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Air Quality Analysis (PM 2.5) in Smoke-free home in Yogyakarta City

Muchsin Maulana
Public Health Faculty
Ahmad Dahlan University
Yogyakarta, Indonesia
muchsin.maulana@ikm.uad.ac.id

Septian Emma Dwi Jatmika
Public Health Faculty
Ahmad Dahlan University
Yogyakarta, Indonesia
septianemma@ikm.uad.ac.id

Kuntoro
Public Health Faculty
Airlangga University
Surabaya, Indonesia
kuntoro@yahoo.com

Santi Martini
Public Health Faculty
Airlangga University
Surabaya, Indonesia
santi-m@fkm.unair.ac.id

Sri Widiarti
Public Health Faculty
Airlangga University
Surabaya, Indonesia
widatisantosos@gmail.com

Yuliantiven
Health Center Lolong Guba
Health Departement of Buru Distric
Maluku, Indonesia

***Abstract*— Good air quality is the air that free from pollutant-induced irritation. Particulate matter is a complex of solid and tin particle that found on the air. PM 2.5 is the particle that has 2.5 micrometers of diameter size or called a fines air particle. The one of air pollutant on some house is smoking activity. Based on a study before, there was a result that said the average concentration of PM 2.5 was on 32 µg/m3. The result was over than the standard from WHO (25 µg/m3). Methods: This study was a descriptive study with a qualitative approach. The sampling technique that used in this study was snowball sampling. Results: there were two respondents (two houses) that has worse air quality because the level of PM 2.5 was over than the standard (25 µg/m3) on the house of E, PM 2.5 level raised on 35.66 µg/m3. And on the home of F, PM 2.5 level built on 32.66 µg/m3. The factor of the situation was the obedient of the respondent with RBAR program declaration, many vehicles around the house, and the house range was very tight. The results of PM 2.5 air quality measurements in homes in the neighborhood of smoke-free dwellings in the city of Yogyakarta were 62% or 6 respondents who had good air quality. While 38% or 2 respondents have poor air quality, because the average PM 2.5 level exceeds the threshold determined by WHO, which is 25 µg / m3.**

Keywords—air quality, PM 2.5, RW RBAR program

I. INTRODUCTION

Good indoor air quality is the air that is free of pollutants, which causes irritation, discomfort, or disruption of occupants' health. Room temperature and humidity also affect the comfort and health of residents. The air quality in the room is actually determined intentionally or accidentally by the occupants of the room itself (1).

One source of indoor air pollution is smoking, that there is an increase in deaths in Indonesia caused by non-communicable diseases. The proportion of deaths from non-communicable diseases in 2007 was 59%, an increase in prevalence from 2001 was 49.9%. The highest causes of death are a stroke, hypertension, diabetes, cancer, and chronic obstructive lung disease. This increase is in line with increasing consumption of smoking (2).

The impact of exposure to dust particles or Particulate Matter (PM 2.5) on health, both in solid and liquid forms depends on their size. The particle size that is harmful to the health of the respiratory tract generally ranges from 0.1 microns to 10 microns. Inhaled PM2,5 can affect human health. These particles enter the alveoli and can cause an inflammatory reaction that can cause respiratory complaints. PM2.5 is very dangerous for human health because these particles can penetrate the deepest parts of the lungs, cardiovascular disease (3).

Particulate matter (PM2.5) measurements in Non-Smoking Areas (KTR) in Semarang City showed average PM2.5 levels in places allowed to smoke three times greater than homes that were not allowed to smoke. This value is far above the WHO targeted value (25µg / m3) and the air quality threshold value in Minister of Health Regulation No. 1077 of 2011 (35µg / m3) (4).

II. METHOD

A. Method

This research was carried out in the neighborhood of RW in eight houses, which became the forerunner to the application of smoke-free dwellings in the city of Yogyakarta, with household head respondents. Data collection uses observation and measurement of air quality with the Aerosol PM 2.5 Side Pack, with the details of one measure 15 minutes on the home page, 30 minutes in the house, and 15 minutes on the home page.

B. Result and Disscussion

1) Result

This research detects air quality in a smoke-free home environment in the city of Yogyakarta. Movement of smoke-free homes, as a form of protection for passive smokers from exposure to cigarette smoke. In addition, it also moves community members to change the norms of household smoking. Passive smokers most affected by cigarette smoke are families at home, such as the wife and children of smokers themselves (5).

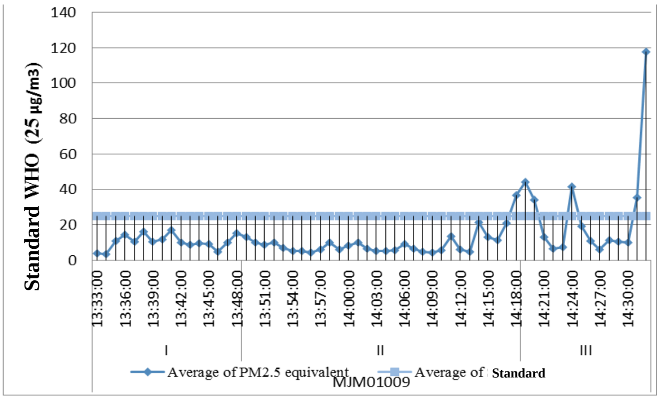

Fig. 1. Fluctuation PM 2,5 respondent A.

The results of measurement of PM 2.5 levels in respondent A, from the first minute to the 44th minute or from the point I to point II the value that still meets the standard quality threshold. Whereas there was an increase in the 45th minute at the third point of measurement. This condition has exceeded the standard quality threshold. Increased graph fluctuations at point III due to residents of the house and surrounding neighbors have returned from work, so that it is associated with improving the quality of the surrounding air.

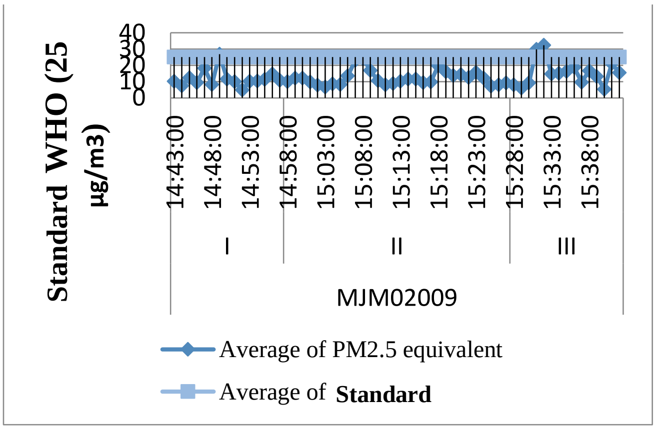

Fig. 2. Fluctuation PM 2,5 respondent B.

The results of PM 2.5 air quality measurements in respondent B from the initial minutes of analysis are still said to be good because they are still below the quality standard threshold. Began to experience an increase in the third point of the 4th minute to the 5th minute, then decreased again until it was below the standard quality threshold set by WHO which is 25 μg / m3.

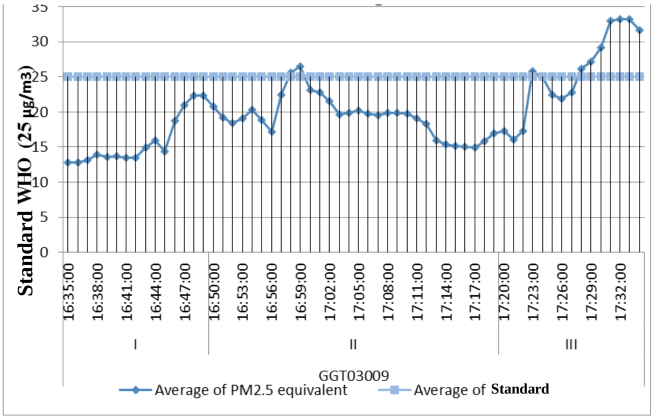

Fig. 3. Fluctuation PM 2,5 respondent C.

The air quality PM 2.5 in the respondent C data has air quality below the quality standard threshold value. There was an increase in the 10th minute at the second measurement point and the 4th minute at the 3rd measurement point. This value is above the WHO air quality range standard, which is 25 μg / m3.

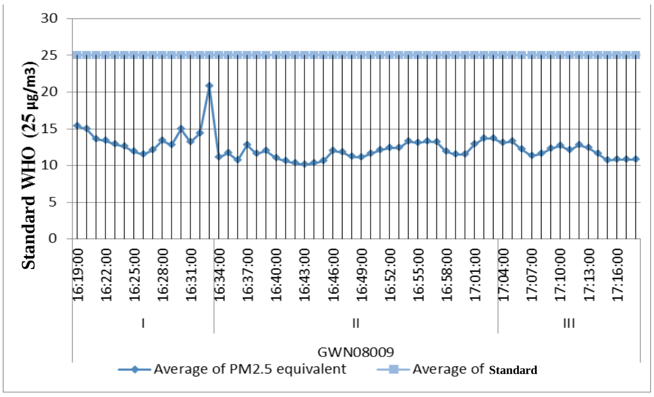

Fig. 4. Fluctuation PM 2,5 respondent D.

PM 2.5 air quality in the measurement of respondent D has good air quality because the results of these measurements are still below the standard quality standard threshold values that have been determined by WHO that is equal to 25 μg / m3.

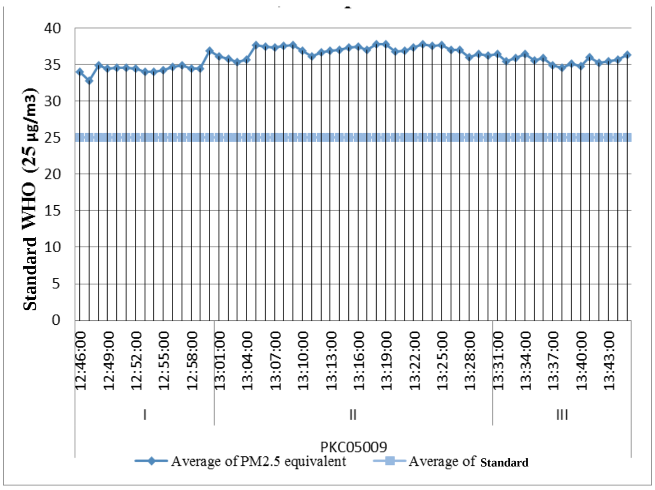

Fig. 5. Fluctuation PM 2,5 respondent E.

PM 2.5 air quality in respondent E has inferior air quality because the measurement value of PM 2.5 levels from the starting point of measurement to the endpoint of analysis exceeds the standard quality threshold that has been determined by WHO that is equal to 25 µg / m3.

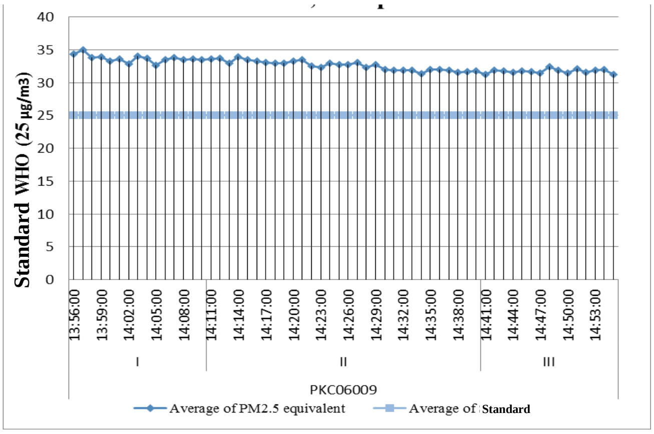

Fig. 6. Fluctuation PM 2,5 respondent F.

PM 2.5 air quality in respondent F can be said to be wrong, because the value of the air quality measurement results exceeds the quality threshold set by WHO, which is 25µg/m3.

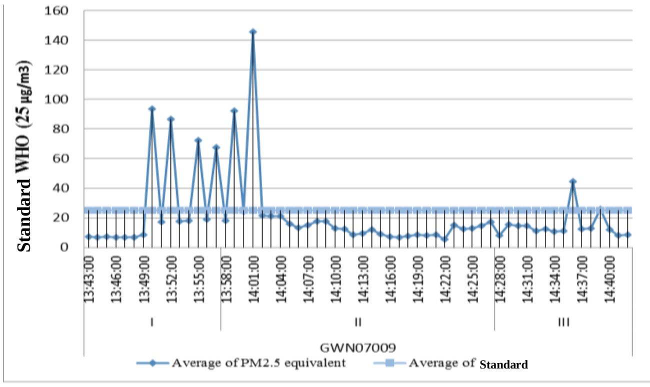

Fig. 7. Fluctuation PM 2,5 respondent G.

PM 2.5 air quality in respondent G can still be said to be useful, but there is an increase in the graph in the 50th minute at the measurement point I to the 02 and minute at the measurement point II.

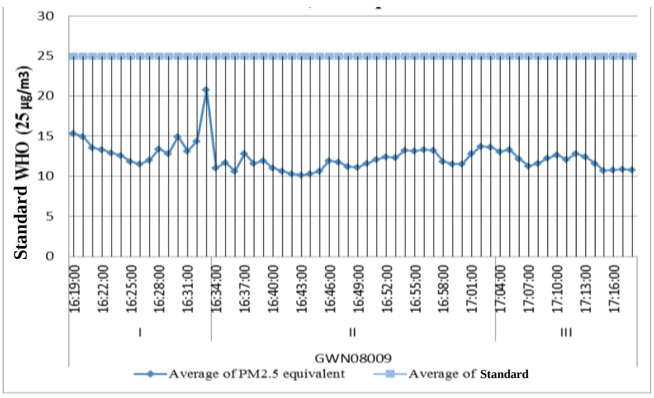

Fig. 8. Fluctuation PM 2,5 respondent H.

PM 2.5 air quality in respondent H has good air quality. Because the value of this measurement results is below the standard quality threshold set by WHO, which is 25 µg / m3.

2) Discussion

The results showed that two houses had poor air quality, namely respondents E and F. each had a measurement value of 35.66 µg / m3 and 32.66 µg / m3, the results of the air quality measurements were above the predetermined standard quality threshold values. By WHO namely 25 µg / m3. observations revealed that the two houses contained people who smoked inside the house, provided ashtrays and contained cigarette butts.

PM2.5 shows higher concentration during winter, as a result of the enhanced levels of secondary aerosols (6). In Shijiazhuang and Chengde, the PM2.5 pollutions was dominated by coal combustion. Motor vehicle exhausts and coal combustion emissions both played important roles in Tianjin PM2.5 pollution. However, motor vehicle exhausts had played a more important role in Beijing owing to the reduction of coal consumption and sharp increase of cars in recent years. At SDZ, regional transportation of air pollutants from southern urban areas was significant (7).

Apart from the emission strengths of primary aerosols and gaseous precursors, the dynamically variable synoptic weather conditions and circulation patterns also have a crucial role in the anomalies of PM (both fine and coarse mode) concentrations (8).

Lowest and highest PM2.5 often occurs in the afternoon and evening hours, respectively, associated with daily variation of the boundary layer depth and anthropogenic emissions. The diurnal distribution of the PM2.5-to-CO ratio consistently displays a pronounced peak during the afternoon periods, reflecting a significant contribution of secondary PM formation (9).

The changes in PM2.5 concentrations resulting from changing all eight meteorological parameters simultaneously were approximately within 25% or so of the sum of the changes to the eight individual perturbations. The sensitivities of PM2.5 concentrations to changes in these meteorological parameters indicate that changes in climate could potentially have important impacts on PM2.5 concentrations (10).

PM 2.5 levels in Seoul were influenced by both local urban activities and regional-scale transport. Conditional probability function (CPF) results identified possible source directions of local sources such as motor vehicles (gasoline and diesel), industry, and road salt. Potential source contribution function (PSCF) results showed that possible source areas contributing to the elevated secondary particle concentrations (sulfate and nitrate) in Seoul to be the major industrial areas in China (11).

The very acidic PM2.5 aerosols in Beijing and Shanghai add to the atmospheric acidification and affect pH-dependent heterogeneous reactions, such as the oxidation of SO2 to sulfate and the formation of secondary organic aerosols. The strong production of nitrates via hydrolysis can also change the atmospheric lifetime of NOx, thereby affecting the photochemical production of ozone (12).

We have explored the concentration–response relation between PM2.5 and daily deaths in six U.S. cities and combined the results to obtain greater stability, while accounting for heterogeneity in response. The population mean curve shows no evidence of a threshold down to the lowest levels of PM2.5. In fact, the curve is quite linear over the exposure range from 0 to 35 µg/m3(13)

Particulate matter (PM) pollution has raised serious concerns for public health. Although outdoor individual protection could be achieved by facial masks, indoor air usually relies on expensive and energy-intensive air-filtering devices (14).

There are many factors that affect the air quality of PM 2.5 in the air, that is, whether or not anyone smokes in the house, regular activity or not in the house, door or window of the parliament that is open to enter the air, using an angina fan or AC, does not smell of cigarettes and there are no cigarette butts in the house, there are motorized vehicles passing by, the distance between adjacent dwellings and there is a birdcage in the home or the house.

III. Conclusions

The air quality of PM 2.5 in a house in a smoke-free home in the city of Yogyakarta is 62% or 6 respondents who have good air quality and 38%, or 2 respondents have poor air quality because it exceeds the threshold set by WHO, 25 µg / m3. Habits of residents who violate the declaration of smoke-free house programs in the city of Yogyakarta include: there is smoking in the house, there are still people who provide ashtrays in the house, there are cigarette butts inside the house and smell of cigarettes inside the house.

References

[1] Candrasari C, Lingkungan JM-JK, 2013 undefined. Hubungan kualitas udara dalam ruang dengan keluhan penghuni Lembaga Pemasyarakatan Kelas IIA Kabupaten Sidoarjo. journal.unair.ac.id [Internet]. [cited 2019 Jul 22]; Available from: http://www.journal.unair.ac.id/filerPDF/keslingdfce63f81bfull.pdf

[2] Ministry of Health. Riset kesehatan dasar (Riskesdas) 2013. 2013.

[3] Ministry of Health. Pedoman pengembangan kawasan tanpa rokok. 2011.

[4] TCSC-IAKMI. Proceeding 1st Indonesian Conference on Tobacco or Health. ISBN :978-602-19582-4-7. In 2014.

[5] Quit Tobacco Indonesia. Panduan Rumah Bebas Asap Rokok. In Yogyakarta: Fakultas Kedokteran UGM; 2013.

[6] Tiwari S, Srivastava A, Bisht D, … TB-J of A, 2009 undefined. Black carbon and chemical characteristics of PM10 and PM2.5 at an urban site of North India. Springer [Internet]. [cited 2019 Jul 22]; Available from: https://link.springer.com/article/10.1007/s10874-010-9148-z

[7] Zhao P, Dong F, He D, … XZ-A, 2013 undefined. Characteristics of concentrations and chemical compositions for PM2.5 in the region of Beijing, Tianjin, and Hebei, China. atmos-chem-phys.net [Internet]. [cited 2019 Jul 22]; Available from: https://www.atmos-chem-phys.net/13/4631/2013/

[8] Zhang R, Jing J, Tao J, … SH-… C and, 2013 undefined. Chemical characterization and source apportionment of PM2.5 in Beijing: seasonal perspective. atmos-chem-phys.net [Internet]. [cited 2019 Jul 22]; Available from: https://www.atmos-chem-phys.net/13/7053/2013/

[9] Zhang Y, reports FC-S, 2015 undefined. Fine particulate matter (PM2.5) in China at a city level. nature.com [Internet]. [cited 2019 Jul 22]; Available from: https://www.nature.com/articles/srep14884

[10] Dawson J, physics PA-… chemistry and, 2007 undefined. Sensitivity of PM2.5 to climate in the Eastern US: a modeling case study. atmos-chem-phys.net [Internet]. [cited 2019 Jul 22]; Available from: https://www.atmos-chem-phys.net/7/4295/2007/acp-7-4295-2007.pdf

[11] Heo J, Hopke P, and SY-AC, 2009 undefined. Source apportionment of PM2.5 in Seoul, Korea. atmos-chem-phys.net [Internet]. [cited 2019 Jul 22]; Available from: https://www.atmos-chem-phys.net/9/4957/2009/acp-9-4957-2009.pdf

[12] Pathak R, Wu W, and TW-AC, 2009 undefined. Summertime PM2.5 ionic species in four major cities of China: nitrate formation in an ammonia-deficient atmosphere. atmos-chem-phys.net [Internet]. [cited 2019 Jul 22]; Available from: https://www.atmos-chem-phys.net/9/1711/2009/acp-9-1711-2009.html

[13] Schwartz J, Laden F, Zanobetti A. The concentration-response relation between PM(2.5) and daily deaths. Environ Health Perspect [Internet]. 2002 Oct [cited 2019 Jul 22];110(10):1025–9. Available from: https://ehp.niehs.nih.gov/doi/10.1289/ehp.021101025

[14] Liu C, Hsu P, Lee H, Ye M, Zheng G, … NL-N, et al. Transparent air filter for high-efficiency PM2.5 capture. nature.com [Internet]. [cited 2019 Jul 22]; Available from: https://www.nature.com/articles/ncomms7205.