

An Overview of Air Quality in Kerala

Sindhu P.¹, Praveen A² and J Letha³

¹College of Engineering, Thiruvananthapuram

²Rajiv Gandhi Institute Of Technology, Kottayam

³Cochin University of Science & Technology, Kochi

E-mail: ¹sindhup@cet.ac.in, ²praveen@rit.ac.in, ³lethajanaki@gmail.com

Abstract—Kerala, the “God’s own country” is one of the most densely populated states in India which has undergone the highest level of urbanisation with a percentage increase of 83.82% over the previous decade. Rapid urbanisation often leads to the increase in the air pollutants namely sulphur dioxide, oxides of nitrogen, suspended particulate matter, respirable particulate matter etc. in the ambient air. The increased air pollutant concentrations in urban area is said to be responsible for, cardiovascular diseases, neurobehavioral effects, deficits in pulmonary functions and change in morbidity and mortality rate. Besides deleterious effects on human health it also causes evident negative effects on vegetation, materials and visibility reduction etc. The problem of air pollution in many cities has become so severe that there is a need for timely information about changes in pollution level to the public. The Air Quality Index AQI, is such a rating scale for reporting the ambient air pollution recorded at monitoring sites on a particular time scale. It is a number used by governmental agencies used to indicate how clean or polluted our air is. As AQI increases, an increasingly large percentage of population is likely to experience adverse health effects due to air pollution. Air quality monitoring and modelling has gained importance as there is frequent occurrence of air pollution incidents and increased awareness among public about various health related problems associated with it. The Kerala State Pollution Control Board is monitoring ambient air quality at thirty locations in the State. The locations fall under the categories of industrial, residential and other areas and ecologically sensitive areas. The present paper aims at evaluating AQI in selected monitoring stations in Kerala to assess ambient air quality status. The data was obtained from the Water and Air Quality Directory 2014 published by Kerala State Pollution Control Board.

1. INTRODUCTION

Deterioration in quality of ambient air is a major problem facing urbanised regions across the world. Urban air pollution is a major issue having adverse impacts on physical, biological, and socio-economic systems that include ambient air quality, human health, and property. Main sources of air pollution include energy production in power plants, fuel burning in vehicles, industrial processes, other than the natural disasters as volcanic eruptions, forest fires etc. The effects of air pollution can be both long term and short term. The human health concerns like deficits in pulmonary functions, cardiovascular diseases, neurobehavioral effects and change in morbidity and mortality rate etc are the important short-term

consequences of air pollution. On the other hand, global warming and greenhouse effect are included in the long term consequences on the global climate[4].

The problem of air pollution in Indian cities has also become so severe that there is need for real time information on the state of quality of air at these places. Also there is a need for timely information about changes in pollution level to the public as there is frequent occurrence of air pollution incidents and increased awareness among public about various health related problems associated with it. The Air Quality Index AQI, is such a rating scale for reporting the ambient air pollution recorded at monitoring sites on a particular time scale. It is a number used by governmental agencies used to indicate how clean or polluted our air is. As AQI increases, an increasingly large percentage of population is likely to experience adverse health effects due to air pollution.

Kerala is one of most densely populated states in India with a population density of 859 persons per square km as per 2011 census. The state of Kerala has one of the highest rate of urbanisation in the country, with reports stating a Fig. of 83.82 percentage over the last decade [3] . Urbanisation being the most important cause for air quality deterioration, a study on air quality in Kerala was worth considering.

The objective of the present study is to explore the air quality in Kerala from the data obtained from the ambient air quality monitoring stations. The objective of an AQI is to quickly disseminate air quality information that entails the system to account for pollutants which have short-term impacts. AQI scheme transforms weighted values of individual air pollutant concentrations into a single number or set of numbers. While complexity in building the AQI is inevitable, simplicity in AQI description is essential for general public to understand the air pollution, possibly take actions to protect themselves and for policy makers to take quick and broad decisions to improve air quality.[5] Air quality monitoring system in India can be classified into online and manual monitoring. In the present study

AQI was evaluated to compare the quality of air from stations monitored manually. The data required for the analysis was

obtained from the Water and Air Quality Directory 2014 prepared by Kerala State Pollution control Board.

2. METHODOLOGY

The pollutant concentration data from all the thirty available monitoring stations in Kerala for 2014 was collected in connection with this research. At present the Kerala State Pollution Control Board is monitoring ambient air quality at thirty locations in the State. The locations fall under the categories of industrial, residential and others and sensitive. Of the thirty stations twenty four comes under National Ambient Air Quality Monitoring Programme and six under State Ambient Air Quality Monitoring Programme[1]. The study area is shown in figure1.

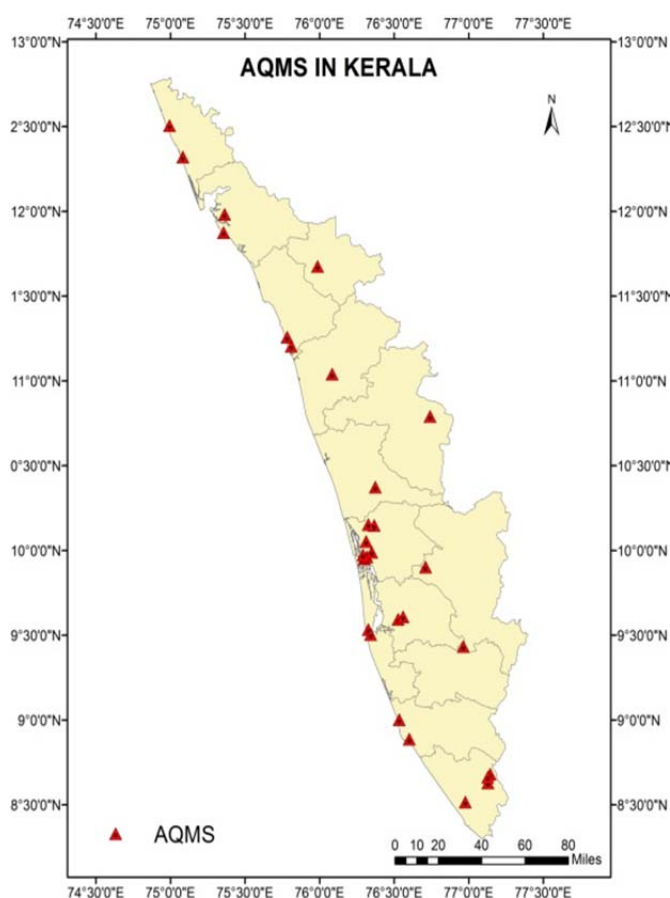


Fig. 1: Study area

Ambient air monitoring is conducted twenty four hours a day for two days every week at each station. Sulphur dioxide and Nitrogen oxides are monitored at four hour interval and Respirable Suspended Particulate Matter at eight hour interval. The monitoring and method of analysis are according to the NAAQS.

AQI was determined as per USEPA equation and the highest among that of each of the pollutant is considered as the overall AQI. Its calculation includes subindices for each pollutant and it relates the ambient pollutant concentrations to index values on a scale. Break point concentrations depends on the national ambient air quality standards (NAAQS) and the results of the epidemiological studies indicating the risk of adverse health effects of each pollutant. The sub index and break point concentrations used were specifically developed for Indian conditions() and is given in table 1. Air quality index was calculated based on the equation given below

$$I = \frac{I_{high} - I_{low}}{C_{high} - C_{low}} (C - C_{low}) + I_{low}$$

Where, I is the AQI

C is the pollutant concentration

C_{low} is the breakpoint concentration <= C

C_{high} is the breakpoint concentration >= C

I_{low} is the index breakpoint corresponding to C_{low}

I_{high} is the index breakpoint corresponding to C_{high}

The values of breakpoint and index breakpoint concentrations are given in Table-1 and Table 2 the colour code and health aspect of AQI values.

Table 1: Sub-Index values for pollutants

SL NO	INDEX VALUE	SO2	NO2	RSPM	SPM
1	0-100	0-80	0-80	0-100	0-200
2	101-200	81-180	81-180	101-150	201-260
3	201-300	181-564	181-564	151-350	261-400
4	301-400	565-1272	565-1272	351-420	401-800
5	401-500	>1272	>1272	>420	>800

Table 2: Colour code and health effects of AQI

AQI	Remark	Color Code	Possible Health Impacts
0-50	Good		Minimal impact
51-100	Satisfactory		Minor breathing discomfort to sensitive people
101-200	Moderate		Breathing discomfort lungs, asthma and heart patients
201-300	Poor		Breathing discomfort on prolonged exposure
301-400	Very Poor		Respiratory illness on prolonged exposure
401-500	Severe		Affects healthy people and seriously impacts those with existing diseases

3. RESULTS AND DISCUSSION

The ambient air quality near all the National ambient air Quality Monitoring stations in Kerala during 2014 was determined based on AQI values. The monitoring stations situated in different areas viz. residential and others, industrial and ecologically sensitive areas were found separately. It was found that almost all AQI values lies in good or satisfactory range. A graph was plotted to show the AQI values of those stations with moderately polluted air for some part of the year 2014 is shown in Fig. 2,3,4 respectively. In the residential and other category only three stations had moderately polluted air and that too for less than 20% of the time. The maximum polluted air in Kerala during 2014 was monitored in a station in an industrial category where more than 70% of the year the air quality was in moderately polluted zone.

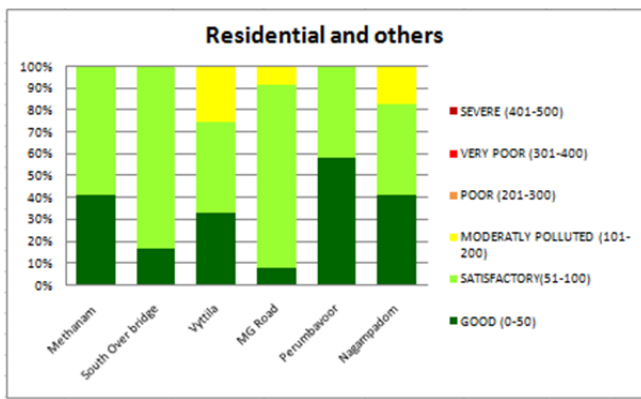


Fig. 2: Monthly variation of AQI for stations in residential and other category during 2014

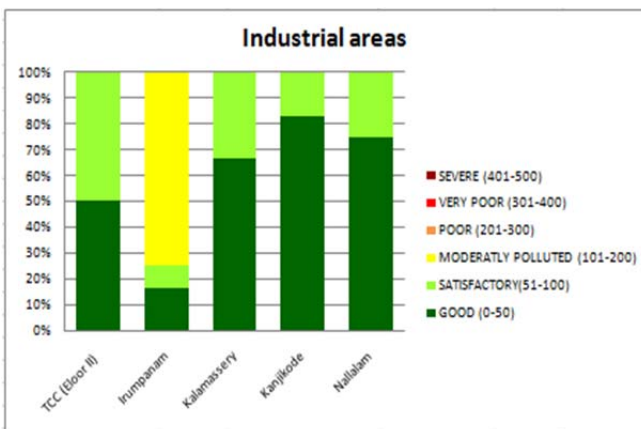


Fig. 3: Monthly variation of AQI for stations in industrial category during 2014

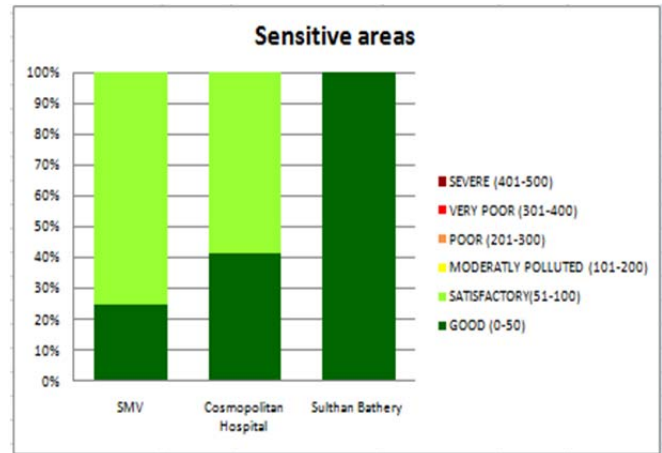


Fig. 4: Monthly variation of AQI for stations in sensitive zone during 2014

4. CONCLUSIONS

AQI of all the air quality monitoring stations in Kerala during 2014 was evaluated. The respirable particulate matter is the criteria pollutant affecting air quality in all the monitoring stations. The quality of air comes under good and satisfactory most of the time study. The maximum pollute air was identified in an industrial area with moderate pollution. All the sensitive zones showed good and satisfactory air quality. A constant monitoring of the air quality in Kerala is to be ensured for maintaining and improving it.

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