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A Study of Traffic Related Air Pollution at Dindigul District, Tamil Nadu, India

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ABSTRACT

Air pollution has emerged as one of the challenging problems before mankind in the past few decades. With rapid rise in population, industries and automobiles the air pollution has become a major environmental problem in the modern world. Sulphur dioxide and oxides of nitrogen concentration at Dindigul district are for residential areas were well below the prescribed permissible standard. Suspended Particulate Matter concentration exceeded standard very often in Dindigul district. From the air quality index values of the stations such as residential, Traffic cum commercial and industrial areas under investigation, it is clear that the ambient air in Dindigul district is fairly clean especially near the residential area. Traffic cum commercial and industrial areas was more polluted which may be due to heavy vehicular movement as well as population. An air quality index may be calculated and reported to the public on a daily basis. More stringent measures should be taken to control vehicular and industrial pollution. Source studies of SPM may be carried out to ascertain the sources and put up relevant control measures in place.

1. Introduction

Air pollution is being exacerbate by four specific events namely rapid economic development, high levels of energy consumption, expansion of cities and increase in automobiles traffic that typically occur as countries industrialization [5]. An unplanned, instructed and unzoned growth of both industrial and residential areas, as happened with many cities of the developed and developing world, has further enhanced the air pollution problems. Transportation is the major source of air pollution in metropolitans' cities. Among the various pollutants emitted from vehicles Respirable Particulate Matter (RPM) and Suspended Particulate Matter (SPM) are the primary pollutants and are harmful to human being [2].The road condition is also responsible for producing RSPM and SPM. The number of vehicles is increasing every year which in turn create severe air pollution problems and expose threat to human life and health [3,4]. The overall assessment of the air quality can provide useful insights for the development of the air quality management plan and generated data base which are at present affected by high levels of particulate matter which are responsible for noncompliance against air quality standards [8]. The data base also helps the regulatory agencies to identify locations where the natural resources and human health could be at risk.

2. Experimental Methods

2.1 Description of Location

The main pollutants present in the ambient air of Dindigul town are; SO_2, NO_X and SPM. The samples were collected in different category and are given in Table 1. To monitor these pollutants, different types of analyzers are available. A general rule, only proven and generally accepted measurement methods and instrument should be used in monitoring studies.

The samples were collected bimonthly for one year. The parameters monitored for ambient air quality are SO_2, NO_X, SPM and RSPM.

Table 1 Sampling Sites, Collection of samples and analysis

Site No.	Site	Location Description	Category
1.	Thomaiyarpuram	Tanneries, Small scale industries	Industrial (Tannery area)
2.	Dindigul Bus stand	Traffic, hotels, shopping complex, theatre, commercial complex, market	Commercial cum Traffic
3.	Lakshmanapuram	Residential areas of lower and middle classes, small shops	Residential

2.2 SO_2, NO_X and SPM

SO_2 and NO_X were collected on 4 hourly basis for 24 hrs by drawing air flow at 1 L/min through potassium tetrachloromercurate and sodium hydroxide as an absorbing solutions respectively. SO_2 was determined by west gaeke spectrophotometric method (Standard method for air sampling and analysis) and NO_X was determined by Jacob Hoch Heiser spectrophotometric method. Atmospheric air is drawn through preweighed glass fiber filter paper, GF/A at a flow rate of 1.4-1.5 m^3/min on 8 hourly basis for 24 hrs. SPM is calculated by taking the difference between initial and final weight of the filter paper and total volume of the air drawn during sampling.

2.3 Vehicular Population

Vehicle count was also carried out and the vehicles were grouped into the following categories (i) cars and jeeps (both LPG and CNG/Non-LPG or CNG) (ii) two wheelers (iii) buses and (iv) three wheelers (both LPG or CNG/Non-LPG or CNG) [1]. The vehicular count was carried out simultaneous to the air quality monitoring covering peak traffic period.

2.4 Air Quality Index

Based on the observed concentrations, a simple air quality index based on the AQI [7,9,10] was calculated. The simple formula to compute index was a given below,

$$I = KI*CI$$

Where I= Index calculated, CI= Observed concentration of pollutant.

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The geometry mean of the quality rating calculated for each pollutant is considered as air pollution index. The air pollutant index has got a scale of below 10 (very clean) and above 125 (severely polluted) with 25 unit interval.

3. Results and Discussion

The vehicular population moving during the monitoring period is compiled in the following Table 2. Air pollutants such as SOx and NO_X concentrations measured in the residential, traffic and industrial areas are given in the Table 3. From the results, the following interface is drawn. It is found that the concentration of SPM pollutants is particularly high in the industrial as well as traffic cum bus stand area as compared to residential area.

Table 2 Vehicle movement census at stations in Dindigul district

Location	Buses	Two wheelers	Cars		Autos	
			LPG	NON-LPG	LPG	NON-LPG
Residential	110	400	30	200	45	27
Traffic cum bus stand	230	633	85	520	159	69
Industrial	160	551	65	170	22	15

This can be accounted for by the fact that it is a developing area and construction activities abound in the region, leading to the high SPM values. Another reason could be the excess of road dust might have a significant contribution to the SPM concentration. It is clear that the concentration SO_2, harmful pollutant, is well below the permissible standard of 80 μg/m^3. This has happened because of the regular revision and improvement of pollution control measures and various management aspect carried out by CPCB.

It can be seen that though the NO_X concentration of this pollutant is higher than that of SO_2, it is still well below the permissible standard. Fuel quality specifications are also phasing out of old commercial vehicles and leaded petrol has led to decreased pollution in recent years. With introduction of LPG and CNG as an alternative fuel and steps taken in recent years to control vehicular emissions might lead to cleaner air in the future in Dindigul as well as total air pollution would not be as menacing as it today.

Table 3 Air quality index calculated for the monitored locations

Location	Quality rating			AQI	Category
	NO_X	SO_2	SPM		
Residential	10.3	2.5	460.2	24.3	Clean
Traffic cum bus stand	20.5	6.8	550.2	41.6	Moderately polluted
Industrial	18.2	6.7	667.2	40.3	Fairly clean

An air quality index has been calculated for the various areas, depending upon the observed concentrations of the pollutants monitored. The air quality categories based on the index values are given in Table 3. Though SPM values are high at all the locations during most of the monitored sites, the air quality index has indicated a fairly clean environment in the residential area. Some of the other ways of calculating air quality index have been reported [6]. From the AQI values of the areas, it is clear that ambient air in Dindigul district is fairly clean especially near the residential area. This trend is reflected in the periodic concentration plotted in Fig. 1. For SO_2, NO_x and SPM, there is a distinct pattern matching to the vehicular movement with the air quality in the area. Unlike the air quality clean in the residential area, the vehicular count as well as the air quality is high in traffic area and is a matter of concern.

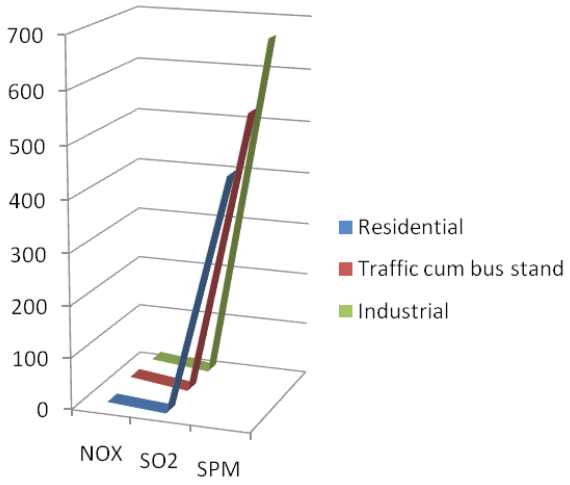

Fig. 1 Air quality rating at different stations in Dindigul district

4. Conclusion

SO_2 and NO_x concentrations at Dindigul were well below the permissible standard limit in the residential area as permitted by the CPCB. SPM concentration exceeded the standard very often for the Dindigul district. Based on the air quality index this is due to the heavy vehicular pollution observed from the vehicle census. Based on the above conclusion, the following recommendations are suggested. An air quality index calculated and reported to the public on a daily basis. More stringent measures should be taken to control vehicular and industrial pollution source. The problem of SPM can be checked by easing out of tempos and replacing them with more efficient and ecofriendly mass transport service. To control the pollutant plant of better filtering ability should be planted.

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