CHAPTER 5

CONCLUSION

5.1 GENERAL

Urban air pollution is a severe environmental problem, which requires immediate attention on the part of researchers. The detailed background information on urban air quality status is very much essential for local control agencies to implement the air quality management programme. Coimbatore city has a high potential for air pollution due to its exponential population and industrial growth. The hostile topography and climate necessitates continuous monitoring of air pollutants and implementation of control strategies. However, this requires a systematic, cost effective and efficient air quality monitoring and modeling procedure for Coimbatore city. The conclusion of the study as follows:

5.2 AMBIENT AIR QUALITY MONITORING STUDY

An extensive review has been carried out to study the monitoring procedure adopted to assess the urban air quality status in other cities. Based on the traffic survey, the survey stations for air quality monitoring namely AAQMS 1, AAQMS 2, AAQMS 3, AAQMS 4, AAQMS 5 and AAQMS 6 have been chosen. This study shows that the sources for air pollution are due to dust arising from roads and vehicular emissions.

- The sampling has been done for PM_{10}, $PM_{2.5}$, SO_2, NO_X, CO, O_3 and NH_3 at all the stations continuously for 24-hours, twice a month on each station for the period of two years from 2011-2012. The following conclusion has been

arrived from the Ambient Air Quality Monitoring study as follows:

- The Air Quality Index (AQI) for all the AAQMS computed from the Ambient Air Quality monitoring conducted during the year 2011 and 2012 are listed under Light Air Pollution except AAQMS 1 and AAQMS 6. Both of the AAQMS 1 and AAQMS 6 are listed under Light and Moderate Air Pollution,

- The air quality index has been determined for each monitoring day in each station and the air quality has been categorized as CA, LAP, MAP, HAP and SAP. The study of Air quality index revealed that MTP Road and Gandhipuram are more polluted. The concept of AQI can be helpful to the public to get a general idea of the air quality,

- The concentrations of PM_{10}, $PM_{2.5}$, CO and NH_3 at AAQMS 6 are found to be the highest among the sites investigated during the pre-monsoon season. Similarly, the concentrations of SO_2, NO_X and O_3 at AAQMS 1 found to be the highest among the sites investigated during the pre-monsoon season,

- The concentrations of PM_{10}, CO, O_3 and NH_3 at AAQMS 6 found to be the highest among the sites investigated during the monsoon season. Similarly, the concentrations of $PM_{2.5}$, SO_2, and NO_X at AAQMS 1 site is found to be the highest among the sites investigated during the monsoon period,

- The concentrations of PM_{10}, $PM_{2.5}$, O_3 and NH_3 at AAQMS 6 found to be the highest among the sites investigated during the Post monsoon season. Similarly, the concentrations of SO_2, NO_X, and CO at AAQMS 1 site found to be the highest among the sites investigated during the post monsoon period,

- The concentrations of PM_{10} and NH_3 at AAQMS 6 were found to be the highest among the sites investigated during the winter season. Similarly, the concentrations of SO_2, NO_X, CO and O_3 at AAQMS 1 site were found to be the highest among the sites investigated during the winter season. The concentrations of $PM_{2.5}$ at AAQMS 3 were found to be the highest among the sites investigated during the winter season,

- The maximum average concentrations of all the seven criteria pollutants and its corresponding AQI were recorded on the month of May except $PM_{2.5}$ and CO. The maximum overall average concentrations of $PM_{2.5}$ and CO were recorded on the month of July and November respectively,

- For the year 2011, it was observed that, for PM_{10} the minimum value has been recorded at AAQMS 3 and the minimum value was 98.5 µg/m^3. The maximum value of PM_{10} has been recorded at AAQMS 6 and the maximum value was 152.5 µg/$m^{3,}$

- For the year 2012, it was observed that, for PM_{10} the minimum value has been recorded at AAQMS 3 and the

minimum value was 100.2 µg/m^3. The maximum value of PM_{10} has been recorded at AAQMS 6 and the maximum value was 154.6 µg/$m^{3,}$

- For the year 2011, it was observed that, for $PM_{2.5}$ the minimum value has been recorded at AAQMS 5 and the minimum value was 16.0 µg/m^3. The maximum value of $PM_{2.5}$ has been recorded at AAQMS 6 and the maximum value was 49.8 µg/m^3 ,

- For the year 2012, it was observed that, for $PM_{2.5}$ the minimum value has been recorded at AAQMS 5 and the minimum value was 18.1 µg/m^3. The maximum value of $PM_{2.5}$ has been recorded at AAQMS 4 and the maximum value was 51.2 µg/m^3 ,

- For the year 2011, it was observed that, for SO_2 the minimum value has been recorded at AAQMS 2 and the minimum value was 5.3 µg/m^3. The maximum value of SO_2 has been recorded at AAQMS 1 and the maximum value was 33.5 µg/m^3,

- For the year 2012, it was observed that, for SO_2 the minimum value has been recorded at AAQMS 5 and the minimum value was 7.4 µg/m^3. The maximum value of SO_2 has been recorded at AAQMS 1 and the maximum value was 34.5 µg/m^3,

- For the year 2011, it was observed that, for NO_X the minimum value has been recorded at AAQMS 4 and the

minimum value was 7.3 µg/m^3. The maximum value of NO_X has been recorded at AAQMS 1 and the maximum value was 39.7 µg/m^3,

- For the year 2012, it was observed that, for NO_X the minimum value has been recorded at AAQMS 4 and the minimum value was 9.7 µg/m^3. The maximum value of NO_X has been recorded at AAQMS 1 and the maximum value was 41.0 µg/m^3,

- For the year 2011, it was observed that, for CO the minimum value has been recorded at AAQMS 5 and the minimum value was 500 µg/m^3. The maximum value of CO has been recorded at AAQMS 1 and AAQMS 6 and the maximum value was 779 µg/m^3,

- For the year 2012, it was observed that, for CO the minimum value has been recorded at AAQMS 5 and the minimum value was 501 µg/m^3. The maximum value of CO has been recorded at AAQMS 1 and the maximum value was 782 µg/m^3,

- For the year 2011, it was observed that, for O_3 the minimum value has been recorded at AAQMS 5 and the minimum value was 6.2 µg/m^3. The maximum value of O_3 has been recorded at AAQMS 6 and the maximum value was 32.5 µg/m^3,

- For the year 2012, it was observed that, for O_3 the minimum value has been recorded at AAQMS 2 and the minimum

value was 8.1 µg/m^3. The maximum value of O_3 has been recorded at AAQMS 6 and the maximum value was 34.5 µg/m^3,

- For the year 2011, it was observed that, for NH_3 the minimum value has been recorded at AAQMS 2 and the minimum value was 5.4 µg/m^3. The maximum value of NH_3 has been recorded at AAQMS 6 and the maximum value was 27.5 µg/m^3,

- For the year 2012, it was observed that, for NH_3 the minimum value has been recorded at AAQMS 2 and the minimum value was 7.5 µg/m^3. The maximum value of NH_3 has been recorded at AAQMS 6 and the maximum value was 29.8 µg/m^3,

- One-way ANOVA was tested for monitoring station wise variation of pollutants concentrations during 2011 and 2012 and the results are given in Table 4.22 and 4,23 respectively. The concentration of air pollutants as compared to the sampling sites showed significant variations of $p < 0.0001$. The values of F vary as pollutants vary,

- If the 'p' value is greater than 0.05 then it can be inferred that there is no significant difference in the average values of the pollutant parameters between the year 2011 and 2012,

- The time series concentrations line for 2011 is slightly above the time series concentrations line for 2012. It is well

evidenced from the Figure 4.51 to Figure 4.98, the time series concentrations of air pollutants PM_{10}, $PM_{2.5}$, SO_2, NO_X, CO, O_3, NH_3 and AQI show that there were no significant variations between the air quality data observed during the year 2011 and 2012,

- The meteorological parameters such as wind speed, wind direction, temperature, pressure, etc. have been observed at the roof top of the building at R.S.Puram, Coimbatore on the same day of monitoring of air pollutants. The wind rose diagrams have been constructed for each month in the years 2011 and 2012. The meteorological parameters were used as an input to run the CALINE - 4 model,

- The temporal variations of these pollutants have been analysed. The study revealed that the occurrences of pollutant concentrations are random. The sampling sites AAQMS 5 and AAQMS 2, AAQMS 4, AAQMS 3, and AAQMS 1, AAQMS 1 and AAQMS 6 were grouped as homogeneous based on the average concentrations of PM_{10} and $PM_{2.5}$ for the years 2011 and 2012 for the pollutants PM_{10} and $PM_{2.5}$. The sampling sites AAQMS 4, AAQMS 2, AAQMS 5 and AAQMS 6, AAQMS 6, AAQMS 3, and AAQMS 1 were grouped as homogeneous subsets based on the average concentrations of SO_2 sampled during 2011 and 2012. For the pollutant, NO_X, the sampling sites AAQMS 4, AAQMS 5, AAQMS 6, AAQMS 3, and AAQMS 5, AAQMS 6, AAQMS 3, AAQMS 2 and AAQMS 6, AAQMS 3, AAQMS 2,and AAQMS 1 were grouped as a homogeneous subset for the years 2011 and 2012. The

sampling sites AAQMS 2, AAQMS 3, and AAQMS 4 and AAQMS 6, AAQMS 1 were grouped as a homogeneous subset based on the average concentrations of CO sampled during 2011 and 2012,

- The sampling sites AAQMS 5, AAQMS 4 and AAQMS 4, AAQMS 2, AAQMS 3, AAQMS 1, AAQMS 6 were grouped as a homogeneous subset based on the average concentrations of O_3 sampled during 2011 and 2012,

- The sampling sites AAQMS 4, AAQMS 2, AAQMS 1, AAQMS 5 and AAQMS 3 were grouped as a homogeneous subset based on the average concentrations of CO sampled during 2011 and 2012,

- The sampling sites AAQMS 5 and AAQMS 2 and AAQMS 2 and AAQMS 4, AAQMS 4 and AAQMS 3, AAQMS 3, AAQMS 1 and AAQMS 6 were grouped as a homogeneous subset based on the average AQI values computed during 2011 and 2012 and

- It is concluded that the Air Quality Index computed at the sampling stations Lawley Road (AAQMS 5) and Railway Station (AAQMS 2), Railway Station (AAQMS 2) and Hope College (AAQMS 4) and Hope College (AAQMS 4) and Ukkadam (AAQMS 3). Gandhipuram (AAQMS 1) and MTP road (AAQMS 6) were homogeneous.

5.3 MODELING STUDY

The prediction and simulation of atmospheric dispersion of CO at nearby road junctions in Coimbatore city using CALINE-4 model was attempted.

In order to ascertain the reliability of CALINE-4 model for predicting CO concentrations, the validation of CALINE-4 model was essential by comparing the observed concentrations of CO with predicted concentrations of CO.

- The R^2 value was obtained from the scatter diagram for all the AAQMS. The higher correlation of 0.99 was existed for AAQMS 6 and AAQMS 3 recorded the lowest value of 0.82.

- The dispersion patterns of CO along the major road of the Coimbatore city for each month of the year 2012 have been drawn. It reveals that the concentrations of CO are higher in the stretch of Gandhipuram to MTP Road and MTP Road to Lawley Road. The measured and modelled concentrations of CO were well within the National Ambient Air Quality Standards.

In order to forecast the concentrations of CO at nearby road junctions in Coimbatore City, Artificial Neural Network (ANN) was attempted after evaluating the performance of the ANN model. The ANN model was validated against measured CO concentrations. The values predicted by ANN were compared with the measured values.

- The R^2 value was obtained from the scatter diagram for all the Ambient Air quality monitoring stations. The higher correlation of 0.995 was existed at AAQMS 5 and AAQMS 6 recorded the lowest value of 0.959.

- It indicates that the ANN model performs better for all the six busy road junctions. The ANN model will be used to forecast the future concentrations of CO at nearby road junctions in Coimbatore city.

5.4 SCOPE FOR FUTURE WORK

Depending upon the growth pattern of the city, more number of monitoring stations are to be added,

The monitoring of the pollutants can be performed for a longer period and the trend in the pollutant concentrations can be observed, and

The performance of the models can be tested with monitored pollutants concentrations other than CO.