residents and local authorities and responsibilities for the development of Ipoh city as well as not leaving the quality of life of the population that caused by the construction of cement and quarry based factories in Ipoh. The perceptions of respondents who are staying in Ipoh is important in contributing feedback on planning, development and implementation of sustainable planning and development that will be undertaken by the responsible parties. Based on the mean score analysis of the resident's suggestion on the planning to create a good air quality condition shows the value. This shows that the average respondents in this study agree with the steps proposed to address the problem of dust contaminating their residential area. Therefore, the results of this study clearly show that effective measures need to be taken to address this problem, as people have to face risks to their health and interrupt their quality of life.

5. CONCLUSION

As a conclusion, PM_{10} concentration levels are quite high in some areas in Ipoh due to the limestone-based industrial factors in the production of cement and quarry activities undertaken in exploiting the natural resources found in the Titiwangsa ranges. However, the level of PM_{10} concentration in all study stations is still under the guideline of Air Quality Standard of the DOE set by Malaysia. This is because each study station shows the daily mean of PM_{10} concentrations below 150 $\mu g/m^3$ and shows that the level of quarry and cement industrial production in Ipoh still meets the permissible standards. However, according to the United

Kingdom's air quality, PM_{10} concentrations at each study station are at a level that does not meet the standards in the United Kingdom because it exceeds 50 µg/m^3 daily average daily.

The rapid urbanization process involves various development activities requiring the discretion of all parties to ensure that the development takes into account the preservation of the urban physical environment and the quality of urban life. Quality of our life is something that is relatively difficult to measure and differs between individuals. However, the level of wellbeing and comfort of a person in the life process involves the environment, nutrition, education, health, housing, and aesthetic to measure the quality of life of every human being. The improvement in the aspect shows the improvement in the quality of life of the community or otherwise [13].

6. REFERENCE

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