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OUT DOOR AIR QUALITY AND HEALTH EFFECTS: A CASE STUDY

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Abstract

Outdoor air pollution affects several aspects of the environment and economy, but most importantly, human health, and so the investigations on the status of outdoor air quality and the health of the inhabitants in Indian urban areas are imperative. In this connection, gaseous and particulate pollution is estimated by adopting CPCB (Central Pollution Control Board) standard methods and primary health data is collected from the residents by questionnaire technique at three selected areas in Madurai city. At one of the chosen sites, blood lead concentrations of the inhabitants is also measured. The impact of air pollution on human health is assessed and it can be concluded that inflexible execution of pollution abatement measures is inevitable to safeguard the health of the people of this city.

INTRODUCTION

Urban air pollution has immediate and long-term implications for the health of the population and for the physical environment (Gerald E. Streit et.al., 1996). Interest in ambient concentrations of gaseous and particulate pollutants has increased over recent years because of a great concern, mainly over the health effects of these pollutants (Sinn, W., 1980, Chamberlain, A.C., 1983). In this connection, the present investigation is carried out not only to appraise the status of ambient air quality at three selected sites in Madurai, which is the second largest and most densely populated city of the state Tamil Nadu, but also to assess the health level of the public by means of primary and secondary health data and the lead concentrations from the human blood samples.

MATERIALS AND METHOD

Madurai city, 450 km from Chennai in a south direction, is the second largest and the most densely populated city in Tamil Nadu with an estimated population of about 1.2 million as per census 2001 and has a surface area of 52.4 km^2 (Shahul Hameed, K., 2001). In the last twenty years population shifts, increased over-all industrialization, trade and commerce have resulted in an increase of vehicular population in Madurai city. This

temple city attracts a large number of pilgrims from other parts of the country and abroad. Besides electro-plating plants, foundries, brick industries and a large number of small plants producing a verity of other products, there are two major rubber industries and one textile complex in Madurai city. The growing number of automobiles and small industries are now posing a threat to the air environment of the city.

Eight hour air samples were collected using a commercial high volume air sampler (Envirotech APM 410-411) from three representative stations of the city namely 1.Periyar bus stand 2.Palangantham and 3.Goripalayam. Monitoring was carried out once in a week at all these sampling sites during the winter season. CPCB (Central Pollution Control Board) recommended standard methods that were adopted to estimate both the gaseous and particulate pollutant concentrations (CPCB, 1997). During the time of sampling, the meteorological parameters, namely temperature, wind velocity and humidity were simultaneously recorded on a half hourly basis. Weather conditions were also recorded. By the by, blood samples were collected from the residents as well as shopkeepers at one of the sampling sites, where the highest concentration of air pollutants were recorded. The blood lead concentrations were estimated by adopting the AAS method (Varian Spectra 220). While the estimated pollutant concentrations and observed atmospheric conditions are recorded in Table 1 and Table 2 respectively, the lead concentrations in the blood samples of residents (men), residents (women), shopkeepers (men) and shopkeepers (women) are presented in Table 3, Table 4, Table 5 and Table 6 respectively. The health status of the habitants at the sampling sites was studied using hospital records as well as the collected database through a detailed questionnaire, which included mainly the bio information, personal habits, details of indoor and outdoor air pollution sources and effects of air pollution on their health. While the hospital records showed that the number of patients affected by air pollution related diseases constituted about 27% of the total number of patients, the collected database through questionnaire revealed that 42% of the respondents endured the effects of air pollution.

RESULT AND DISCUSSION

It is observed from table 1 that the NO_2 ranges between 21.8 and 69.7 $\mu g/m^3$, SO_2 varies from 16.9 to 30.2 $\mu g/m^3$, SPM has a minimum of 190.3 $\mu g/m^3$ and maximum of 330.5 $\mu g/m^3$ and lead ranges between 0.48 to 0.89 $\mu g/m^3$. It should be pointed out here that all the pollutants are within the permissible limits set by the Central Pollution Control Board. As all the sampling stations of the present concern are traffic areas, the recorded concentrations may be mainly attributed to vehicular traffic. In addition, background concentrations from the industries and the emissions from the residential and commercial activities may contribute to their own extents in polluting this atmosphere. As the sampling period falls in winter season, accumulation of gaseous pollutants may be one of the reasons for the recorded concentrations. The estimated lead concentrations in the blood samples of the male residents have the minimum of 12.5 $\mu g/dL$ and the maximum of 40.5 $\mu g/dL$, whereas the female residents have 12.6 $\mu g/dL$ and 29.2 $\mu g/dL$ as the minimum and maximum values respectively. The estimated concentration of the male shopkeepers ranges between 12.9 and 37.2 $\mu g/dL$, whereas the female shopkeepers have 10.4 $\mu g/dL$ and 25.3 $\mu g/dL$ as the minimum and maximum values respectively. The

permissible limit of blood lead concentration of adults is 25 µg/dL as per WHO standards. It is studied from the present investigation that some of the residents and shopkeepers endure more lead concentration than this admissible limit. It is difficult to find out the exact correlation between the parameters such as age, daily hours of stay and period of stay and the blood lead concentrations of the inhabitants from the present database. It is worth mentioning here that the blood levels are influenced by the uptake from respiration as well as ingestion of water and food, and in this work concentrations of lead from the later two sources are not investigated. So, no direct associations can be revealed between the ambient air and blood lead concentrations in the present investigation. However, it can be concluded that inflexible execution of pollution abatement measures is inevitable to safeguard the health of the people of this city.

Table: 1 Estimated concentrations of pollutants

Sl.No	Sampling site	SO_2 ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	SPM ($\mu g/m^3$)	Pb ($\mu g/m^3$)
1	Goripalayam	27.8	66.8	330.5	0.89
2	Periyar	30.2	69.7	286.8	0.69
3	Palangantham	16.0	21.8	190.3	0.48

Table: 2 Observed atmospheric conditions

Sl. No	Sampling site	*Mean Solar insolation* (W/m^2)	Mean Temperature (^0C)	Mean Relative humidity (%)	Mean Wind velocity (m/sec)
1	Goripalayam	593	28.4	61.2	2.2
2	Periyar	389	26.2	68.5	2.2
3	Palangantham	542	24.4	62.9	1.8

Table: 3 Lead concentrations in blood samples of residents (Men)

Sl.No	Distance from the road (m)	Age (year)	Smoker/Non smoker	Daily hours of Stay	Period of stay (years)	Concentration of lead (µg/dL)
1.	13	38	Smoker	12	5	26.2
2.	12	22	N.S	10	2	24.5
3.	8	26	N.S	10	9	24.5
4.	10	38	N.S	8	12	17.0
5.	20	39	N.S	8	9	16.0
6.	12	33	Smoker	8	6	37.5
7.	18	20	N.S	8	3	14.0
8.	24	35	N.S	8	3	40.5
9.	24	40	N.S	12	10	24.0
10.	22	25	N.S	12	5	39.0
11.	24	34	N.S	9	3	29.5
12.	23	23	N.S	7	5	15.5
13.	22	22	N.S	3	9	12.5
14.	22	22	N.S	6	6	12.5
15.	12	27	N.S	10	10	17.5

Table: 4 Lead concentrations in blood samples of residents (Women)

Sl.No	Distance from the road (m)	Age (years)	Daily hours of stay	Period of stay (years)	Concentration of lead (µg/dL)
1	10	22	2	1.6	11.24
2	11	23	12	2	15.20
3	14	25	12	5	20.3
4	11	27	24	2	14.20
5	19	28	12	3	19.2
6	21	29	24	4	17.5
7	15	22	12	2	12.6
8	20	22	10	2	29.2
9	15	26	8	8	18.3
10	19	23	12	2	20.5
11	20	24	10	4	21.1
12	23	22	8	5	19.9
13	19	23	12	3	20.4
14	18	27	11	4	16.3
15	17	32	8	7	20.3

Table: 5 Lead concentrations in blood samples of shopkeepers (men)

Sl.No	Distance from the road (m)	Age (year)	Smoker/non smoker	Daily hours of Stay	Period of stay (years)	Concentration of lead (µg/dL)
1.	8	28	Smoker	8	3	15.3
2.	10	25	N.S	10	1	31.3
3.	11	27	Smoker	8	7	29.5
4.	15	21	Smoker	11	6	37.2
5.	20	23	Smoker	10	1	25.6
6.	18	26	N.S	12	2	23.5
7.	17	21	N.S	12	5	16.5
8.	27	20	N.S	9	5	20.1
9.	21	25	Smoker	10	8	21.5
10.	12	22	Smoker	10	2	21.7
11.	21	27	N.S	12	7	19.5
12.	19	20	N.S	9	3	18.5
13.	22	25	Smoker	10	2	20.4
14.	20	24	N.S	10	8	19.3
15.	18	33	N.S	10	9	12.9

Table: 6 Lead concentrations in blood samples of shopkeepers (Women)

Sl.No	Distance from the road (m)	Age (Year)	Daily hours of stay	Period of stay (years)	Concentration of lead (µg/dL)
1	21	31	8	12	16.2
2	18	19	10	5	20.1
3	10	20	8	6	25.3
4	11	21	8	8	20.3
5	19	23	10	2	19.2
6	17	24	8	4	18.2
7	18	20	8	2	18.6
8	19	20	9	3	19.2
9	22	24	10	1	11.2
10	24	20	8	5	12.3
11	26	20	8	7	13.5
12	24	19	10	5	12.2
13	27	21	9	10	10.4
14	25	21	10	7	19.3
15	17	29	8	3	13.9

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