# The association of variations in the quantity of fine particulate matter (PM 2.5) in Bangkok was acquired through exposure to bronchitis patients.

Anna Suthasriroth

Triam Udom Suksa Phatthanakan School

**Abstract**
Issues with oblique air pollution, particularly dust PM2.5 particles, which are droplets smaller than 2.5 microns, are the principal concern for the respiratory system in particular for human health. This study looked at the association between exposure to bronchitis patients and variations in the level of fine particulate matter (PM 2.5) in the Bangkok. The analysis of fine particulate matter between 2011 and 2021 indicated that in 2013, the average was the highest and surpassed the standard, according to a total of 15 data sources used in the secondary data research approach and a monthly research conducted in January (the first month of the winter) found that the average particulate matter (PM 2.5) was greater in the months of the cool weather than in the months of other seasons in the same year then in the summer, March and August also marks the beginning of the rainy season. Resulting in the year's lowest annual average of dust. The association between fine particulate matter and patients with bronchitis in 2020 and 2021 were determined using the equation to be y=57.933x - 183.81 and y=6.1597x + 149.29, respectively. It is demonstrated that PM 2.5 has a lower correlation with bronchitis.

Keywords: respiratory conditions, bronchitis patients, and Bangkok

## Introduction

Small particles are PM 2.5 dust or particles smaller than 2.5 microns is a poisonous material that is both unseen and odorless, yet is extremely hazardous to human health [1]. Checkpoints around Bangkok discovered that the amount of dust particles smaller than 2.5 microns surpassed the norm in several regions, particularly during this period. The values discovered range from moderate to harmful to human health [2]. It is mostly caused by traffic, industry, and open burning in the Bangkok region [3]. PM 2.5 toxic dust will have a bigger impact on health since entering the body through the nasal cavity can result in a variety of illnesses [4].

People with lung illness, as well as adults and children, are more vulnerable to the health effects of particle pollution. Acute exposure to fine particles has been linked to respiratory consequences, including respiratory discomfort, according to research decreased lung function as well as increased airway inflammation and responsiveness Furthermore, epidemiological studies have shown that the pulmonary consequences of particle pollution can be severe enough to need emergency room visits and hospitalization. Chronic obstructive pulmonary disease and respiratory tract infections are examples of this [5]. Micro dust particles cause inflammation and reduce the quantity of antioxidants in the body, causing the body to raise Reactive Oxygen Species (ROS) levels and, eventually cell degeneration. When the lungs are exposed to high levels of fine particulate matter, lung function deteriorates, which can lead to lung cancer [6]. Fann et al., (2011) In 2005, 130,000 people died as a result of PM 2.5-related causes [7]. Small droplets (PM 2.5) to the body will vary depending on the quantity of PM 2.5 dust and the individual's physical state, including the duration of dust exposure [8-10].

Particulate matter (PM 2.5) is produced by transportation, forest fires, and industrial combustion. The usage of coal energy, for example [11], [12]. Furthermore, climatic factors such as wind direction and speed influence the quantity of PM 2.5 dust concentrations, influencing the distribution of air pollution and the growth or reduction in air pollution. Reducing air pollution concentrations revealed that strong wind speeds lowered PM 2.5 dust concentrations [13],[14]. A research conducted in Thailand revealed a significant rise in PM 2.5 particle matter in several places over the winter and summer [15]. The purpose of this study was to determine the amount of PM 2.5 particulate matter in patients with respiratory disease in Bangkok, as well as the relationship between Particulate matter PM 2.5 in respiratory disease patients, as a guideline for future measures or methods for preventing small dust particles in patients with respiratory disease.

**Study metod**

A secondary research study of PM 2.5 particulate matter data with respiratory illness patients in the Bangkok was undertaken and evaluated to determine the association between PM 2.5 particulate matter data and bronchitis patients.

1. A study of PM 2.5 tiny dust particles in the Bangkok region using data from the Pollution Control Department. The yearly average of PM 2.5 dust data was investigated during an 11-year period from 2011 to 2021 by study on yearly, monthly, seasonal average (summer, rainy and winter).

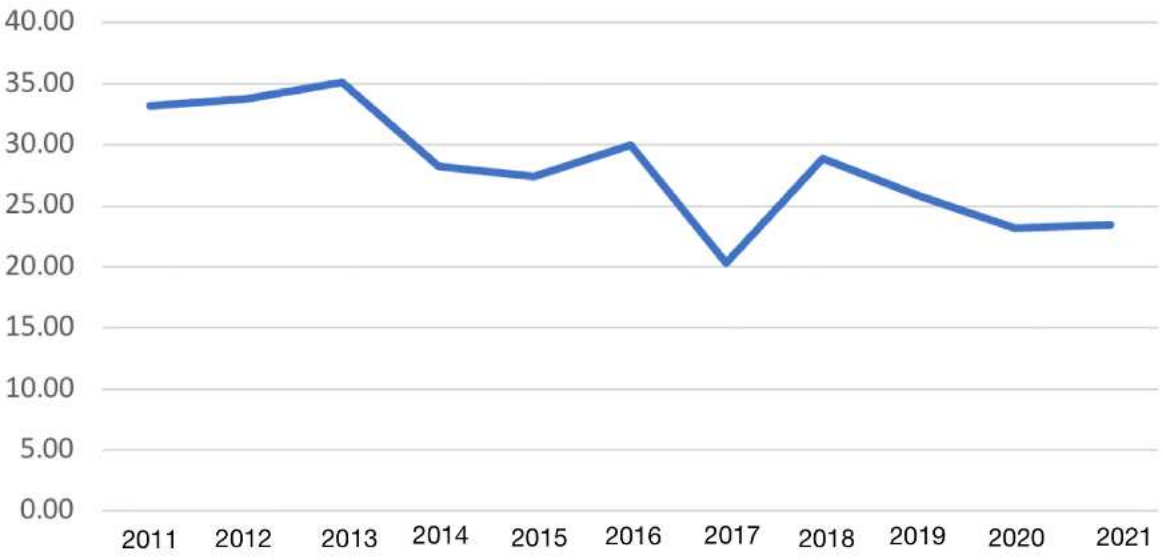
2. A scatter plot analysis to determine the link between PM 2.5 particulate matter and bronchitis patients in the metropolitan region and the decision coefficient (R2).

3. A 2-year study on the relationship of bronchitis patients by collecting the number of cases from the Health Information System from the Ministry of Public Health for a period of 2 years (2020-2021) by study on yearly, months, and seasonal averages (summer, rainy, and winter).

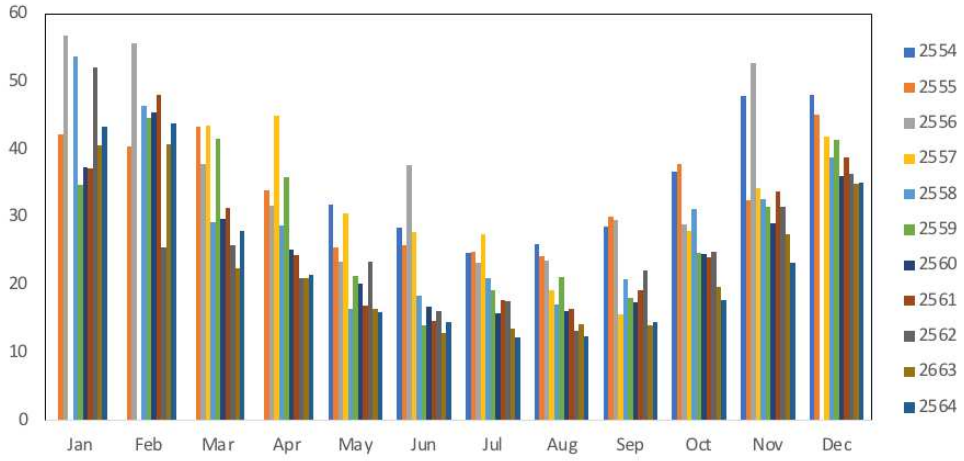
**Result**

The average particulate matter (PM 2.5) is less than 2.5 microns annually.

The annual research of particulate matter smaller than 2.5 microns discovered that the greatest average (35.11micrograms/ $m^3$) was in 2013, while the lowest average (20.33 micrograms/ $m^3$) was in 2017. When the yearly average standard (Standard mean 25 micrograms/ $m^3$) was compared, it was determined to be above the standard for 8 years, and below the standard in 2017, 2020, and 2021.

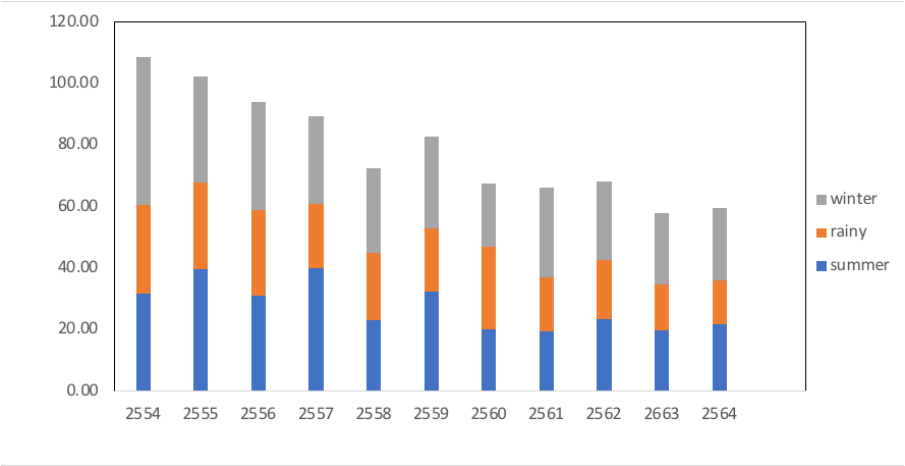


**Average dust particles smaller than 2.5 microns (PM 2.5) monthly.**
Particulate Matter (PM 2.5) monthly average from January to December, during 2011- 2021.



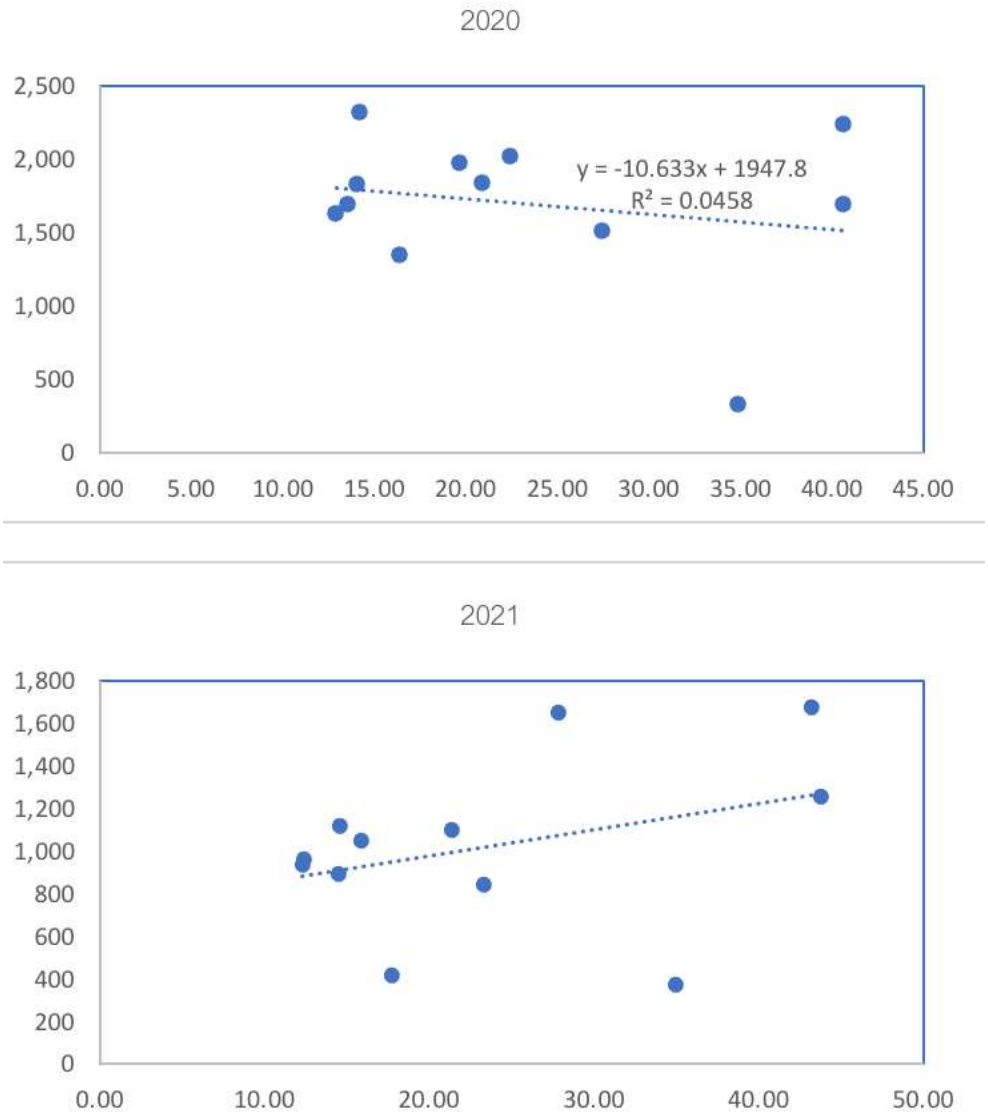

The month with the highest average PM 2.5 dust (44.22 micrograms/ $m^3$) was January. Because January is the rainy season, it was discovered that the average quantity of dust in August is the lowest of the year (average of 18.52 micrograms/ $m^3$) because of the chilly weather, the average dust level is greater than in other months due to August is the wet season, it has the lowest average dust.

**Mean particle matter (PM 2.5) less than 2.5 micrograms**



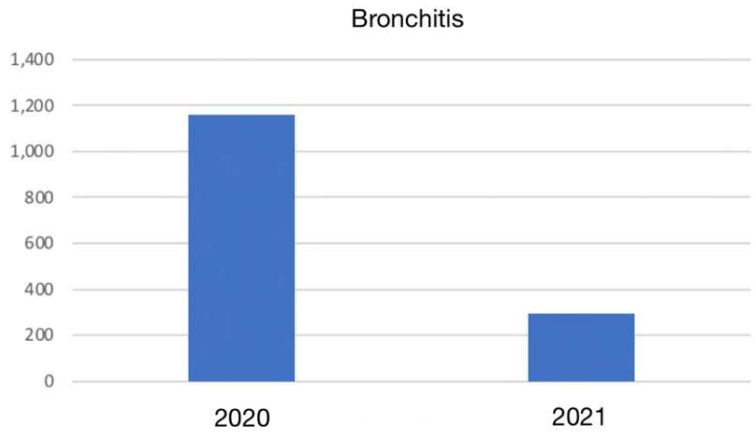

From 2011 to 2021, the seasonal average of PM 2.5 particle matter was analyzed. Summer, wet, and winter seasons were used to split the seasonal average. There were seasonal comparisons. Winter had the highest average particulate matter PM 2.5 levels. Summer comes in second, followed by the rainy season (Mean values of 29.51, 27.62, and 21.86, respectively), which is consistent with Chirasophon and Pochanart's findings (2020) [16]. This is due to the fact that the particles in the cold weather is still in the air without collapsing on the ground. When a considerable amount of pollution accumulates, it can have a negative impact on health [15].

**The association between 2.5 micron fine dust particles (PM 2.5) and the number of patients**




A research of the association between PM 2.5 and bronchitis in 2020 and 2021 discovered that the $R^2$ values were 0.4315 and 0.1738, respectively, with the correlation equations y=57.933x - 183.81 and y=6.1597x + 149.29. The correlation equation and $R^2$ indicate that there is minimal link between dust and sickness.

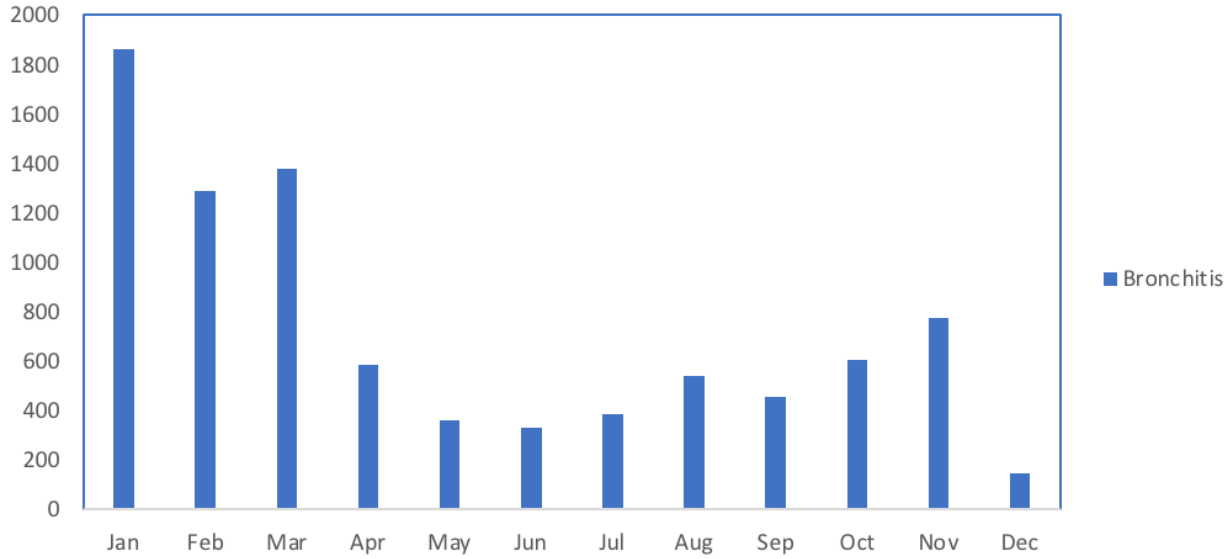
**Bronchitis patients on a yearly basis.**




According to the study, the yearly average bronchitis cases in 2020 (mean 1158 persons) were greater than the yearly average bronchitis cases in 2021. ( with an average of 294.25 persons).

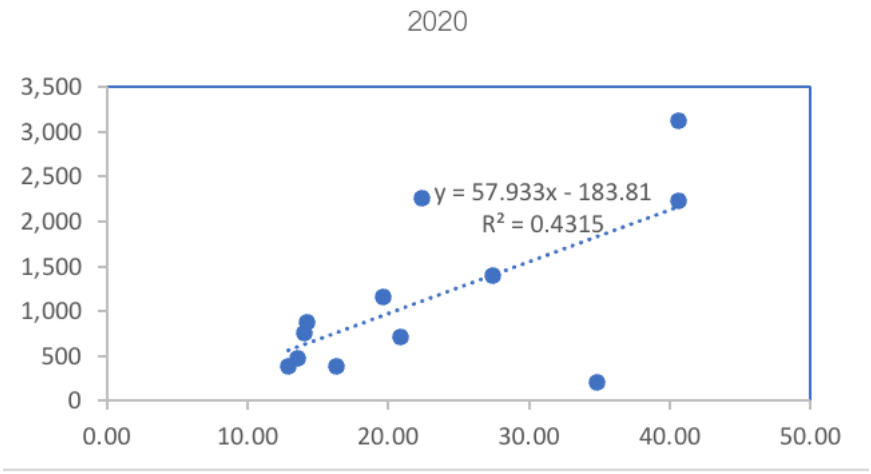
**Mean patients suffering from seasonal bronchitis.**

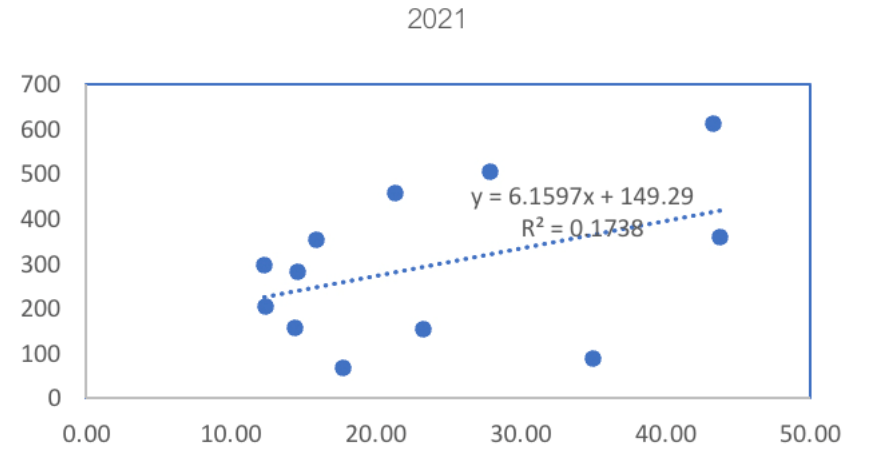
According to the Seasonal Bronchitis Study, the average January bronchitis patient was the highest since it




was winter (mean 1862). The second highest average was in March (1379 persons), while the lowest yearly average for bronchitis cases was in December, with an average of 147.5 persons.

**Associations of patients with bronchitis**.




According to a research of the link between PM 2.5 and bronchitis in 2020 and 2021, the $R^2$ values were 0.4315 and 0.1738, respectively, with the correlation equations y=57.933x - 183.81 and y=6.1597x + 149.29 derived from the $R^2$ values. Furthermore, the correlation equation demonstrates that dust and sickness have a minimal correlation.

**A summary of the study's findings**

The annual average of PM 2.5 particle matter between 2011 and 2021 was determined to be greatest in 2013. (35.11 micrograms/ $m^3$) In 2017, it recorded the lowest average (20.33 micrograms/m3). The monthly average of tiny particulate matter (PM 2.5) was discovered in January. (Winter months) with the highest average PM 2.5 dust (44.22 micrograms Per cubic meter). Month of the rainy season discovered that the average dust was the lowest of the year. (The average is 18.52 micrograms/ $m^3$). The correlation equation and $R^2$ values indicate that there is minimal correlation between dust and sickness. The average number of patients with bronchitis in 2020 is 1158, which is higher than the average of 294.25 in 2021.

Because it was winter, the average number of bronchitis patients was greatest in January (mean 1862). The mean number of patients was 147.5. The $R^2$ for bronchitis patients was 0.4315 and 0.1738, respectively. The relationship equations are y=57.933x - 183.81 and y=6.1597x + 149.29, respectively. The connection demonstrates that dust and such bronchitis have a low correlation.

## References

[1] Chirasophon, S. and Pochanart, P. 2020. [online]. The Long-term Characteristics of PM10 and PM2.5 in Bangkok, Thailand. Asian Journal of Atmospheric Environment. [Search date 26 June 2022]. From https://www.e-sciencecentral.org/upload/ajae/pdf/AJAE_2020_v14n1_73.pdf
[2] IQAir. 2021. [online]. Air quality in Thailand. [ Searched date 26 June 2022]. From https://www.iqair.com/th-en/thailand
[3] New York state. 2021. [ online]. Fine Particles (PM 2.5). [ Searched date 26 June 2022]. From https://www.health.ny.gov/environmental/indoors/air/pmq_a.htm
[4] United State Environmental Protection Agency. 2022. [online]. Particle pollution and respiratory effects. [ Searched date 27 June 2022]. From https://www.epa.gov/pmcourse/particle-pollution-and-respiratory-effects
[5] María de P Pablo-Romero et al. J Air Waste Manag Assoc. 2015. [online]. Effects of fine particles on children's hospital admissions for Respiratory health in Seville, Spain. [ Search date 26 June 2022]. From https://pubmed.ncbi.nlm.nih.gov/25947213
[6] The heart foundation of Thailand under the royal patronage. 2019. [online]. Nutrition therapy from PM2.5 with food. [Search date 29 June 2022]. From http://www.thaiheartfound.org/%20category/details/food/519
[7] FannN,LamsonAD,AnenbergSC,WessonK,Risley D, Hubell BJ . 2012. Estimating the National Public Health Burden associated with exposure to ambient PM2.5 and Ozone. [Search date 23 September 2022]. From https://pubmed.ncbi.nlm.nih.gov/21627672/
[8] Polpiboon T, Jayasvasti I and Roongpisuthipong A. 2014. [online]. Disaster in the winter of particle matter (PM2.5). EAU Herit J. [Search date 23 September 2022]. From https://he01.tci-thaijo.org/index.php/EAUHJSci/article/view/25502
[9] Li R, Zhou R and Zhang J. 2018. [online]. Function of PM2.5 in the pathogenesis of lung cancer and chronic airway inflammatory diseases (Review). Oncol. Lett. [Search date 23 September 2022]. From https://pubmed.ncbi.nlm.nih.gov/29725457/
[10] Li T, Hu R, Chen Z, Huang M, Li Q-Y, Huang S-X, Zhu Z and Zhou L-F. 2018. [online]. PM2.5: the culprit for chronic lung diseases in China. CDTM. [Search date 23 September 2022]. From https://pubmed.ncbi.nlm.nih.gov/30276364/
[11] Koplitz SN, Jacob DJ, Sulprizio MP, Myllyvirta L and Reid C. 2017. [online]. Burden of Disease from Rising Coal-fired Power plant Emissions in Southeast Asia. EnvironSci Technol. [ Search date 17 September 2022]. From https://pubs.acs.org/doi/full/10.1021/acs.est.6b03731
[12] Narita D, Kim Oanh NT, Sato K, Hao M, Permadi DA, Ha Chi NN, Ratanajaratroj T and Pawarmart I. 2019. [online]. Pollution characteristics and policy actions on fine particulate matter in a growing Asian economy: The case of Bangkok metropolitan region. Atmosphere. [Search date 17 September 2022]. From https://www.mdpi.com/2073-4433/10/5/227
[13] Hien TT, Thien Chi ND, Nguyen NT, Vinh LX, Takenaka N and Huy DH. 2019. [online]. Current status of fine particulate matter (PM2.5) in Vietnam's most populous city, Ho Chi Minh city. Aerosol Air Qual Res. [Search date 17 September 2022]. From https://aaqr.org/articles/aaqr-18-12-oa-0471
[14] Mohanraj R, Dhanakumar S and Soloraj G. 2012. [online]. Polycyclic aromatic hydrocarbons bound to PM2.5 in urban Coimbatore, India with Emphasis on Source Apportionment. Sci World J. [Search date 17 September 2022]. From https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3350969/
[15] Somporn chantara, Chakrit Chotamonsak and Wan Wiriya. 2018. [online]. Investigation of mon- itor and classify biomass burning area in nine provinces of Northern Thailand to assess pollutant distribution and moving of air pollutant for planning to Particulate Matter Smog. [Search date 23 September 2022]. From https://so04.tci-thaijo.org/index.php/jar/article/view/241619
[16] Supanan Chirasophon and Pakpong Pochanart. 2020. [online]. The Long-term Characteristics of PM10 and PM2.5 in Bangkok, Thailand. [Search date 25 June 2022]. From https://www.researchgate.net/publication/340382335_The_Long-term_Characteristics_of_PM10_and_PM25_in_Bangkok_Thailand