A Survey of Air Quality Monitoring

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Abstract- *Pollution is one of the foremost and grave public health and environmental anxiety in most of evolving countries. An attempt is made to make people aware about various types of gases and particulate matter present in air highlighting their effects on environment along with the various ways of overcoming this situation. It has been perceived from past few years that the rate at which Urban Air Pollution across India has grown is alarming due to severe unsafe web of particulate matter (PM) and harmful gases present in air that living organism's breath. Levels of particulate matter are extremely higher in all cities of India. Only few cities are such that can be emphasized where Air Quality Monitoring (AQM) has started due to which they show some enhancement in quality of air but mostly affected areas are small and medium sized towns which suffer from phenomenal spurt in pollution in very critical manner. Due to increase in immense number of vehicles, industries and manufacturing units has resulted in excess assembly of pollutants in air making air pollution as a state of national emergency across various cities around the country.*

Keywords- Air Quality Monitoring, Gaseous pollutants, Particulate Matter

I. INTRODUCTION

For developing countries like India air pollution has tremendous impact on human vigor, agricultural practices, climatic variations and overall changes in ecosystem. Every year almost six lakh Indians die due to side effects of air pollution. Almost all the cities are suffering due to increase in concentration of Particulate Matter (PM) in air along with gaseous pollutants like oxides of nitrogen, sulphur along with other toxic materials that are already causing serious damage to environment. Only few cities are such that can be highlighted where Air Quality Monitoring (AQM) has started due to which they show some improvement in quality of air but mostly affected areas are small and medium sized towns which suffer from phenomenal spurt in pollution in very critical manner.

II. MATERIALS AND METHODS

2.1 Air Pollutants

Major pollutants present in air are basically categorized into following types:

- Carbon Compounds: Oxides of carbon (Carbon dioxide (CO2), carbon monoxide (CO)) mostly released from all vehicles and burning of fossil fuels.
- Sulphur Compounds: SO2, NO2, HNO3 released from power plants and all industry units.
- Ozone: (O3) its level in air rises due to change in.
- Chloro carbons: Released in excess from industries, insecticides sprays etc.
- Hydrocarbons: Mostly benzene, benzphrene etc.released from vehicles.
- Metallic Pollutants: In excess lead, nickel, arsenic
- beryllium, tin, vanadium, titanium, vanadium etc .present in all three basic states as solid, liquid or in gaseous form.
- Photochemical pollutants: Photochemical smog, PAN.
- Particulate matter: Fly ash, grit, dust and Suspended

Particulate Matter (SPM) released from hydroelectric power plants and industries. It also can include bacterial cells, fungal spores and pollen in air.

2.2 Sources

There are numerous sources for occurrence of air pollution; some of these sources can be widely classified into following types.

2.2.1 Vehicles – A Major Cause

The toxic pollutants released from various vehicles are major source of air pollution. Due to rapid growth in use of personal vehicles rather than using private vehicles have not only increased extensive demand of vehicle oil but also have increased the concentration of particulate matter in air2. This steady shift has also led to change of transport pattern as

nowadays people prefer roadways rather than using railways. By the endof 2010 it was estimated that India has more than 5 million vehicles running out of which 65%vehicles are two wheelers working on petrol. Across major cities of country 800 to 1000 tons of pollutants are released into air daily out of which 50 percent come from vehicle exhausts. It has been estimated that by the end of 2035 the total Indian fuel demand will be six times the fuel demand recorded in year 2005. There is a wider shift in choice of persons personal vehicles as most of the people prefer bigger vehicles that are usually compact, medium in size and use high quantity of fuel. It has been estimated by the end of 2030-31 that if 50 per-cent of India's fuel efficiency is achieved by revising energy policies then India can save 65 percent of its total energy consumption and decrease CO2 emissions equal to removing seven millions of four wheelers. Overall 15 percent of total CO2 is released into air through transport sector in India. It has been found that 6 percent increase in quantity of CO2 emissions occurs per year3.

Table 1, gives the average data relatedto various pollutants released from vehicles for metropolitan cities

Type of pollutant	Percentage value
carbon monoxide	70%
hydrocarbons	50%
oxides	30–40 %
SPM	30 %

For a vehicle without cleaning device on using 1000 gallons of petrol it releases 3200 lb. of CO, 2200–2400 lb. of organic vapors, 25-75 lb of NOx and 0.3 lb. of solid carbons. The chief sources of emission form any vehicles are:

- Exhaust System: Produces unburnt hydrocarbons, Co, NO_x, SO_x, lead oxides etc.
- Fuel tank and Carburetor: Produces hydrocarbons.
- Crankcase: 25% of hydrocarbons.

2.2.2 Industrial Wastes and Thermal Power Stations

Due to rapid industrialization and establishment of multiple factories, large number of industries have been running from past releasing chief pollutant gases SO2 and NO2. It has been observed that Mathura based oil refineries are leading to deterioration of Taj Mahal and other monuments at Fatehpur Sikri2. Along with industries there are numerous thermal power plants where coal consumption is in millions of tones and chief pollutants released are fly ash, hydrocarbons, S02 along with other gases4. Table 2 gives the data related to various pollutants released from a 200 MW thermal power plant where, total coal consumed is 1400 tones per day.

Table 2. Pollutants Emitted out from 200 MW Thermal

Components	Emission factor Kg/ton of coal	Emitted quantity (tones per day)
Aldehydes	0.0025	0.0035
Carbon monoxide	0.25	0.35
NOX	0.01	0.14
Oxides of Sulphur	19(S)	13.34
Particulate matter	8(A)	369.6
Ash	2(A)	92.4

(A) Ash content in coal percent, (S) Sulphur content in coal per cent

2.2.3 Other Anthropological Sources

Apart from major sources given above, the following activities also play a vital role in causing air pollution:

- Burning up of crop wastes by farmers.
- Stoves and incinerators.
- Refrigeration activities and sprays of aerosol.
- Methane generation due to waste deposition in landfills.
- Verification of nuclear weapons by army personnel's.
- Dust particles generated from any natural sources.
- Uncertain volcanic activities producing high content of fumes, ash and other severe gases.
- Uncertain Forest fires.
- Decomposition of animals leading to production of methane.

2.3 Effects of Air Pollution

Air pollution causes wide range on side effects not only on environment but also on the various organisms dwelling in that environment. Some of those side effects have been summed up below5

- Enhanced ageing of lungs along with damage of lung capacity along with short term irritation in sense organs.
- Main cause of asthma, bronchitis, emphysema etc.
- Reduction in life span.
- Damage of shoots and upper vegetative cover of plants due to acid rain6.

- Depletion of soil nutrients due to reaction of nutrients with acid rain.
- Changes in physical appearance in vegetative cover due to intake of sulphur dioxide and ozone (flecking, tanning or bleaching)
- Eutrophication in rivers and other water bodies.
- Damage to constructed structures due to acid rain.

III. RELATED WORK

Technique used for pollution monitoring

Previously the air pollution monitoring is done via computerized tomography technique which generate a two dimensional map of pollutant concentration. It provides a many advantages over the differential absorption method. In this system there is a single laser source located at the centre of the area. This laser beam is rotated and directed towards the circumference of the circle. There is a cylindrical mirror so that incident laser beam is reflected in a fan beam over angle across the circle. The beam from the mirrors is the circular region and strikes a set of detectors lie in same plane parallel to the ground. This technique focus on lower transmitted laser energy increasing the range and ability to monitor the area that contains several pollutant sources

Another way of monitoring the air pollution is via the online GPRS sensors array which has been designed, implemented and tested. This system unit that consists at a single chip of microcontroller and a pollution server which is a high end personal application server with a internet connectivity where the mobile data acquisition unit that collect the pollution level & pack it into a frame with GPS location, date and time. This frame is uploaded to the GPRS modem and transmitted to the pollution server via the public mobile network. A data base server which is attached to the pollution level which is used by the various client. Pollution server for storing the pollution level which is used by the various clients. Pollution server having a interfaced with the Google map to provide a real time pollutants level as well as the location in large metropolitan area.

IV. CONCLUSION

Major cause of generation of pollutants was common in all monitored cities i.e. vehicles and automobiles.

- It is better to prevent air pollution rather than allowing it to increase and well know proverb ‘charity begins at home’ suits here, we need to understand the causes, effects and measures to reduce pollution then only we can decrease pollution levels to ensure better environment for future generations .
- More efforts are required for making air quality monitoring a national issue by creating more awareness and following certain laws and rules to decrease the level of pollutants in air.
- One needs to use public automobiles often and try to avoid use of excess personal automobiles as it will help to not only to decrease the excess vehicle congestion on roads but also help in decreasing pollution.
- Energy efficient commodities must be utilized wherever possible as they tend to save energy along with having low negative effects.
- Existing policies and strategies need to be strengthened more to ensure more positive results.
- People should prefer public transport rather than using personal vehicles.
- More vehicle evaluation on regular intervals needs to be done based on air pollutants emissions and proper certification should be given to vehicles.
- Awareness needs to be created among people related to health effects of air pollution so that people start taking it seriously and breathe a safer and pure air.

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