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A Case Study on Atmospheric Pollution over Mumbai -A West Coastal Mega City in India

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ABSTRACT *Atmosphere as varied and vast as the universe itself is a natural phenomenon all pervasive. The process of atmospheric studies has been there ever since the existence of human race. Air pollutants released from various sources affect directly or indirectly man and his environment. The resulting ground level concentration patterns have to be estimated for a wide variety of air quality analyses for social planning and industrial growth. Air pollutants emitted from different sources are transported, dispersed or deposited by meteorological and topographical conditions. Pollutants are substances which, when present at high enough concentrations, produce harmful effects on people and/or the environment. Air pollution was first perceived as a local problem in urban industrialized areas, hence taller smoke-stacks for industries and power plants were a ready solution. Urban population is growing very rapidly throughout the world, besides the world population is urbanizing much faster than is growing.*

INTRODUCTION

Air pollutants in mega cities arise from a wide variety of sources although they are mainly a result of combustion processes. Today, the largest source of pollution in most urban areas is motor vehicles, and to a lesser extent industry. Traffic-generated pollutants include nitrogen oxides, carbon monoxide, volatile organic compounds and particulates. On warm summer days the strong sunlight leads to a buildup of ozone through the oxidation of volatile organic compounds (VOCs) such as benzene in the presence of nitrogen oxides. However, due to the special atmospheric chemistry of ground level ozone, levels are very often lower in urban areas than in the countryside.

GEOGRAPHICAL FEATURES OF MUMBAI

Mumbai situated in west coast of India has been a major center of industrial and economic activities. Over the last twenty years the city has witnessed rapid urbanization and increased industrial activity and massive growth in population. Figure-1 shows the annual average concentrations of SO_2, NO_2 and SPM from 2000 to 2004. Data has been collected from Parel (Industrial), Bandra (Residential) and Kalbadevi (Residential). The concentration levels of SO_2 ($6\mu gm^{-3}$ to $13.30\mu gm^{-3}$) and NO_2 ($17.4\mu gm^{-3}$ to $34.10\mu gm^{-3}$) at all locations in Mumbai are in low level and SPM is observed in moderate ($219\mu gm^{-3}$ to $280\mu gm^{-3}$) conditions according to NAAQS standards. Most of the time SO_2 is observed maximum in the industrial area i.e Parel and NO_2 is at Kalbadevi residential area[1].

Mumbai is situated on west coast of India with latitude 18° 15′ N longitude 72° 52′ E has been a major centre of industrial and economic activities. The city of Mumbai has witnessed rapid urbanization, increased industrial activity and massive growth in population during last twenty two years. As a result, city has grown into a mahanagar of 430 sq. km. It is now an urban octopus whose tentacles encompass towns outside the municipal limits, like Thane, Kalyan etc. Though the southern business district still remains the vital core of the metropolis, the industrial activity has increased enormously in the suburbs and the extended suburbs.

THEORY AND METHODOLOGY:

Air pollutants consist of gaseous pollutants, odors, and SPM, (suspended particulate matter) such as dust, fumes, mist, and smoke. The concentration of these in and near the urban areas causes severe pollution to the surroundings. The largest sources of human-created air pollution are energy generation, transportation, and industries that use a great deal of energy sources. Depending on their source and interactions with other components of the air, they can have different chemical compositions and health impacts. Since these pollutants are generally concentrated in and around urban areas, the outdoor urban pollution levels are far higher than in the rural areas[2,4]. Some of the gases mentioned below can seriously and adversely affect the health of the population and should be given due attention by the concerned authorities.

The gases mentioned below are mainly outdoor air pollutants that can and do occur indoor depending on the source and the circumstances.

Oxides of nitrogen

This gas can make children susceptible to respiratory diseases in the winters.Carbon monoxide CO (carbon monoxide) combines with hemoglobin to lessen the amount of oxygen that enters our blood through our lungs. The binding with other haeme proteins causes changes in the function of the affected organs such as the brain and the cardiovascular system, and also the developing foetus. It can impair our concentration, slow our reflexes, and make us confused and sleepy.

Sulphur dioxide

SO2 (Sulphur dioxide) in the air is caused due to the rise in combustion of fossil fuels. It can oxidize and form Sulphuric acid mist. SO2 in the air leads to diseases of the lung and other lung disorders such as wheezing and shortness of breath. Long-term effects are more difficult to ascertain as

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SO2 exposure is often combined with that of SPM.

Suspended particulate matter (SPM)
Suspended matter consists of dust, fumes, mist and smoke. The main chemical component of SPM that is of major concern is lead, others being nickel, arsenic, and those present in diesel exhaust[5,6,9]. These particles when breathed in, lodge in our lung tissues and cause lung damage and respiratory problems[8,9]. The importance of SPM as a major pollutant needs special emphasis as a) it affects more people globally than any other pollutant on a continuing basis; b) there is more monitoring data available on this than any other pollutant; and c) more epidemiological evidence has been collected on the exposure to this than to any other pollutant.

DATA BASE:
The data is collected from Central Pollution Control Board (CPCB) New Delhi, for the period from 2000-2004 in industrial and residential areas for the selected west coastal Mega City-MUMBAI.

ANALYSIS AND RESULTS:
The concentration of SO2, NO2 and SPM in Mumbai are analyzed from 2000 to 2004. The pollution levels in this mega city of Southern India have been exceeded the WHO air quality guidelines(3). The data is collected for industrial and a residential area at different locations in the Mumbai city is shown in Table 1 and National Ambient Air Quality Standards (NAAQS) of SO2, NO2 and SPM are shown in Table 2. Behavior of SO2, NO2 and SPM in the selected Mumbai mega city are discussed.

CONCLUSIONS:
The analysis of data collected from CPCB, Mumbai during 2000 to 2004 in shows that the concentration levels have been increased from 2000 to 2004 due to dense population and rapid industrialization. Here industries, automobiles, domestic fuel consumption and the use of domestic appliances contribute to the emissions while gases from garbage dumps contaminate the air. Due to increase in pollutants the temperatures inside the cities are higher around 4^0 C to 6^0 C compared to the surrounding rural areas. Hence Government has to take up some severe precautions to bring down the concentration of pollutants and reduce the use of energy consumable goods.

MUMBAI
Parel (I)
Bandra (R)
Kalbadevi (R)

Table 1: Data collected locations in Mumbai mega city

Pollution Level	Industrial	
	S02 & NO2	SPM
Low (L)	0-40	0-180
Moderate (M)	40-80	180-360
High (H)	80-120	360-540
Critical (C)	>120	>540

Table 2: National Ambient Air Quality Standards

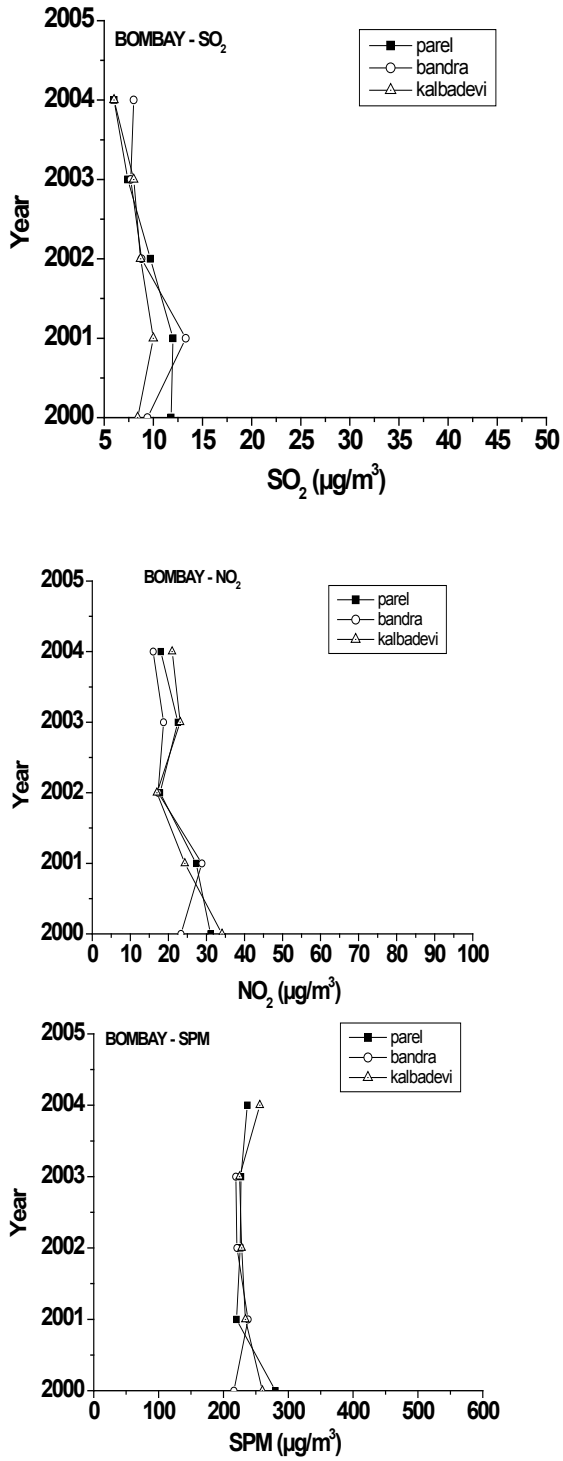

Figure: Concentration of SO_2, NO_2 and SPM from 2000-2004 of MUMBAI Coastal mega city in India

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