Journal of Materials and Environmental Science
ISSN : 2028-2508
e-ISSN : 2737-890X
CODEN : JMESCN

J. Mater. Environ. Sci., 2025, Volume 16, Issue 8, Page 1373-1387

http://www.jmaterenvironsci.com

Assessment of Air Quality Parameters of Urban and Rural areas in selected Districts of Bangladesh

Ani S.A.[1], Usha K.F.[1], Auyon S.T.[1], Nipa N.[1,2], Islam M.A.[1*], Khan M.B.[1]

[1]*Department of Environmental Science, Faculty of Agriculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh*

[2]*PDCA International Ltd, Uttara, Dhaka, Bangladesh*

**Corresponding author, Email address: maislam@bau.edu.bd*

Received *04 May 2025,*
Revised *28 June 2025,*
Accepted *01 July 2025*

Keywords:
- ✓ *Air quality;*
- ✓ *Indoor pollutants,*
- ✓ *Outdoor pollutants;*
- ✓ *Particulate matter;*
- ✓ *AQI in Bangladesh*

Citation*: Ani S. A., Usha K. F., Auyon S. T., Nipa N., Islam M. A., Khan M. B. (2025) Assessment of Air Quality Parameters of Urban and Rural areas in selected Districts of Bangladesh, J. Mater. Environ. Sci., 16(8), 1373-1387*

Abstract: This research assessed the levels of AQI, PM_1, $PM_{2.5}$, and PM_{10} in Bangladesh from August'22, to October'24. The primary locations for this study were eight urban and eight rural points within the major eight districts. Eight significant districts around the country have had their PM and AQI levels monitored. The main findings of this study are that PM_1 concentrations range from 35 to 107 µg/m^3, with Cox's Bazar's metropolitan region having the highest concentration. Again, the urban area of Mymensingh has the greatest concentration of $PM_{2.5}$ at 112 µg/m^3, whilst the rural areas of Bandarban have the lowest concentration at 47 µg/m^3. The concentration of the main pollutant, PM_{10}, was 196 µg/m^3 in Manikganj's urban area and 78 µg/m^3 in Bandarban's rural areas. According to recommendations from the Bangladeshi Department of Environment, AQI values ranged from 48 in rural Bandarban to a high of 243 in Manikganj's urban area, which indicated very poor air quality. Additionally, rural places have better air quality than urban sites. It was also discovered that the hilly area is quite healthy, according to particulate matter concentration and AQIs. Due to their extensive vegetative cover, low population density, poor infrastructure and lack of the industrial revolution. One of the main causes of the unfavorable air quality in metropolitan areas is the industrial growth and urbanization. However, the scenario in rural areas is likewise becoming more and more of a worry.

1. Introduction

Air is a priceless natural resource that supports life. Fresh air is one of nature's most essential gifts without which humans cannot survive. The contamination of this essential resource can interfere with human operations. The existence of dangerous compounds in the atmosphere that can have a detrimental impact on human health is known as air pollution (Basak *et al.*, 2024). Clean air is essential to maintain the gentle balance of life on this planet, not just for humans, but wildlife, vegetation, water and soil (Afifa *et al.*, 2024; Manisalidis *et al.*, 2020; Jodeh *et al.*, 2017). Air pollution is also a leading cause of death globally, resulting in the loss of millions of healthy years of life (EPA, 2009, 2019). Moreover, the health burden has fallen disproportionately upon people in many low- and middle-

income countries, where air quality continues to deteriorate (Cesaroni *et al.*, 2014; Chetouani *et al.*, 2017; Goshua *et al.*, 2022; Sarker *et al.*, 2018; Mondol *et al.*, 2020; Hasan *et al.*, 2020; EPA, 2019).

Air pollution is a serious environmental health hazard, that also affecting the populations of Bangladesh. Air pollution of Bangladesh is caused due to increasing population and associated motorization (Alam, 2009). The interdisciplinary issue of air pollution seriously threatens the health of people, the environment, and the biodiversity of the planet. In 2016, 4.2 million premature deaths in both urban and rural regions were attributed to ambient air pollution, with 91% of the world's population residing in locations where the World Health Organization's (WHO) air quality guidelines were not being reached (WHO, 2018).

In 1992, the World Bank designated air pollution in developing countries as one of the four most critical global environmental problems (World Bank, 1992). In Bangladesh, Indoor and outdoor air pollution led to 1.23 lakh deaths according to the calculation of 2017 (Molla, 2019). So, it is high time to work against air pollution. Air pollution has become a public health concern in Bangladesh, as well as one of the country's and the world's major environmental hazards. However, air pollution is now a major hazard in Bangladesh, particularly in large cities. In Bangladesh, vehicular and industrial emissions are the two main sources of air pollution (Mondol *et al.*, 2020). Motor vehicles, brick kilns, diesel generators, and industries are the primary sources of air pollution (Hasan *et al.*, 2020). Air pollutants comprise primary and secondary air pollutants. Primary Air pollutants are emitted directly from sources. They include particulate matter (PM), sulfur dioxide (SO2), carbon monoxide (CO), nitric oxides (NOx), hydrocarbon, volatile organic compounds (VOCs), and ammonia (NH3) (EPA, 2009, 2016; Anderson *et al.*, 2012; Bae & Yun, 2018). Secondary air pollutants are produced by chemical reactions of two or more primary pollutants or reactions with normal atmospheric constituents (Sitaras & Siskos, 2008; Das *et al.*, 2021). After short-term or long-term exposure, the main categories of air pollutants also have a negative impact on human health. The most common conditions linked to inhaling these contaminants include asthma, bronchitis, lung cancer, and cardiac issues (Saxena & Sonwani, 2019).

Particulate matter pollution is a major concern in the large cities of Bangladesh. The main contributors of air pollution are motor vehicles, brick kilns, diesel generators and industries. In recent years, much research interest has been shown on atmospheric particles as they influence on climate change and cause adverse health effects (Hasan *et al.*, 2016; Bahauddin & Tariq, 2010).

In Bangladesh, ambient and PM2.5 is one of the substantial environmental risks, causing about 21% of all deaths while Bangladesh are the leading country compare to other south Asian countries in terms of air pollution (World Bank, 2018). While being a potential global leader and modern economic hub of Bangladesh, it is experiencing tremendous overcrowding, extensive slum housing and poor sanitation due to lack of infrastructure, formal job opportunities and social services. With these, pollution comes as a by-product and air pollution is the worst of them all. In recent years much research interest has been shown on atmospheric particles as they influence on climate change and cause adverse health effects (Hasan *et al.*, 2020).

The industrial revolution brought new issues with it as technology advanced. One of these issues, air pollution, has had a significant negative impact on both the environmental quality of urban and rural areas worldwide (Manisalidis *et al.*, 2020). In Bangladesh's largest cities, air pollution is a serious problem. The main sources of air pollution are diesel generators, factories, motor vehicles, and brick kilns. As they influence climate change and have negative health effects, atmospheric particles have attracted a lot of study interest recently (Hasan *et al.*, 2010). Although there is a lack of air quality monitoring data in Bangladesh, routine DOE inspections show that ambient levels of SPM, SO2, and airborne lead are greater than the country's air quality standards. The study conducted to monitor the urban and rural air quality and to assess the particulate matter of the selected districts of Bangladesh.

2. Methodology

2.1 Study area

Bangladesh is located in southeast Asia. Randomly eight districts have been selected for this study. PM and AQI monitoring in air have been done in eight districts located at different regions of the country Manikganj in the middle, Kushtia to the southwest, Rangpur to the northern part, Chattogram, Bandarban, Khagrachori, Cox's Bazar to the southeast, and Mymensingh to the northeast part of the country. Southeast part of this study also covers the hilly region of Bangladesh. The sampling location sites has been shown in the **Figure 1**,

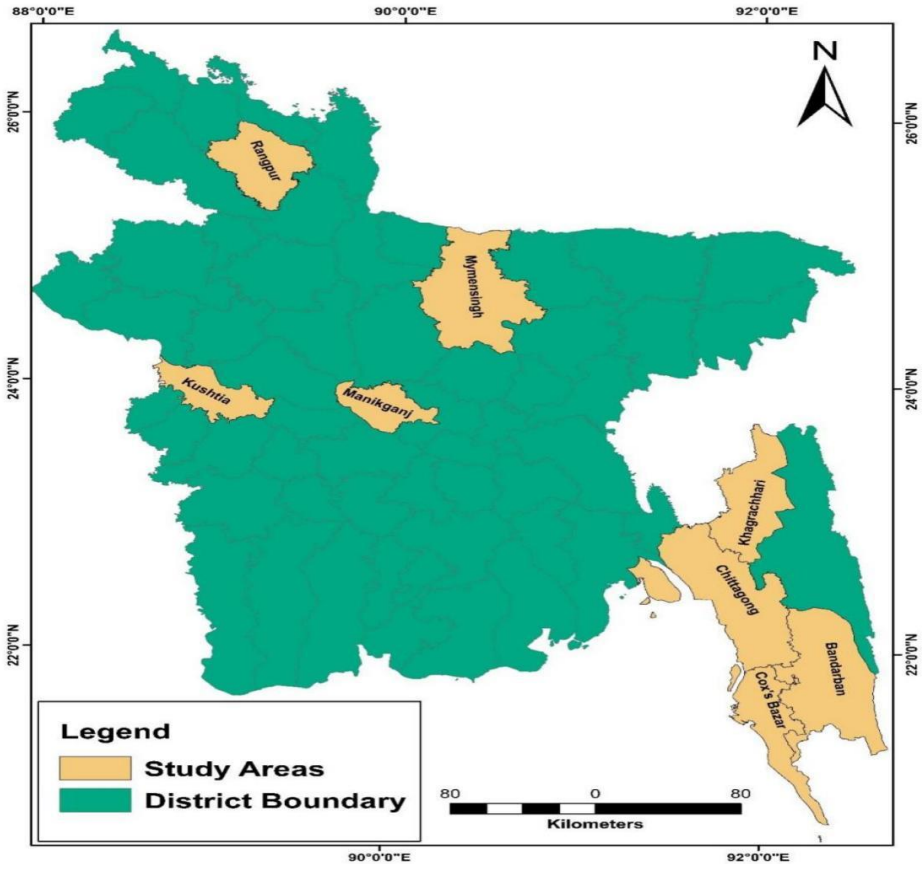


Figure 1. Map showing the sampling Sites of the Study

2.2 Methods and Equipment

PM and AQI were measured using the instrument 'Airveda Air Quality Monitor'. **Table 1** comprises the measured parameters and their values.

Table 1. Measuring Parameters and their values- features of 'Airveda Air Quality Monitor'

Measurements	Parameters	Values
AQ Parameters	PM1	µg/m^3
	PM2.5	µg/m^3
	PM10	µg/m^3
AQI		None

2.3 Collection of Field Data

Primary data has been collected by using Airveda air quality monitoring tools and visiting the urban and rural area of the selected eight districts of Bangladesh. According to the duration and frequency of this study, the total number of visiting sites for data collection was 16 (2 areas for each district, one was urban and one was rural). The district selection was random but the objectives of the study was to represent some important sites of Bangladesh. The study was also conducted to maintain the facts that, where the gap for previous studies and also covered the areas. This study undertook massive initiatives of not continuously capturing particulate matter (PM) concentrations in the air.

2.4 Data Processing, Analysis and Interpretation

Data were entered in Microsoft Excel spreadsheets and then were imported for analyses. Data was calculated from the average values of each location of the study area and then all the data was illustrated into Graphs and Diagrams. This study used ArcGIS to selection of the study area. And then, the collected data were also analyzed and interpreted for final presentation using MS word, MS Excel.

3. Result and Discussion

3.1 Monitoring the Particulate Matter in Rural and Urban Areas

From the district wise air quality assessment, the main source of pollutant PM1, PM2.5 and PM10 have been identified in the ambient air. In Bangladesh perspective there is no standard for PM1 but PM2.5 and PM10 have standard limit according to Environment Conservation Rules, 1997 which was amended on 19 July 2005 vide S.R.O No. 220-Law/2005. The particulate matter of urban and rural areas of eight selected districts of Bangladesh is represented in the **Figure 2**.

3.1.1 Manikganj Districts (Urban & Rural Areas)

From the recorded & analyzed data it is seen that for Manikganj district in urban areas PM1 value was 98 µg/m^{3}and for rural areas it was 79 µg/m^3. The PM2.5 value in urban area was recorded 104 µg/m^3 and for rural area 89 µg/m^3. The PM10 concentration was 196 µg/m^3 and 178 µg/m^3 for urban and

rural areas, respectively (**Figure 3**). The major assessment is AQI which was found 243 in urban areas of Manikganj and in rural areas it was found 180. The concentration of PM2.5 and PM10 showed higher concentration than the recommended value (**Figure 3**).

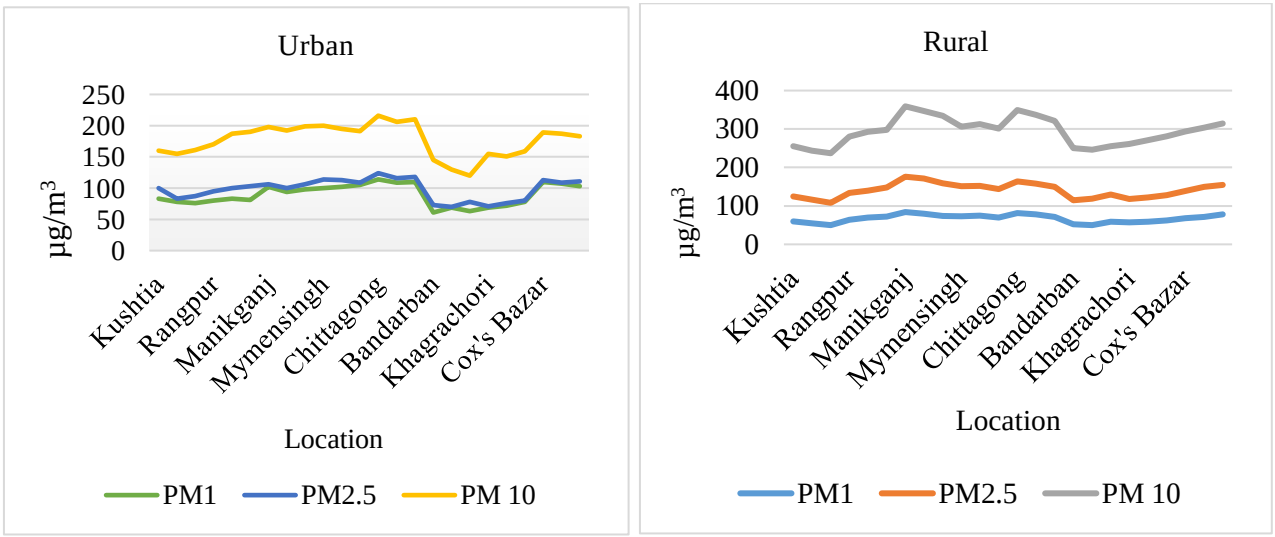


Figure 2. Comparison of Monitored PM in Urban & Rural areas of Eight Districts of Bangladesh

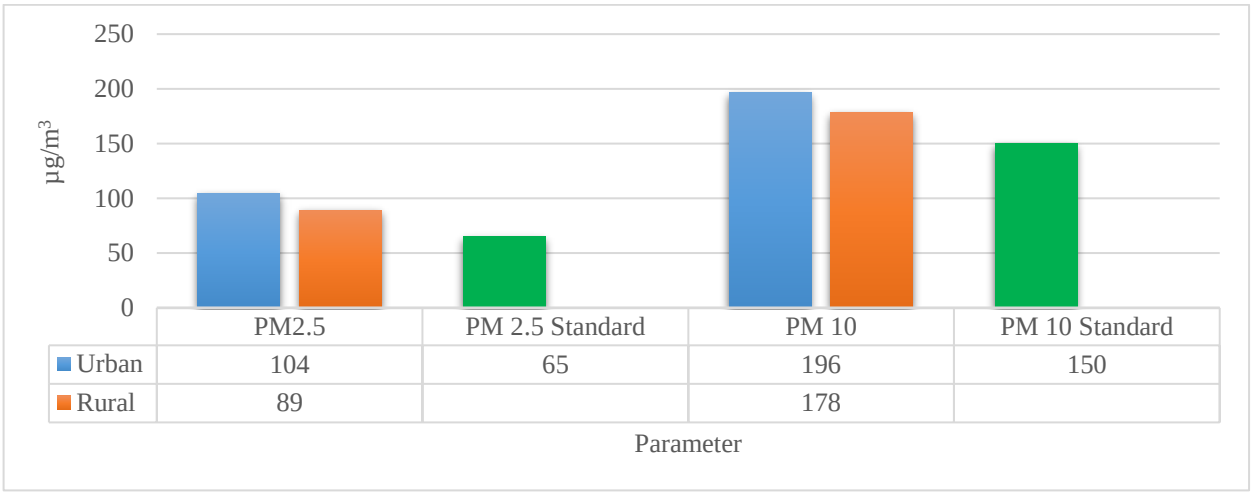


Figure 3. Comparison of Estimated and Standard Values of PM2.5 & PM10 in Manikganj

There are numerous brick kilns in the Manikganj district, which is not far from Dhaka. The three main sources of air pollution are smoke from unsafe automobiles, dust produced by public and private building sites, especially those of the government's megaprojects, and haze from brick kilns (Hasan *et al.*, 2020; Das *et al.*, 2021; Mondol *et al.*, 2020).

3.1.2 Kushtia (Urban & Rural Areas)

According to the data, the PM1 value for the Kushtia district in urban areas was 79 µg/m^3, while the value for rural regions was 55 µg/m^3. In an urban region, the PM2.5 concentration was 90 µg/m^3, while in a rural area, it was 61 µg/m^3. PM10 was found to be present at 159 µg/m^3 in urban areas and 129

µg/m^3 in rural areas. For the PM10 the values of urban area and rural areas meet the national standard for Bangladesh which is 150 µg/m^3. The values in rural area were meet the national standard but not meet the national standard for urban area as the standard value is 65 µg/m^3. According to the evaluation, Kushtia's urban parts had an AQI of 195, while its rural areas had an AQI of 134. The parameter variation values for the Kushtia Districts are shown in **Figure 4,** where also indicate the standard value and estimated value of PM2.5 and PM10.

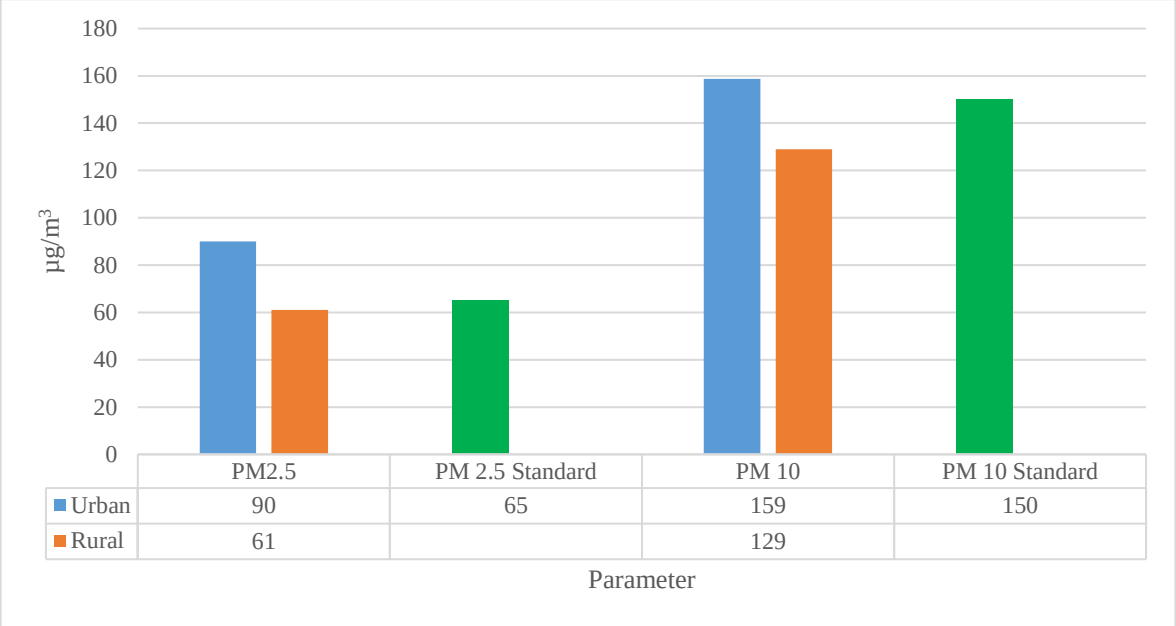


Figure 4. Comparison of Estimated and Standard Values of PM2.5 & PM10 in Kushtia

3.1.3 Rangpur (Urban & Rural)

In Rangpur districts, the urban PM1 value was found 81 µg/m^3, and the rural PM1 value was 69 µg/m^3, according to the data that has been collected and analyzed. About 99 µg/m^3 for the urban region and 72 µg/m^3 for the rural area were the PM2.5 values that were recorded. PM10 levels were found to be 182 µg/m^3 in urban areas and 150 µg/m^3 in rural areas. The most important measurement is the AQI, which was determined to be 208 in urban parts of Rangpur and 148 in rural regions. The parameters of the Rangpur Districts' variation values are shown in **Figure 5**, also compares the estimated and standard values for PM2.5 and PM10 in terms of their respective quantities.

3.1.4 Mymensingh (Urban & Rural)

From the recorded & analyzed data it was seen that for Mymensingh district in urban areas PM1 value was 102 µg/m^{3}and for rural areas it was 73 µg/m^3. The PM2.5 value in urban area was recorded 112 µg/m^3 and for rural area 76 µg/m^3. Followed by PM2.5 the PM10 was identified 195 µg/m^3 in urban area and 158 µg/m^3 for rural area. The recorded data shows that in Mymensingh the AQI value was found in urban area 191 and 173 was reported in rural area of Mymensingh. The parameter variation values for Mymensingh Districts are shown in **Figure 6**. **Figure 6** compares the estimated value of PM2.5 and PM10 to the standard value.

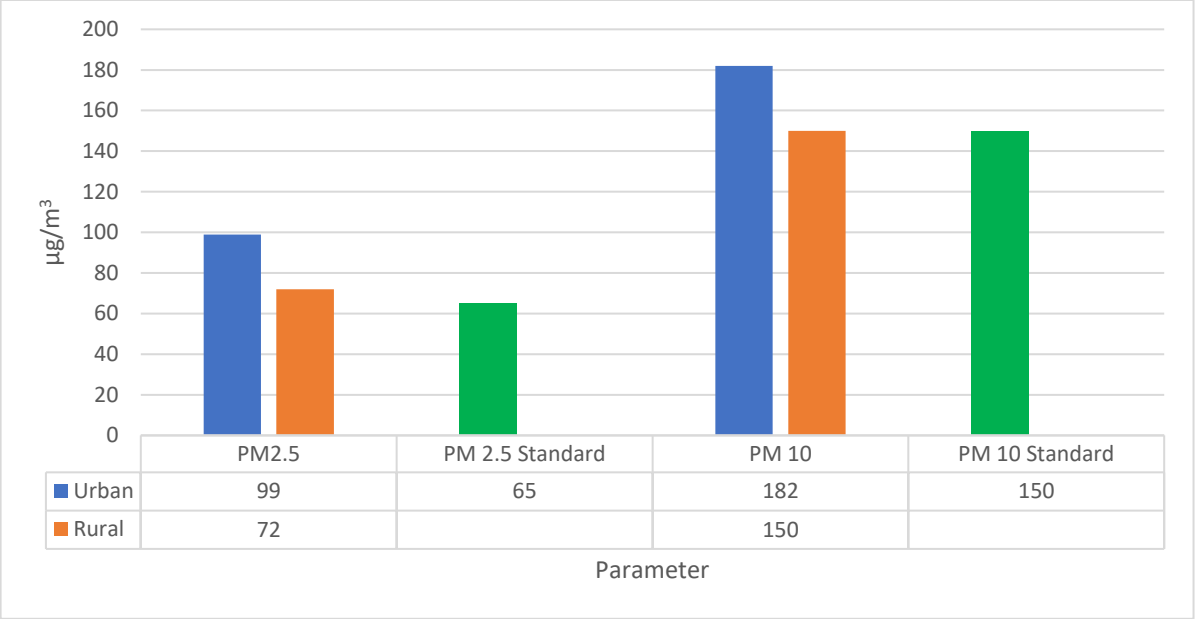


Figure 5. Comparison of Estimated PM and Standards for Urban & Rural Area of Rangpur

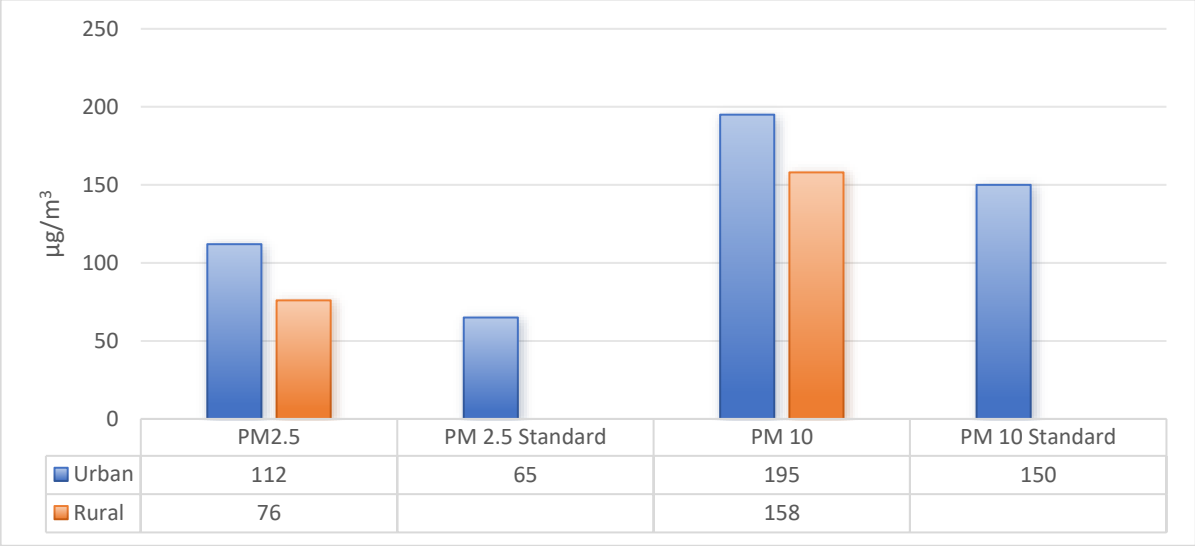


Figure 6. Comparison of Estimated and Standard Values of PM2.5 & PM10 in Mymensingh

The test results show that all the parameters did not exceed the national standard. According to ECR-97, the concentration of PM2.5 is 65 µg/m^3. So, from the test result PM2.5 value is exceeding the Bangladesh standard due to some dust particles for the nearby main road and other commercial activities. since it was observed that higher amount of dust particles was present in the sampling site due to high vehicular movement, Construction works etc. For rural areas the concentration of PM2.5 is low but not meet the national standard as this was the residential area and the amount of dust particles are comparatively low. As well as the PM10 data in urban areas of Mymensingh exceeded the national standard as it was reported 195 µg/m^3. On the other hand, in rural area, it was found within national standard.

3.1.5 Chattogram Urban & Rural)

From the recorded & analyzed data it was seen that for Chattogram districts in urban areas PM1 value was 111 µg/m^3 and for rural areas it was 77 µg/m^3. The PM2.5 value in urban area was recorded 119 µg/m^3 and for rural area 81 µg/m^3. Followed by PM2.5 the PM10 was identified 211 µg/m^3 in urban area and 178 µg/m^3 for rural area. In additions the AQI which was found 281 in urban areas of Rangpur and in rural areas it was found 179. The variance values for the Chattogram Districts' parameters are shown in **Figure 7**, where also compared the estimated and standard values for PM2.5 and PM10 in that regard.

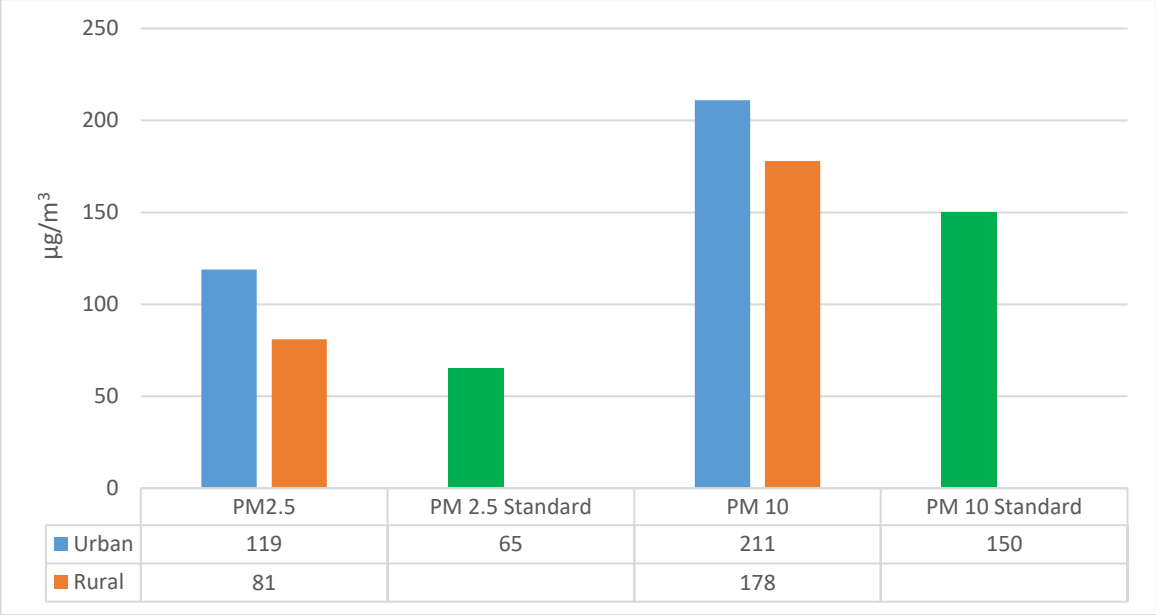


Figure 7. Comparison of Estimated and Standard Values of PM2.5 & PM10 in Chattogram

There are numerous sources of air pollution in Chattogram, the most famous of which are unsuitable automobiles and factories. Every year, the quantity of largely reconditioned vehicles increases. The values for both urban areas and rural areas exceeded the national standard of Bangladesh as the standard value is 65 µg/m^3 & 150 µg/m^3.

3.1.6 Bandarban (Urban & Rural)

From the recorded & analyzed data, it was seen that for Bandarban district in urban areas PM1 value was 47 µg/m^3 and for rural areas it was 35 µg/m^3. The PM2.5 value in urban area was recorded 64 µg/m^3 and for rural area 47 µg/m^3. The PM10 was identified 101 µg/m^3 in urban area and 78 µg/m^3 for rural area. The parameter variation values for the Bandarban Districts are shown in **Figure 8** where also compared the estimated and standard values for PM2.5 and PM10 in that regard.

The analyzed data represent that the value of PM2.5 and PM10 are consecutively 64 µg/m^3 and 101 µg/m^3 in urban areas which was not exceeded the national standard for Bangladesh as per ECR-97. The recorded data shows that in Bandarban the AQI value was found in urban area 98 which is

moderate. In the contrary 48 was reported in rural area which is healthy as per DoE guideline of Bangladesh. There are many vegetation covers in Bandarban that's why the air is clean and healthy as well the main receptor for the pollutant is not significant in Bandarban region so the air quality is moderate & healthy in nature.

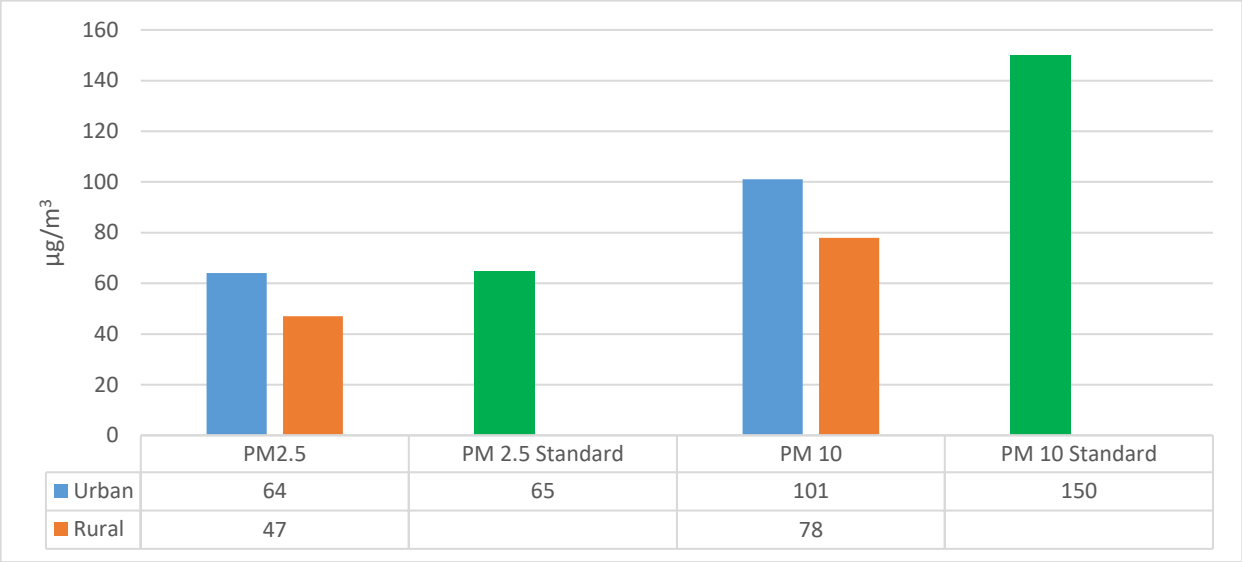


Figure 8. Comparison of Estimated and Standard Values of PM2.5 & PM10 in Bandarban

3.1.7 Khagrachori (Urban & Rural)

From the recorded & analyzed data it was seen that for Khagrachori districts in urban areas PM1 value is 54 µg/m^3 and for rural areas it is 41 µg/m^3. The PM2.5 value in urban area was recorded 69 µg/m^3 and for rural area 55 µg/m^3. The PM10 was identified 144 µg/m^3 in urban area and 105 µg/m^3 for rural area. The AQI value was found in urban area 116 in Khagrachari and 50 was reported in rural area of Khagrachari. **Figure 9** comprises the variation values of the parameters of Khagrachori Districts. And **Figure 9** indicates the comparison between the standard value and estimated value of PM2.5 & PM10.

Like Bandarban district Khagrachari is one of the most magnificent places for tourist with hill forest, waterfall and natural beauty. With the gradual increase of population and tourist movement in the urban area of Khagrchari, Vehicular movements are high and it resulting some air pollution. The derived data represent that the value of PM2.5 and PM10 are consecutively 69 µg/m^3 and 144 µg/m^3 in urban areas which were meet the national standard for Bangladesh as per ECR-97.

3.1.8 Cox's Bazar (Urban & Rural)

From the recorded & analyzed data it was seen that for Cox's Bazar districts in urban areas PM1 value was 107 µg/m^3 and for rural areas it was 72 µg/m^3. The PM2.5 value in urban area was recorded 111 µg/m^3 and for rural area 76 µg/m^3. Followed by PM2.5 the PM10 was identified 186 µg/m^3 in urban area and 156 µg/m^3 for rural area. The recorded data shows that in Cox's Bazar the AQI value was found in urban area 193. In the contrary 156 was reported in rural areas of Cox's Bazar. The variance values for the Manikganj Districts' parameters are shown in **Figure 10**. Furthermore, **Figure 10**

compares the estimated and standard values for PM2.5 and PM10 in terms of their respective quantities.

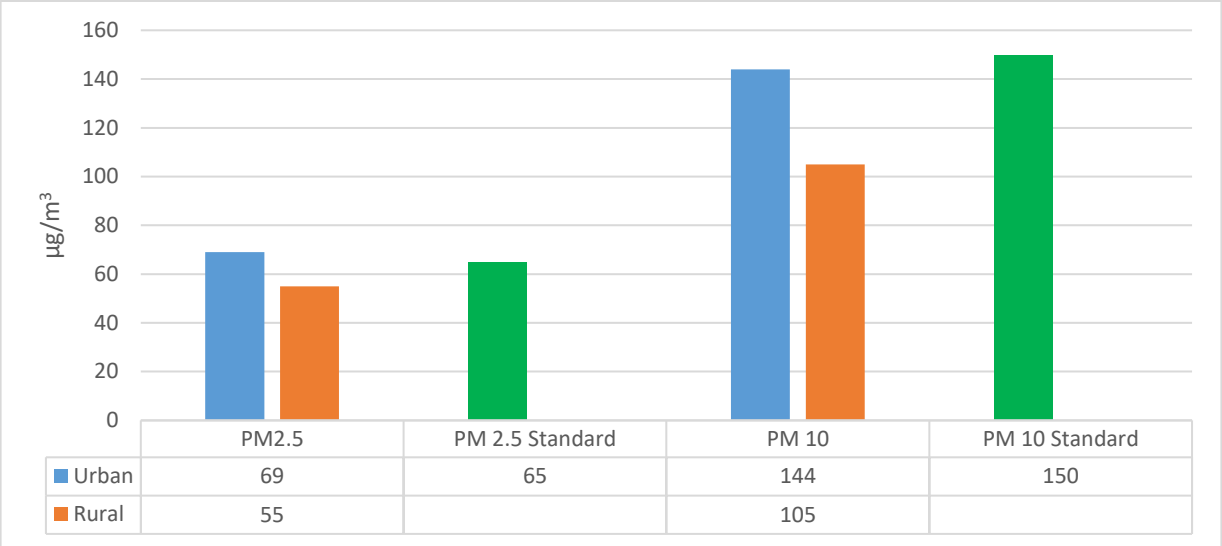


Figure 9. Comparison of Estimated and Standard Values of PM2.5 & PM10 in Khagrachori

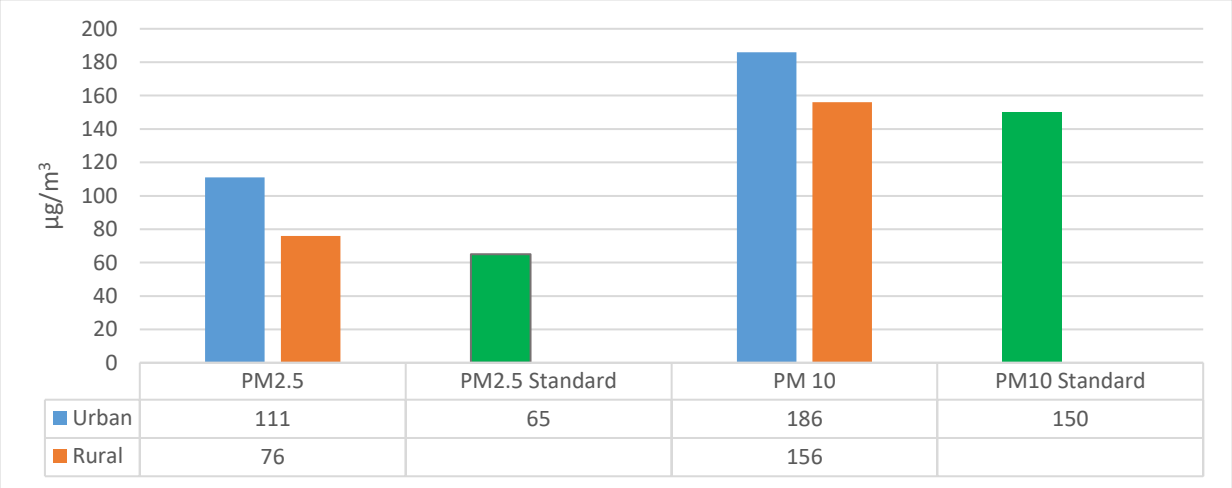


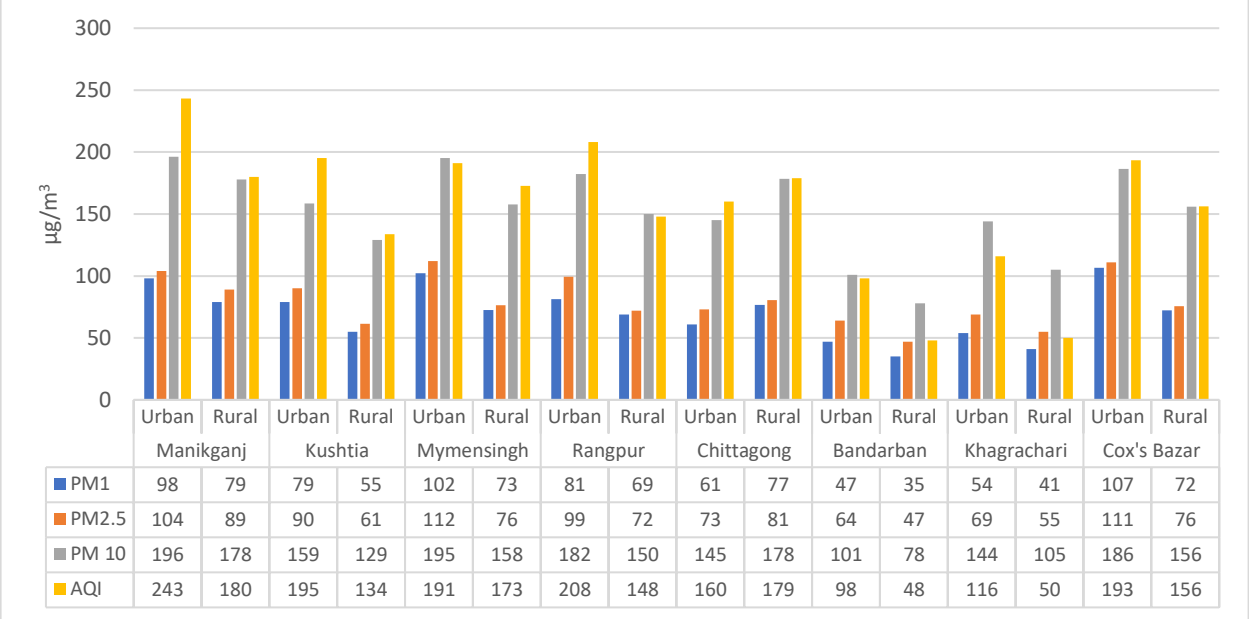
Figure 10. Comparison of Estimated and Standard Values of PM2.5 & PM10 in Cox's Bazar

Cox's Bazar is renowned for its tranquil nature with the magnificent green trees and attractive hills on one side and the appealing waves on the other. The PM10 value was beyond the national standard for urban areas. The main causes of air pollution as construction works, industrial works, and tourism. From this study it can be said unless appropriate and adequate measures are taken in our tourism policy to reduce the pollutions, the sustainability of Cox's Bazar as a tourist destination would be challenged.

3.2 Comparison of Air quality Status in Eight Districts in Bangladesh

In consequences of all analyzed data this section has been described the comparison of air quality status in eight selected districts of Bangladesh. It can be summarized that all of the results of the air quality

test shows, PM1 was 107 µg/m^3 which was highest in urban area of Cox's Bazar and lowest in rural areas of Bandarban which was 35 µg/m3. Again, highest PM2.5 was 112 µg/m^3 in urban area of Mymensingh and reported lowest in rural areas of Bandarban which was 47 µg/m^3. The major pollutant which is PM10 reported 196 µg/m^3 in urban area of Manikganj and lowest in rural areas of Bandarban which is 78 µg/m^3. AQI value was reported as high in 243 in urban area of Manikganj and lowest AQI was reported 48 in in rural areas of Bandarban (**Figure 11**). Begum *et al.*, (2008, 2009) reported the PM pollution mostly in Dhaka city and its surrounding, so that the findings supported by previous reports also.



	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
	Manikganj		Kushtia		Mymensingh		Rangpur		Chittagong		Bandarban		Khagrachari		Cox's Bazar	
PM1	98	79	79	55	102	73	81	69	61	77	47	35	54	41	107	72
PM2.5	104	89	90	61	112	76	99	72	73	81	64	47	69	55	111	76
PM 10	196	178	159	129	195	158	182	150	145	178	101	78	144	105	186	156
AQI	243	180	195	134	191	173	208	148	160	179	98	48	116	50	193	156

Figure 11. Comparison of Air quality Status in Eight Selected Districts of Bangladesh

3.3 AQI (Air Quality Index)

The AQI is a tool for reporting daily air quality of any city or country. It tells how clean or polluted the air is, and what associated health effects might be a concern for public. The AQI focuses on health effects that one might experience within a few hours or days after breathing polluted air. The derived data from the result shows that in Manikganj the AQI value was found in urban area 243 which is very unhealthy. In the contrary 180 was reported in rural area which also referred as unhealthy as per DoE guideline of Bangladesh. The recorded data shows that in Kushtia the AQI value was found in urban area 195 which is unhealthy. In the contrary 134 was reported in rural area which also referred as alarming situation and need caution as per DoE guideline of Bangladesh (**Figure 12**). In consequence of overall, it can be said that, Air pollution in rural areas is comparatively lower than in other urban regions of Kushtia. The recorded data shows that in Rangpur the AQI value was found in urban area 208 which is very unhealthy. In the contrary 148 was reported in rural area which also referred as alarming situation and need caution as per DoE guideline of Bangladesh.

Figure 12. Comparison of Air quality Status (AQI) of Urban and Rural areas in Bangladesh

The recorded data shows that in Mymensingh the AQI value was found in urban area 191 which is unhealthy (**Figure 12**). In the contrary 173 was reported in rural area which also referred as unhealthy as per DoE guideline of Bangladesh. In Mymensingh compounding the situation is the rising number of registered vehicles. The number of these has increased over the years, contributing to air pollution. The derived data from the result shows that in Chattogram the AQI value was found in urban area 281 which is very unhealthy (**Figure 12**). In the contrary 179 was reported in rural area which also referred as unhealthy as per DoE guideline of Bangladesh. The recorded data shows that in Khagrachari the AQI value was found in urban area 116 which is is concerning in the contrary and 50 was reported in rural area which referred as healthy as per DoE guideline of Bangladesh. There is many vegetation cover in Khagrachari that's why the air is clean and healthy as well the main receptor for the pollutant is not significant in Bandarban region so the air quality is moderate & healthy in nature. The recorded data shows that in Cox's Bazar the AQI value was found in urban area 193 which is unhealthy. In the contrary 156 was reported in rural area which also referred as unhealthy as per DoE guideline of

Bangladesh. Lastly the AQI value was reported as high in 243 in urban area of Manikganj which referred as very unhealthy and lowest AQI was reported 48 in in rural areas of Bandarban which denote healthy as per DoE guideline of Bangladesh.

4. Conclusion

The major findings of this study are that the concentration of PM1 is 107 µg/m^3, and it is highest in Cox's Bazar's urban area and lowest in Bandarban's rural sections, where it is 35 µg/m^3. Again, Mymensingh's urban region has the highest PM2.5 concentration at 112 µg/m^3, whereas Bandarban's rural parts have the lowest concentration at 47 µg/m^3. The primary pollutant, PM10, was measured at 196 µg/m^3 in Manikganj's urban region and 78 µg/m^3 in Bandarban's rural sections. According to Bangladeshi Department of Environment guidelines, AQI values ranged from 48 in rural Bandarban to a high of 243 in Manikganj's urban region, which indicated very poor air quality. And the air quality status of rural areas is better that the urban areas. It was also found that according to particulate matter concentration and AQIs, the hilly area is a moderately healthy environment. Because of their huge vegetation cover, low density of population, low infrastructure and less industrial revolution. Industrial revolution and urbanization are one of the main reasons for the unpleasant air quality status of urban areas. But day by day, the rural area scenario is also a growing concern. The rural area's status is not good enough to be sustained in a sound and healthy environment. Due to the impacts of increasing motorization and transportation the problem of air pollution is severe in Bangladesh. Particular matter pollution has seriously threatened the health of the people. As compared with the other countries, studied on PM in Bangladesh is still lagging behind. Our nation's government has already taken a number of actions to enhance air quality. In addition, it is necessary to enforce the laws and procedures already in place. And in order to draw firm findings and guide the nation toward a cleaner, more sustainable future, this kind of study is required to be conducted continuously for an extended length of time in more places.

Acknowledgement: The technical inputs of the Laboratory Environmental Science, Bangladesh Agricultural University (BAU), Mymensingh, Bangladesh are acknowledged. Financial support was given by Ministry of Science and Technology (MoST), Bangladesh.

Disclosure statement: *Conflict of Interest:* The authors declare that there are no conflicts of interest. *Compliance with Ethical Standards:* This article does not contain any studies involving human or animal subjects.

References

Afifa, Arshad K., Hussain N., Ashraf M.H., Saleem M.Z. (2024), Air pollution and climate change as grand challenges to sustainability, *Science of The Total Environment*, 928, 2024, 172370, ISSN 0048-9697, https://doi.org/10.1016/j.scitotenv.2024.172370

Alam G. M J. (2009) Environmental Pollution of Bangladesh – It's Effect and Control. *International Conference on Mechanical Engineering*, Dhaka, Bangladesh

Anderson J. O., Josef G. T., Andrew S. (2012) Clearing the Air: A Review of the Effects of Particulate Matter Air Pollution on Human Health, *Journal of Medical Toxicology* 8(2), 166-175.

Bae S., Yun C. H. (2018) Health Effects of Particulate Matter. *Journal of the Korean Medical Association* 155, 242-248.

Bahauddin K., Tariq S. U. (2010) Status of Particulate Matter and Its Impact on Roadside Population of Dhaka City, Bangladesh: A Review Study. *Proc. of International Conference on Environmental Aspects of Bangladesh* (ICEAB10), Japan.

Basak S. B., Tuhin T. R., Uddin M. J., Nipa N. (2024) A quantitative assessment of air particulate matter concentration and its correlation with the climatic factors of Dinajpur city, Bangladesh. *Aust. J. Eng. Innov. Technol.*, 6(3) 79-85. https://doi.org/10.34104/ajeit.024.079085

Begum B. A., Samir K. P., Dildar M. H., Swapan K. B, Philip K. H. (2009) Indoor Air Pollution from Particulate Matter Emissions in Different Households in Rural Areas of Bangladesh. Building and Environment 44(5): 898–903.

Begum B. K, Biswas S. K, Hopke P. K (2008) Assessment of trends and present ambient concentrations of PM2.2 and PM10 in Dhaka, Bangladesh. Air Quality-a auto-Vsphere and Health 1: 125-133.

Cesaroni G., Forastiere F., Stafoggia M., Andersen Z. J., Badaloni C., Beelen R., Peters A. (2014) Long term exposure to ambient air pollution and incidence of acute coronary events: Prospective cohort study and meta-analysis in 11 European cohorts from the escape project. *BMJ (Online)*, 348: 1–16.

Chetouani A., Hammouti B., Salghi R. (2017), Physical-Chemical Study Generated Air pollution and Treated WasteWater, ISBN: 978-3-330-86794-9, Edit Univ. Europ.

Das R.C., Mallick S., Islam M. A., Alam M. A., Tareq M. Z. (2021) Heavy Metal Assessment in Road Soil and nearest Crop Field along Mymensingh to Valuka. *Bangladesh J. Environ. Sci.*, 40, 9-16.

ECR (1997) The Environment Conservation Rules. Government of the People's Republic of Bangladesh. Ministry of Environment and Forest. 205-207.

EPA (Environmental Protection Agency) (2009) Standard operating procedure for the continuous measurement of particulate matter.

EPA (Environmental Protection Agency), (2016) Health and environmental effects of particulate matter (PM).

EPA (Environmental Protection Agency), (2019) Health and environmental effects of particulate matter (PM) Health effects visibility impairment further reading 1-2.

Goshua A., Akdis C. A., Nadeau K. C. (2022) World Health Organization global air quality guideline recommendations: Executive summary, European Journal of Allergy and Clinical Immunology, 77(7). https://doi.org/10.1111/all.15224.

Hasan M., Hossain R. M. A., Sarjana U., Hasan R. (2016) Status of Air quality and survey of particulate matter pollution in pabna city, Bangladesh. *American journal of engineering Research,* 5 18-22.

Hasan R., Islam M. A., Marzia S., Hiya H. J. (2020) Atmospheric Content of Particulate Matter PM2.5 in Gazipur and Mymensingh City Corporation Area of Bangladesh. *International Journal of Research in Environmental Science*, 6(2), 21-29.

Jodeh, S., Hasan, A.R., Amarah, J., *et al.* (2018). Indoor and outdoor air quality analysis for the city of Nablus in Palestine: seasonal trends of PM10, PM5.0, PM2.5, and PM1.0 of residential homes. *Air Qual Atmos Health*, 11, 229–237, https://doi.org/10.1007/s11869-017-0533-5

Manisalidis I., Stavropoulou E., Stavropoulos A., Bezirtzoglou E. (2020) Environmental and Health Impacts of Air Pollution: A Review. *Frontiers in Public Health*, 8. https://doi.org/10.3389/fpubh.2020.00014

Molla M. A. (2019) Air pollution killed 1.23 lakh in 2017. The Daily Star, https://www.thedailystar.net/frontpage/air-pollution-in-bangladesh-killed-1,23-lakh-2017-1724689

Mondol M., Hossain M., Sultana S., Islam M., Biswas P. (2020) Impact of air pollution in Mymensingh city of Bangladesh: focusing peoples' perception. *Progressive Agriculture*, 31(3), 154-163.

Sarker R., Yeasmin M., Rahman M. A., Islam M.A. (2018) People's perception and awareness of air pollution in rural and urban areas of Mymensingh sadar upazila. *Progressive Agriculture*, 29(1), 22-32.

Saxena, P., Sonwani, S. (2019). Primary Criteria Air Pollutants: Environmental Health Effects. In: Criteria Air Pollutants and their Impact on Environmental Health. *Springer, Singapore*. https://doi.org/10.1007/978-981-13-9992-3_3

Sitaras, I.E., Siskos, P.A. (2008) The role of primary and secondary air pollutants in atmospheric pollution: Athens urban area as a case study. *Environmental Chemistry Letters*, 6, 59–69. https://doi.org/10.1007/s10311-007-0123-0

WB (World bank) 1992 The Environment: A New Challenge for GATT. Background paper for World Development Report 1992.

WB (World Bank) 2018: Enhancing Opportunities for Clean and Resilient Growth In Urban Bangladesh, Country Environmental Analysis Report.

WHO (World Health Organization) 2018: Air quality guidelines: WHO, Geneva.