The study of air pollution potential is essential for any urban area in order to initiate remedial measures for the mitigation of air pollution. The main objective of the thesis is to provide the climatology of air pollution potential and to give the spatial distribution of sulphur dioxide concentration for Trivandrum. The effects of air pollution are well known and so are the sources. Sulphur dioxide is the single most important contaminant and is very effective even at low concentrations. Once the pollutants are emitted into the atmosphere their subsequent dispersion and dilution is governed solely by the atmospheric conditions. Some unfavourable conditions such as presence of inversions and highly stable conditions, low mixing and weak wind conditions, quite often lead to unsatisfactory air quality levels. Hence a detailed study of atmospheric conditions for any urban area is essential.

The extensive literature survey (Chapter II) shows that the above is indeed the case. It also shows the necessity of studying the climatological occurrence of inversions, isothermals, lapse conditions, mixing heights, ventilation coefficients, winds and stability. The study of surface turbulence and its relationship with the other parameters is also shown to be important. The estimation of
ground concentration of sulphur dioxide has been made by many with the help of various mathematical models. The survey reveals that in spite of the presence of various mathematical models, Gaussian plume model is the widely used one. The various methods of computation and their limitations are spelt out.

These studies are carried out extensively for Trivandrum, an industrially developing city, where there is a lot of potential, otherwise, for further industries. The climatology of air pollution potential is discussed in detail giving equal importance to each of the parameters involved. The isopleth analysis is applied for studying the spatial distribution of sulphur dioxide concentration and the regions of high and low concentrations are identified. Based on these studies and the subsequent discussions, the main conclusions drawn are given hereunder.

The studies of occurrence of inversions, isothermals and lapse conditions (Chapter IV) show that lapse conditions dominate in all the months followed by isothermals and inversions. Inversions and isothermals are found to be most frequent in the month of January. While considering the intensities of inversions and lapse conditions, in every 50mb layer, presence of former do not seem to cause much anxiety as far as air pollution is concerned, since its
percentage of occurrence is extremely low. The above three factors do not show significant monthly variations because of the coastal characteristics.

To get a clear idea about the vertical and horizontal extent of mixing, mixing heights and ventilation coefficients have been studied in detail (Chapter V). Mixing height values are maximum during the afternoon hours and minimum during early morning hours. The highest mixing heights are observed in the months of February and March. Day time mixing heights are lower in the monsoonal months than in the rest of the year. The very low mixing heights during night-time all through the year and during day time in the months of May, June, July and October could result higher concentrations as any pollutants emitted into the atmosphere would not be allowed to get dispersed.

Ventilation coefficients which determine the horizontal mixing are found to be high in the monsoonal months. The monthly variation of ventilation coefficients almost follows the pattern of mixing heights: During night-time the values are extremely low. The emission from various sources should be reduced during night-time in order to keep the concentration of pollutants within the permissible levels.

Atmospheric stability is one of the most important
parameters affecting the dispersal of pollutants. It is seen that highly stable conditions are observed during night-time and unstable conditions only in day time. Unstable conditions are more frequent in the non-monsoonal months with its maximum being in December and January. Neutral conditions are more frequent during day time. There is a systematic increase of neutral conditions from January to September with a consequent decrease of highly unstable conditions during day time. While considering the entire night-time, highly stable conditions are most dominant in all the months. These conditions do not allow pollutants to get dispersed thereby resulting in higher concentrations slightly away from the source.

To study the effect of wind on the dispersal capacity of the atmosphere, six hourly wind roses are analysed. During night-time winds are extremely weak in most of the cases except in the monsoonal months, with the calm frequency reaching above 75%. Winds are strongest in the monsoonal months and more frequent from the northwestern sector. During day time in the monsoonal months westerlies dominate. As far as the dispersion of pollutants is concerned, the monsoonal months seem to be more favourable.

Studies on pollution potential indices show that the index is highest in the month of February revealing good dispersal capacity in this month. The index is highest
during day time and lowest during night-time. The indices are highly variable from month to month and hour to hour with maximum variation in August and minimum in May. There is a systematic increase of the index from early morning hours to around maximum temperature epoch and a decrease thereafter, in all the months. As in earlier cases, here also the night-time seems to be less favourable for the dispersal of pollutants.

\( G_{60} \), which shows a good diurnal variation with lowest values during night-time and highest values during day-time can be taken as a measure of surface turbulence. Surface turbulence is maximum in the month of January amongst the four typical seasonal months. During day time turbulence is minimum in July but during night-time it is more in this month. \( G_{65} \) values are maximum in the month of July and minimum in the month of January, with its maximum diurnal variation occurring in April. \( G_{60} \) is more appropriate being taken as a measure of surface turbulence.

Linear regression equations are developed between mixing height and \( G_{60} \), mixing height and \( G_{65} \) and \( G_{60} \) and \( G_{65} \). All of these show very high correlation coefficients. Since the variations in \( G_{60} \) are larger compared to that of \( G_{65} \), mixing height obtained from \( G_{60} \) are likely to be more accurate. It is also seen that even when mixing height values are zero \( G_{60} \) values exist.
Investigation of the spatial distribution of sulphur dioxide concentrations by means of multiple stack Gaussian plume model reveals that the months of November and December show the highest concentrations while the monsoonal months show the lowest concentrations. Higher values of mixing height do not seem to have as much impact as the wind has on the dispersal of pollutants. It is seen that the distribution of pollutants does not follow the unidirectionality of the wind pattern in many cases. Therefore most of the factors studied suggest that monsoon season appears to be safe in view of the low concentrations.

Most of the city area is found to be free from pollution, especially, the southeastern and the eastern sectors. Therefore, the present location of factories are not inappropriate. To avoid any clustering of industries, appropriate locations of new industries can be chosen in the extreme northeastern parts, since the spreading of the pollutants towards south is insignificant. Any further establishment of industries in the northwestern parts will result in rather high concentrations in central northern part.

Also, it seems that if the night-time emissions are brought down, the effective concentration for the whole day would automatically come down.
It is shown that a considerable reduction during night-time and a consequent increase during day time would bring down the concentrations effectively.

It is already pointed out that some improvements are necessary for the model in order that it would be more effective. The vehicular sources also should be taken into consideration for further studies.