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Spatial distribution of air quality in Netrokona district town, Bangladesh

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Abstract

Air pollution is one of the significant environmental concerning issues in Bangladesh. It has been getting worse at a district level over the past few decades. The main objective of this study was to observe the concentration of Particulate Matter (PM) in Netrokona district town depending on the different uses of land represents. This research was carried out with the assistance of a portable Air Quality Monitor in a total of sixty different places throughout the Netrokona district town. It was revealed that, on average, locations in the district town of Netrokona had particulate matter concentrations (60.97, 99.63, 130.12 μg/m³) respectively. Moreover, averaged $PM_{2.5}$ was 1.53 times fold than Bangladesh's National Ambient Air Quality Standards (NAAQS) level. On the basis of $PM_{2.5}$ concentration, the study demonstrated that three of the most polluted places were located in commercial areas, whereas two of the least polluted places were in sensitive areas. According to estimates, the ratio of $PM_{2.5}/PM_{10}$ was found 76.76%, while the ratio of $PM_1/PM_{2.5}$ was 61.17%. This research ranks land uses by average $PM_{2.5}$ concentration: mixed area> commercial area> road intersection area> residential area> village area> industrial area> sensitive area.

Keywords: Air Pollution; Particulate Matter; Gaseous Pollutant; Concentration; Netrokona District town; Bangladesh

1. Introduction

Air pollution is not only addressed as a major environmental threat but also a huge public health concern for the entire earth [1]. It has gained priority among environmental issues in South Asian countries as well as in other parts of the world because they ranked as the most polluted countries globally [2]. Air pollution is the contamination of physical, chemical or biological changes in the air by harmful gases (CO, CO_2, NO_x, SO_x etc.), dust especially particulate matter and smoke that can affect the human health and the normal activity of animals and plants [3]. Particulate matter, shortly known as PM is a complex mixture of small solid and liquid particles that are able to float in atmosphere, usually determined as aerosol [4]. Several factors such as size, physical and biological properties and chemical composition of particulate matter vary with their location and time [5]. Coarse particles (PM_{10}), fine particles ($PM_{2.5}$), and ultrafine particles ($PM_{0.1}$) are three main group of particulate matter found in the highly polluted air [6]. Sources like any types of constructional work, road dust or natural dust storms and other atmospheric sources are normally responsible for the creation of PM_{10}. The fine and ultrafine particle mainly come from natural and human-made sources such as vehicle exhausts comes from car, truck, bus and off-road vehicles, power plant emissions and other combustion activities that involve the burning of fuels for cooking such as wood, heating oil or coal and natural sources such as forest and grass fires [7]. Other gaseous substances in air specially carbon monoxide (CO) one of the most harmful components. Cooking, generators, automobile exhaust, gas stoves, tobacco smoke etc. acts as the sources of CO emission. CO affects both human and animal health according to its concentration of inhalation which may inhibit oxygen intake in the blood by formatting carboxyhemoglobin [8]. According to a joint study conducted by the World Bank and the Institute of Health Metrics and Evaluation, and based on the country-level populations and pollution data, around 90-92% of the total population of the world, live in regions that surpass the World Health Organization (WHO) guideline (10 μg/m³) for air pollution level. Air pollution is considered to be one of the top ten killers in the world, and sixth in South Asia, according to global burden of disease [9]. Children, old age and diseased people and pregnant mother known as vulnerable group

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can be affected with several disease and difficulties occurred if they are exposed to these PM for a long period of time [10]. People are now suffering from not only respiratory diseases like asthma, lung cancer, chronic obstructive pulmonary disease (COPD), bronchitis etc. but also cardiovascular disease and neurodegenerative disease all around the world because of air pollution [11][12]. According to the findings of the Air Quality Life Index (AQLI), the average person's lifespan in Bangladesh, India, Nepal, and Pakistan could be increased by 5.6 years, if pollution levels decreased sufficiently to satisfy the standards of the WHO [13]. Therefore, over population, urbanization, rapid growth of industrialization, huge number of vehicles etc. all are the responsible for increasing air pollution in district town [14]. Netrokona is one of the rapidly developing cities in Bangladesh. The booming population along with unplanned urbanization, some recent ongoing constructional work and insufficient transportation management system are polluting air in this city [14]. The study was conducted to assess the current ambient air quality, and characteristics of the air pollutants (PM and CO) at the seven land uses in Netrokona District town, preparing Geospatial mapping on the concentration of PM_1, $PM_{2.5}$, PM_{10}, and CO. It is also expected that the study would help to establish future control strategies to generate a pollution free environment in Netrokona district.

2. Material and Methods (Site Selection and Data Collection and Data Analysis)

The investigation is conducted in the 2,744 km² Netrokona District (Mymensingh division) area between 24.934725 and 90.757511. Netrokona is a district in northern part of Bangladesh, along the state of Meghalaya's boundaries. In Netrokona, there are five main rivers: Kangsha, Someshawri, Dhala, Magra, and Teorkhali. The river is an element of the Surma-Meghna River System. During the monsoon, a large portion of the district becomes a haor [15]. Sixty places were chosen on the basis of land usage. After that, we classified each area into one of seven categories based on land use: village area, industrial area, road intersection area, commercial area, mixed area, and sensitive area. A total of nine "sensitive zones" were chosen, including medical facilities, educational institutions, religious buildings, and government offices. on the other hand, mixed areas (9 locations), feature a variety of properties, streets, and other services. The remaining 51 sites included five sites are intersections of roads or the busiest intersections of roads and bends; nine locations are in the industrial sector; twelve sites are in the commercial sector; ten sites are in the village zones. As per of the study, four individual air pollutants: PM_1, $PM_{2.5}$, PM_{10} and CO were collected by using Air Quality Monitor meter (Model: B07SCM4YN3), Handheld Carbon Monoxide Meter and GPS location camera also used. Moreover, IBM SPSS V22 and MS Excel 2020 were used for data analysis. ArcGIS 10.4.1. version for preparing the concentration map of Netrokona district town.

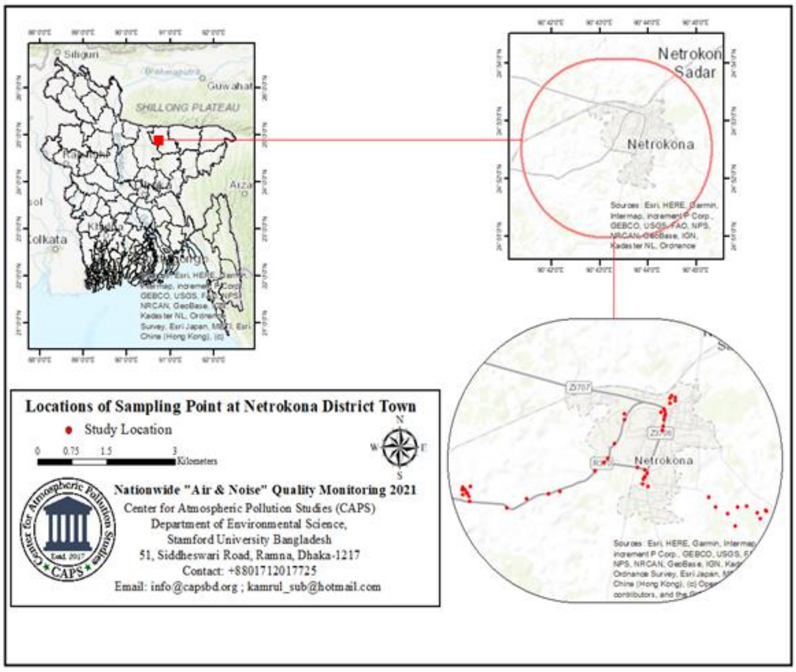

Figure 1 Study Area (Netrokona District Town Area and Data Collection Locations Point).

3. Results and discussion

3.1. Analysis of PM_1, $PM_{2.5}$, PM_{10} and CO on Different areas in Netrokona District

The status of air pollution in Netrokona District was investigated by comparing PM_1, $PM_{2.5}$, PM_{10} and CO data from 60 locations in 7 areas (sensitive, residential, mixed, commercial, road intersection, industrial and village area) as shown in Figure 2 to 9. Figure 2 shows the concentration (µg/m^3) of the PM of some locations in sensitive areas in Netrokona district town. These particular locations included administrative offices, educational institutes and mosques. As we could see, among these 9 sensitive places, three highly polluted places were BADC Farm Jame Mosque, besides Upazila Parishad and DC Office with $PM_{2.5}$ concentration of 80.75, 80.75 and 79.25 µg/m^3 respectively and comparatively less contaminated places were Police Super Office and Nur Mosque with $PM_{2.5}$ concentration of 59.75 and 64.75 µg/m^3 respectively. It was also noted that the concentrations of $PM_{2.5}$ found in the most polluted place was 1.24 times higher than NAAQS level which are 65 set by the Department of Environment (DoE). However, the concentrations of $PM_{2.5}$ and PM_{10} found in the most polluted places were 3.23 and 2.09 times higher than WHO standard level respectively. The Air Quality Standard (24-hour) set by the WHO for $PM_{2.5}$ and PM_{10} are 25 and 50 µg/m^3 respectively. Again, the study estimated that in all sensitive areas, 77.52% of $PM_{2.5}$ was present in PM_{10} and 60.64% of the PM_1 was present in $PM_{2.5}$.

Figure 3 illustrate that among nine site in mixed area, three highly polluted places were Kacari Masjid Market, Choto Bazar Walton and West Choto Bazar with PM concentration of 128.00, 209.50 and 271.75 µg/m^3, 140.75, 231.75 and 299.50 µg/m^3 and 108.50, 173.25 and 227.25 µg/m^3 chronologic µg/m^3 ally and relatively less polluted places were Boro Bazar, Shahidminar Mor and Nagra, Netrokona with $PM_{2.5}$ concentration of 94.75, 95.50 and 97.25 µg/m^3 respectively. It was also noted that the concentrations of $PM_{2.5}$ and PM_{10} found in the most polluted places were 3.22 and 1.82 times higher than NAAQS level. According to the findings of the study, the proportion of $PM_{2.5}$ to PM_{10} was 77.20 percent. Additionally, it was discovered that 61.27% of the mass of PM_1 was present in $PM_{2.5}$. It was further found that among 6 residential places, three highly polluted places were Arambag residential main gate and South Satpai with $PM_{2.5}$ concentration of 98.50 and 85.75 µg/m^3 respectively which demonstrate in figure (4) while comparatively less polluted places were Satpai Nodir Par and Coke Para with $PM_{2.5}$ concentration of 66 and 76.75 µg/m^3 respectively. It was also noted that the concentrations of $PM_{2.5}$ found in the most polluted places was 1.51 times higher than NAAQS level. Nevertheless, the concentrations of $PM_{2.5}$ and PM_{10} found in the most contaminated area were 3.94 and 2.72 times higher than WHO standard limit respectively. So, we can say that the Arambag residential main gate area was more polluted area than any other residential area of Netrokona district area. This situation occurred due to contribution of household air pollution and dust in that area.

Figure 5 demonstrates PM of some locations in road intersection areas where three highly polluted places were Swiper Colony mor, Arambag mor and Akhra mor with $PM_{2.5}$ concentration of 116.75, 99.75 and 99.50 µg/m^3 discretely and relatively less polluted places were Teri Bazar mor and T&T mor with $PM_{2.5}$ concentration of 87 and 83.75 µg/m^3 respectively. It was also observed that the concentrations of $PM_{2.5}$ and PM_{10} found in the most polluted places were 1.79 and 1 times higher than NAAQS level. The study revealed that there was a 75.60 percent $PM_{2.5}/PM_{10}$ ratio within residential areas and a total of 60.57 percent of the mass of PM_1 was discovered to be in $PM_{2.5}$. However, there was an estimated 77.35% $PM_{2.5}/PM_{10}$ ratio and 61.34% PM_1 mass in $PM_{2.5}$ in traffic crossing areas. Figure 6 illustrates PM among commercial areas in Netrokona district town. It has been found that out of 12 commercial places, three highly polluted places were besides Raymond shop (East Choto Bazar), in front of APEX (East Choto Bazar) and main gate Checkup Medical center with PM concentration of 177.00, 288.25 and 374.50 µg/m^3, 154.00, 242.25 and 320.00 µg/m^3 and 131.00, 210.75 and 275.25 µg/m^3 and comparably less polluted places were Polli Biddut Somiti, Parla Bazar and Kiddi kingdom Park with $PM_{2.5}$ concentration of 71.25, 77.00 and 80.50 µg/m^3. It was noticeable that the concentrations of $PM_{2.5}$ and PM_{10} found in the most polluted places were 4.43 and 2.49 times higher than NAAQS level. For commercial areas the study estimated the ratio of $PM_{2.5}/PM_{10}$ was found 77.29%. It was also found that 61.17% of PM_1 mass was present in $PM_{2.5}$.

Figure 7 shows all the locations in Industrial area. Infront of Home Deco, besides the Bismillah Food, and White Star were three of the area's most polluted places with $PM_{2.5}$ particles concentrations of 87, 82.75, and 82.25 µg/m^3 each, whereas Shimu & Saddam Fashion, Khurshed Chemical, and Nobabi footwear were three of the least polluted locations, with $PM_{2.5}$ concentrations of 71, 74, and 77.25 µg/m^3 respectively. The concentrations of $PM_{2.5}$ observed in the most polluted areas was found to be approximately 1.33 times higher than the NAAQS threshold. However, the concentrations of $PM_{2.5}$ and PM_{10} found in the most polluted places were 3.48 and 2.23 times higher than WHO standard level respectively. Figure 8 shows the concentration of PM of polluted locations in village areas in Netrokona district town. It has been discovered that out of 10 village areas, two polluted places were Khatibnoguya-3, Mogra Nodir Par with PM concentration of 48.75, 79.50 and 153.50 µg/m^3 and 57.00, 93.00 and 135.50 µg/m^3 respectively and the less polluted place were Khatibnoguya-1 and Khatibnoguya-4 with PM concentration of 42.50, 70.25 and 90.75 µg/m^3 and 47.00, 77.50 and 100.25 µg/m^3 respectively. Therefore, it was also observed that the concentrations of $PM_{2.5}$ and PM_{10} found in the most polluted places were 1.22 and 1.02 times higher than NAAQS level which are 65 and 150 µg/m^3 set by the DoE. According to the findings of the study, the ratio of $PM_{2.5}$ to PM_{10} was 78.50%. In the industrial zone, there was 61.75 percent of the mass of PM_1 in the $PM_{2.5}$. Once more focusing on rural areas, it was calculated that the ratio of $PM_{2.5}$ to PM_{10} was 73.89 percent. Additionally, it was discovered that 61.47% of the mass of PM_1 was present in $PM_{2.5}$. Figure 9 shows a comparison of the average concentration of carbon monoxide through seven distinct land use categories in the town of Netrokona.

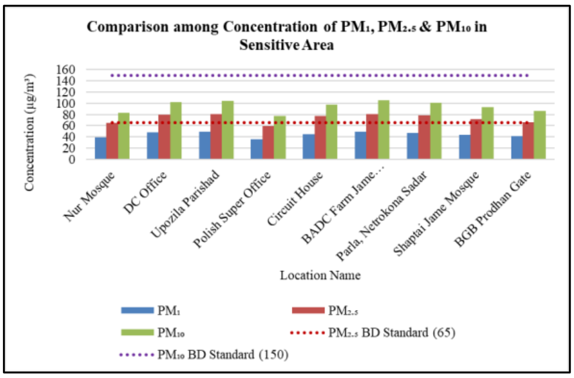

Figure 2 Comparison among Concentration of PM_1, $PM_{2.5}$ & PM_{10} in Sensitive Area

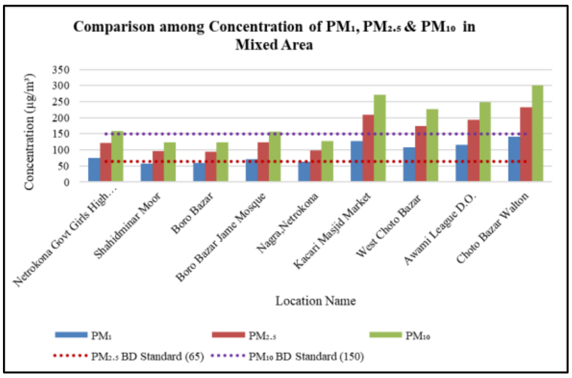

Figure 3 Comparison among Concentration of PM_1, $PM_{2.5}$ & PM_{10} in Mixed Area

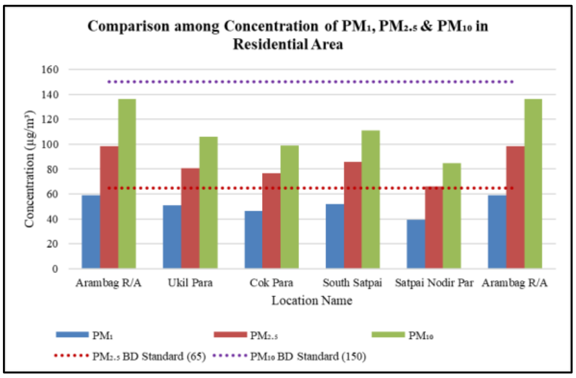

Figure 4 Comparison among Concentration of PM_1, $PM_{2.5}$ & PM_{10} in Residential Area

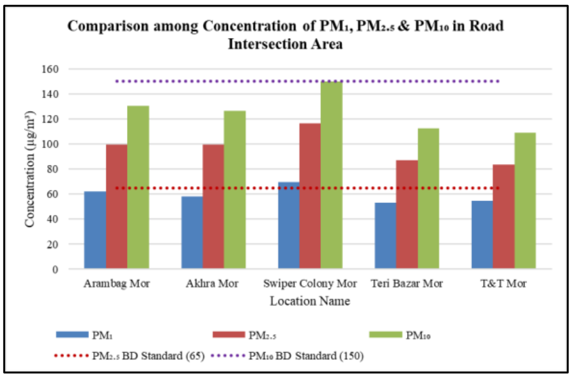

Figure 5 Comparison among Concentration of PM_1, $PM_{2.5}$ & PM_{10} in Road Intersection Area

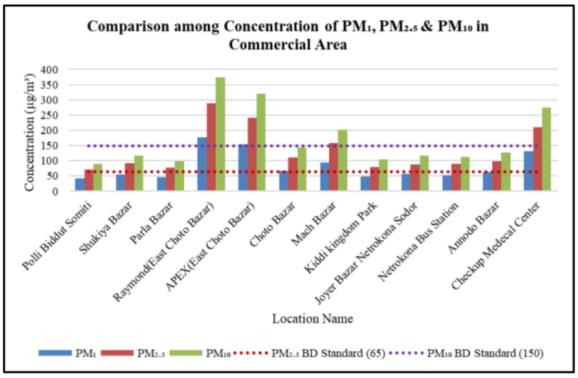

Figure 6: Comparison among Concentration of PM_1, $PM_{2.5}$ & PM_{10} in Commercial Area

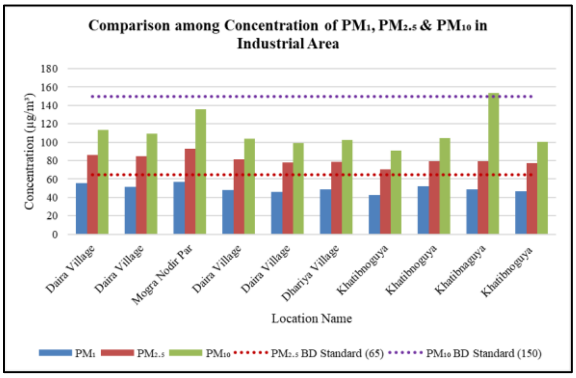

Figure 7: Comparison among Concentration of PM_1, $PM_{2.5}$ & PM_{10} in Industrial Area

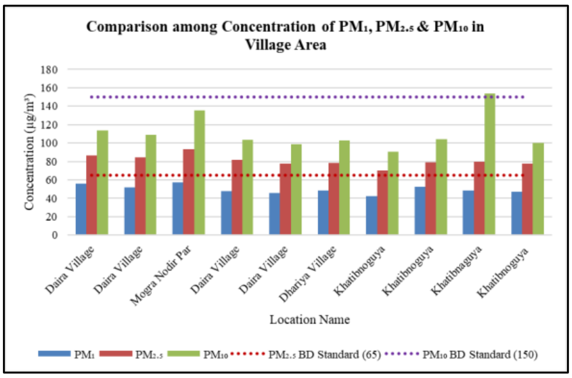

Figure 8: Comparison among Concentration of PM_1, $PM_{2.5}$ & PM_{10} in Village Area

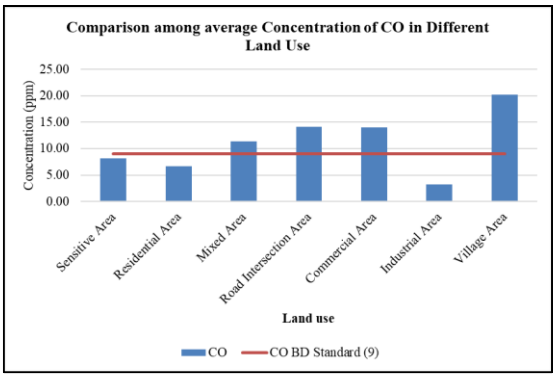

Figure 9: Comparison among average Concentration of CO in Different Land Use

According to the graph, the average concentration of carbon monoxide was found to be highest in the village area (20.20 ppm), followed by the commercial area (14.17 ppm), the road intersection area (14 ppm), and the mixed region (11.33 ppm), all of which had values that were greater than the standard threshold. In addition, the concentration of CO in the most tainted area was 2.24 times higher than the NAAQS level, which was set by the DoE at 9 ppm (8-hour). The burning of coal in brick kilns generate Particulate Matter, Sulphur Dioxide, Oxides of Nitrogen, and Carbon Monoxide [16]. Relatively lower concentration was found in sensitive areas, residential areas, and industrial areas, and it was below the required threshold in any of these areas.

3.2. Dispersion of PM_1, $PM_{2.5}$, PM_{10} and CO

Table 1 Descriptive Statistics for PM_1, $PM_{2.5}$, PM_{10} and CO

S. N.	Name of Land Use	NoL	PM₁ Range (µg/m³) (Min-max)	PM₁ Mean (µg/m³)	PM₁ Std. Deviation (µg/m³)	PM₁ Coefficient of Variation (%)	PM2.5 Range (µg/m³) (Min-max)	PM2.5 Mean (µg/m³)	PM2.5 Std. Deviation (µg/m³)	PM2.5 Coefficient of Variation (%)	PM10 Range (µg/m³) (Min-max)	PM10 Mean (µg/m³)	PM10 Std. Deviation (µg/m³)	PM10 Coefficient of Variation (%)	CO Range (ppm) (Min-max)	CO Mean (ppm)	CO Std. Deviation (ppm)	CO Coefficient of Variation (%)
1.	SA	9	13.3	44.3	4.7	10.5	21.0	73.1	7.9	10.8	2.5	94.3	10.0	10.6	21	8.2	8.2	99.7
2.	MA	9	82.5	91.0	32.3	35.4	137.0	148.9	53.6	36.0	176.0	192.8	69.3	35.9	24	11.3	7.4	65.4
3.	RA	6	19.5	51.1	7.5	14.8	32.5	84.4	12.7	15.1	51.5	112.2	20.6	18.4	9	6.7	3.3	49.9
4.	RIA	5	16.8	59.6	6.7	11.3	33.5	97.4	13.0	13.4	40.8	125.8	16.2	12.9	31	14.0	13.0	92.7
5.	CA	12	135.0	82.2	46.3	56.4	217.0	133.7	73.8	55.2	283.8	173.6	97.0	55.9	56	14.2	15.1	106.3
6.	IA	9	11.5	48.9	3.6	7.3	16.0	79.1	4.9	6.3	29.5	101.0	8.6	8.5	9	3.2	3.3	102.7
7.	VA	10	14.5	49.7	4.5	9.0	22.8	80.9	6.1	7.5	62.8	111.2	19.0	17.1	92	20.2	28.3	140.2

SA-Sensitive area, MA-Mixed area, RA-Residential area, RIA- Road Intersection Area, CA-Commercial area, IA-Industrial area, VA- Village area and NoL-Number of Locations.

The above table 1 shows the descriptive statistics for PM_1, $PM_{2.5}$, PM_{10} and CO of the studied seven land uses. The highest range was found in commercial area (135, 217 and 283 µg/m³) for PM but village area (92 ppm) for CO. However, the lower ranges were found in industrial area (11.50 and 16 µg/m³) for PM_1 and $PM_{2.5}$ and for PM_{10} sensitive area was found lowest land use. For CO the lowest value was same in the residential area and industrial area which was 9ppm. Among all those land uses the highest mean value of the PM was found in mixed area (91, 148.89 and 192.81 µg/m³) and lowest was found in sensitive area (44.33, 73.14 and 94.33 µg/m³) and the highest mean value of CO with same value in commercial area (14.17 ppm) and road intersection area (14 ppm) and lowest mean was found in industrial area (3.22 ppm). Table also revealed the highest standard deviation and coefficient of variation was seen in commercial area for the PM and the lowest was seen in village area for CO. The whisker box plot shows the average of PM and CO concentrations in seven land uses.

A horizontal black line within the box marks the median; the lower boundary of the box indicates the 25th percentile, the upper boundary of the box indicates the 75th percentile. The whisker represents the maximum (upper whisker) and minimum value (lower whisker) for each land use. Points above the whiskers indicate outliers. Following whisker box plot of PM revealed that the commercial area and the mixed area had similar dispersed concentrations whereas the commercial area had the highest dispersion with positively skewed values. PM_{10} revealed that village areas and the industrial areas had compact concentrations. Here positive distribution was seen in industrial areas, and village areas with one closer outlier in industrial area and two closer outliers in village area. However, the residential area, road intersection area, sensitive area, village area, and industrial area had compact concentrations. Whisker box plot of CO revealed that village area had the highest dispersed concentration with positive skewness and had one distant outlier. Commercial area and sensitive area had moderate dispersion where positive skewness was seen in commercial area and negative was seen in sensitive area with one closer outlier. Industrial area was found less dispersed concentration with extremely negative values. However, the road intersection area and residential area had intensive concentration with one closer outlier in road intersection area with extremely positive values. Values were normally distributed in mixed and residential area but extremely positive in road intersection area and extremely negative values.

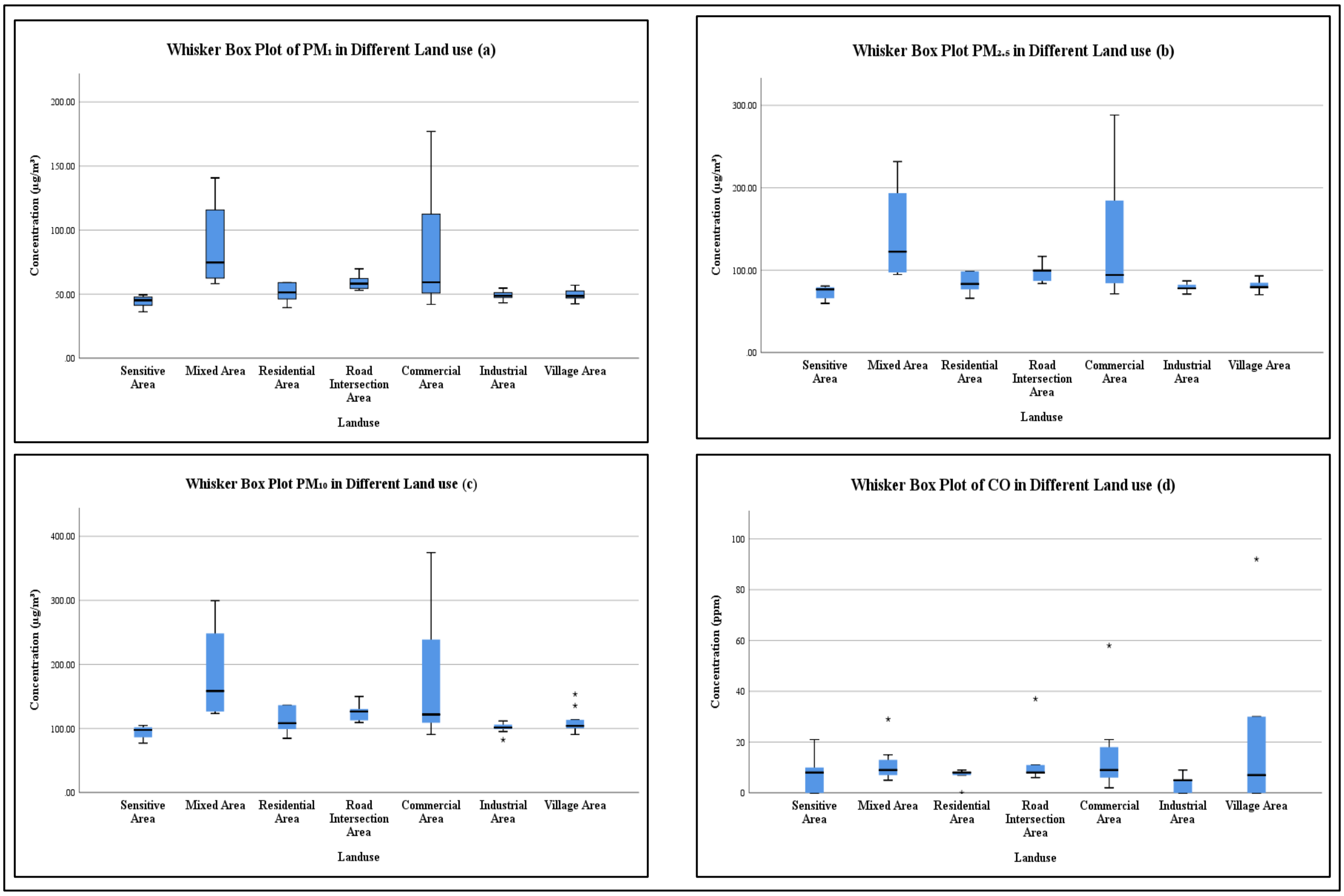

Figure 10 Whisker Box Plot of the Concentration of PM_1, $PM_{2.5}$, PM_{10} and CO in Different Land use

3.3. Significance Test

Table 2 shows Analysis of Variance (ANOVA) for the significant test. ANOVA has been performed to find whether the changes in the concentration of all the parameters between and within land uses are significant. Here the F value was found to be 5.128 for PM_1, 5.227 for $PM_{2.5}$, 4.851 for PM_{10} and 1.326 for CO. P value are 0.00 for PM_1 and $PM_{2.5}$ and

0.001 for PM_{10} and 0.262 for CO. The following tables revealed that the concentrations of parameters change significantly except CO as the p value is greater than 0.05. Therefore, the concentration of PM might change significantly between and within the land uses because p value less than 0.05.

Table 2 Significance Test

ANOVA						
		Sum of Squares	***df***	***Mean Square***	***F***	***Sig.***
PM_1	Between Groups	19072.954	6	3178.826	5.128	.000
	Within Groups	32853.183	53	619.871		
	Total	51926.136	59			
$PM_{2.5}$	Between Groups	50536.174	6	8422.696	5.227	.000
	Within Groups	85396.029	53	1611.246		
	Total	135932.203	59			
PM_{10}	Between Groups	82236.326	6	13706.054	4.851	.001
	Within Groups	149741.402	53	2825.309		
	Total	231977.728	59			
CO	Between Groups	1727.139	6	287.856	1.326	.262
	Within Groups	11505.711	53	217.089		
	Total	13232.850	59			

3.4. Land Use Based Cluster Analysis

Figure 11 shows the dendrogram plot obtained from cluster analysis in terms of PM_1, $PM_{2.5}$ and PM_{10} with Z-score normalization. For this analysis average linkage between groups has been considered. At very primary level two clusters have been found from the graph below. First cluster is consisting of industrial area, village area, residential area and sensitive area; and second cluster includes mixed area and road intersection area. The commercial area individually joined with the first cluster at the approximate distance of 1. This grouping joined with second cluster at the approximate distance of 25. However, two clusters have been found from the dendrogram for CO. Where first cluster consists of road intersection area and commercial area; second cluster includes sensitive area and residential area. The mixed area and village area joined with the first cluster individually at the approximate distance of 1and 3 respectively and industrial area alone joined with second cluster at the approximate distance of 5. These two broad clusters joined at the approximate distance of 25.

3.5. Concentration Map on PM_1, $PM_{2.5}$, PM_{10} and CO of Netrokona District Town in 2021

Figure 12 (a, b and c) shows the concentration of Particulate Matter (PM) at various locations of Netrokona district town in the year of 2021. Concentrations of Particulate Matter (PM) are expressed in $\mu g/m^3$. The concentration of $\mu g/m^3$ means one-millionth of a gram of PM_1, $PM_{2.5}$ and PM_{10} per cubic meter of air. Yellow areas have less, while progressively higher concentrations are shown in orange and red. The concentration of PM was found to higher in the east Choto Bazer area, Medical Center area, Kacari Masjid Market and West Choto Bazar locations. Three least contaminated locations in map were found Police Super Office, Nur Mosque and BGB Prodhan Gate locations. The maximum concentration is shown with red flag and minimum concentration with green flag. The top maximum concentration was found in east Choto Bazar mor and the least concentration was found in Police super office area. In the year 2021, the concentration of carbon monoxide is shown in figure 12 (d) at a number of different locations throughout the Netrokona district town. Parts per million by volume (ppm) is the unit of measurement that is used to express the concentration of carbon monoxide. A concentration of 1 ppm indicates that one carbon monoxide molecule exists for every million gas molecules in the measured volume. Yellow areas have little or no carbon monoxide, while progressively higher concentrations are shown in orange and red. Higher CO concentrations (30-92 ppm) were discovered in the Dhariya area, Choto Bazar, T&T Moor, and Khatibnoguya. The flag-colored red indicates the greatest concentration, while the flag-colored green indicates the lowest possible concentration. Dhariya village had the highest maximum concentration, while Nur mosque had the lowest concentration.

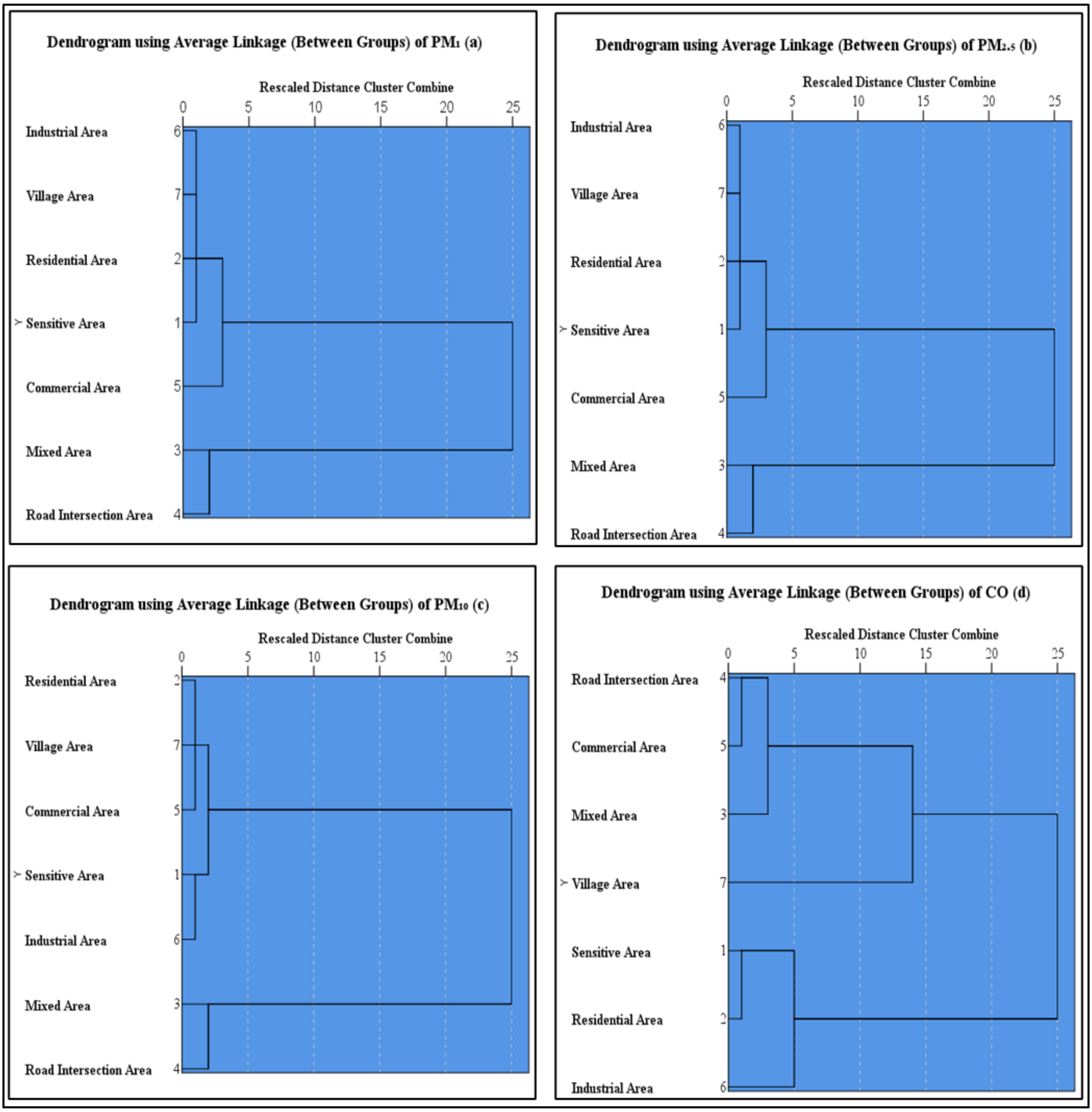

Figure 11 Land Use Based Cluster Analysis for PM_1, $PM_{2.5}$, PM_{10} and CO

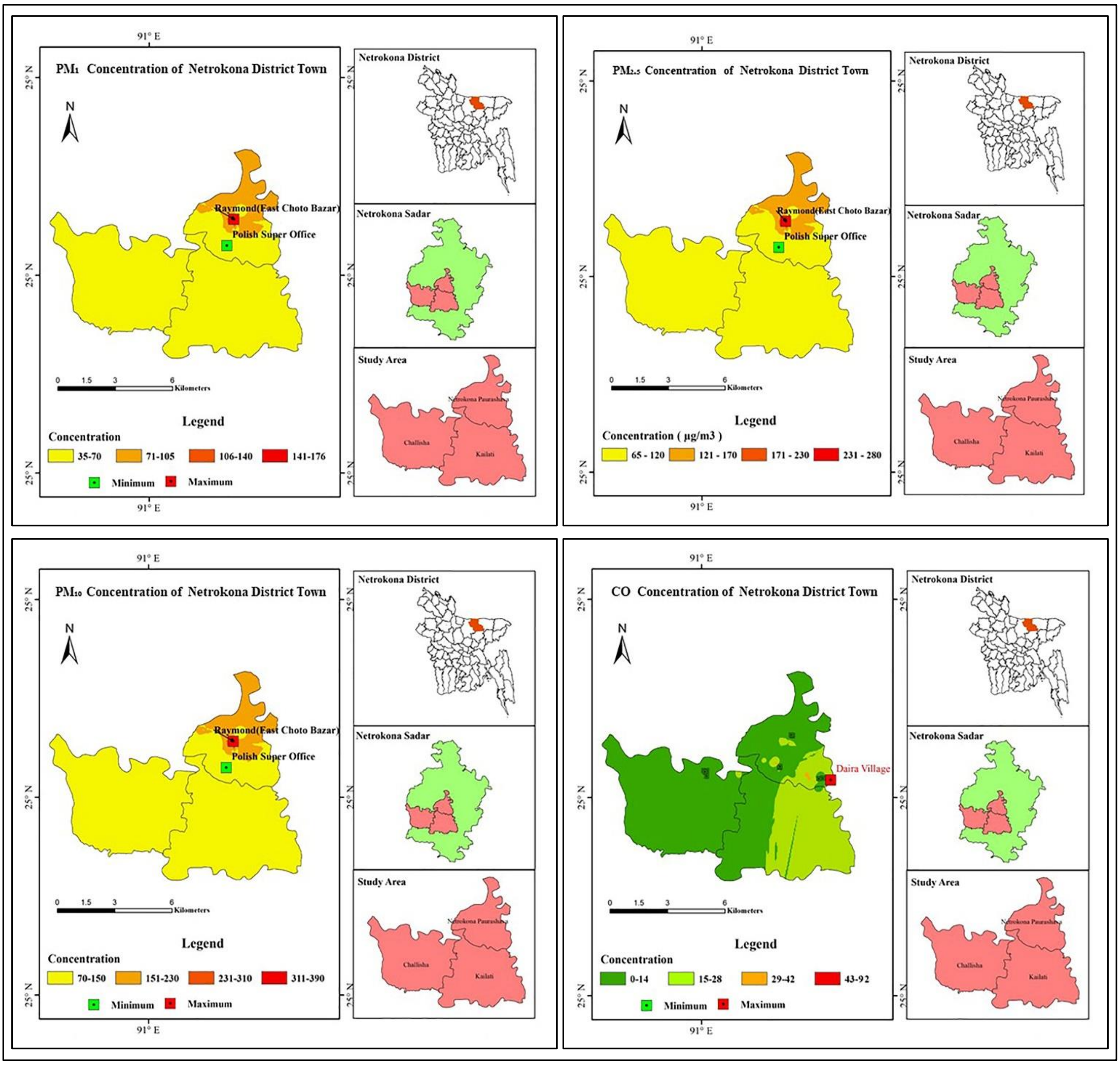

Figure 12 Concentration Map of PM_1, $PM_{2.5}$, PM_{10} and CO in Netrokona District Town

4. Conclusion

Study found that the average concentration of PM_1, $PM_{2.5}$ and PM_{10} of 60 places in Netrokona district town were 60.97, 99.63 and 130.12 µg/m^3 respectively. Therefore, the average concentration of PM_1, $PM_{2.5}$ and PM_{10} was higher in the mixed area and commercial area with the values of 91.00, 148.89 and 192.81 µg/m^3 and 82.21, 133.73 and 173.56 µg/m^3 respectively with the highest being in the mixed area. It was also observed that the concentrations of $PM_{2.5}$ and PM_{10} found in the most polluted land use were 2.29 and 1.28 times higher than NAAQS level. The concentration of PM found were relatively lower in road intersection area, village area, residential area, industrial area and sensitive area. Moreover, the average concentration of PM_1 (44.33 µg/m^3), $PM_{2.5}$ (73.14 µg/m^3) and PM_{10} (94.33 µg/m^3) were found to be the least in sensitive area. From the dendrogram plot of PM_1, $PM_{2.5}$, PM_{10} it has been found out that each of the analysis included at least four clusters at the first phase and these were consecutively to make a single cluster at the approximate distance of 25.

Recommendations

Particulate matter (PM) among other particulate pollutants is a significant issue since its rate of suspension is greater and it has detrimental effects on plants, animals and human health and causes soiling of buildings and reduces the visibility of material etc. (17). Dust pollution, a part of air pollution, not only contributes to health problem but also environmental and financial issues. If this loss is taken into account with other issues like global warming, deterioration in the aspect of beauty, staining of material, and traffic congestion, the sum amount would be much greater (18). To reduce air pollution, the existing rules must be imposed in more comprehensive, regular, and extensive manner. Scientifically managing traffic in urban areas, will aid in reducing fuel consumption by motor vehicles. The authority should have taken some earlier steps to make the city clean. Continuous functioning air-monitoring station should be established which will be operated by skilled individuals using modern equipment and monitoring strategy developed by the government. Also, people need to concern about air pollution, which can reduce the number of pollutants in our daily life.

Compliance with ethical standards

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