ABSTRACT

Vehicular emissions are of particular concern since these are ground level sources and thus have the maximum impact on the general population. Also, vehicles contribute significantly to the total air pollution load in many urban areas, increase in consumption patterns and higher demands for transport, energy and other infrastructure, thereby leading to pollution problems. The air pollutants can be divided into two groups: the traditional Major Air Pollutants (MAP, comprising of sulphur dioxide, nitrogen dioxide, carbon monoxide, particulates, lead and the secondary pollutant ozone) and the Hazardous Air Pollutants (HAP, comprising of chemical, physical and biological agents of different types).

Coimbatore city is the second largest city in Tamilnadu. The city has six major arterial roads and three National Highways. Most of the textile industries are situated in Coimbatore. There are about 40,000 small, medium and large scale industries in the city. Due to industrialisation and urbanisation the city’s air quality is worsening. The ambient air quality of Coimbatore has deteriorated with an increase in the number of vehicles and industrial pollution. It has been found that in some areas the levels of suspended particulate matter and respirable particulate matter are higher than the limit prescribed by the World Health Organization (WHO), being 200 μg/m³ and 35 μg/m³ respectively.

In this research 25 air quality monitoring stations were carefully selected in Coimbatore city based on the traffic count, nature of traffic, busy
road intersections with traffic signals having maximum vehicle idling time, traffic congestion and nearness to commercial & industrial places. The stations were selected in the heart of the city, residential areas, industrial areas and outskirts of the city along the main intersections covering the entire city. The measurements of wind speed and its direction, temperature, humidity, rainfall and solar radiation are important parameters used in the study of air quality monitoring results and to further understand the chemical reactions that occur in the atmosphere. High volume sampler was used for collecting the air samples and analysis was done in the laboratory for Total suspended Particulate matter (TSPM), respirable particulate matter (RPM), sulfur dioxide (SO₂), Nitrogen oxides (NOx) and carbon monoxide (CO). Periodic data collection of the air pollutant concentrations were carried out. Regression analysis has been done to establish the effect of the meteorological parameters with the concentration of air pollutants. Traffic survey was also carried out. Response surface methodology (RSM) was adopted to find out the influence of the meteorological factors on the concentration of the air pollutants.

Air quality dispersion models consist of a set of mathematical equations that interpret and predict pollutant concentrations due to plume dispersion and impaction. These models incorporate the dispersion estimates and various meteorological conditions including temperatures, wind speeds, stabilities, and topography. The stability of the atmosphere depends on the temperature difference between an air parcel and the air surrounding it. These stability classes are referred to as Pasquill-Gifford stability classes. Considering the traffic and meteorological data the pollutants were modelled
using the following Line source Models: General Finite Line Source Model (GFLSM), Indian Institute of Technology Line Source Model (IITLS), Delhi Finite Line Source Model (DFLSM), and CALINE4 model. The observed data were compared with the modelled data. It was found that the predicted results of DFLSM model was close to the observed data.

Air Quality Management System (AQMS) can be defined as a regulation of the amount, location and time of pollutant emissions to achieve some clearly defined set of ambient air quality standards or goals. Data sets created and organized under a Geographical Information System (GIS) generate a comprehensive and accurate solution. Moreover, the combination of GIS and geographic imaging solutions is quickly becoming for the decision planner’s the best support tool. GIS is a computer based information system that enables capturing, modeling, manipulation, analysis, and presentation of geographically referenced data. It is a facility for preparing, presenting, and interpreting facts to identify the state of air pollution in the city. The pollutant data was structured and stored in the temporal database while Coimbatore digital map at a scale of 1:25000 was being uploaded and topologically structured using ArcView and ArcInfo GIS software. The location of stations on the map was determined. Attribute data were assigned to spatial objects and the system was made ready for spatio-temporal analysis and management.

The air pollution concentrations collected from the monitoring stations were analysed and its spatial distribution is shown in the form of maps. The levels of the concentrations are differentiated using various shades. It is found that Gandhipuram has the maximum concentration. The places like
Kavundampalayam, Saravanampatti, Ganapathy, TataBad, Ukkadam and Ramnagar have recorded higher concentration. Next high concentrations were recorded near Thudialur, SITRA, Government Hospital, RS puram, Sundarapuram and near PSG College. The places near GCT, Agriculture college, Vadavalli, Ramanujar nagar, Udayampallayam, Singanallur, Race course area, TVS Nagar (Thadagam Road), Saibaba colony, Ramanathapuram and Selvapuram have recorded low concentration. The same trend was observed in the case of Respirable particulate matter also.

Air quality index (AQI) for the recorded concentrations are calculated and depicted on the map. It was found that AQI falls in two categories only. One is moderate level and the next is unhealthy for sensitive groups. The interior part which comprises Gandhipuram, RS puram, the commercial area of Ganapathy, residential areas like Saibaba colony and in places near Ukkadam bus stand and Singanallur the AQI value shows that it is unhealthy for sensitive group of people. In other areas it is in moderate level.

The vehicular emission can be successfully reduced using fuels with low sulphur content e.g. natural gas or oil instead of coal. Mass Rapid Transport System (MRTS) may be considered for the fast expanding and major urban areas in the country. Traffic congestion can be reduced through effective traffic planning and management. In places of congested areas, fly-covers can be constructed to segregate the traffic flow instead of concentrating it at a particular point. Greater promotion and use of alternative fuels such as Compressed Natural gas (CNG), liquefied petroleum gas (LPG) and battery operated vehicles should be encouraged.