URBAN ENVIRONMENTAL AIR POLLUTION BY EMISSION OF AUTOMOBILES IN BANGALORE CITY, KARNATAKA –INDIA

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Abstract
At the global level, the rapid growth in motor vehicle activity has serious energy security and climate change implications. Bangalore is a rapid development in urban area either in demography, migration, transportation, or industrial sector since last two decades. To know the history of growth of increasing population in Bangalore city. To know the effects urbanization on land use and to that of Transportation in Bangalore city. To identify the number of vehicles in Bangalore city. To identify the types of pollutants released from vehicles in Bangalore city. To forecast and suggestion for controlling measures of air pollution in Bangalore. In the present study of Urban Environmental Air Pollution by Emission of Automobiles in Bangalore City, data from secondary as well as primary sources like Bangalore District Census Hand Book, data from Bangalore Road Transport office.

Key words: *Migration, Transportation.*

Introduction

At the global level, the rapid growth in motor vehicle activity has serious energy security and climate change implications. The transport sector already consumes nearly half of the world's oil. But in urban areas – both developing and developed countries, it is predominately mobile or vehicular pollution that contributes to air quality problem. The sources of pollutants includes emissions from the combustion of fossil fuels in motor vehicles and for industrial processes, energy production, domestic cooking and heating, and high dust levels due to local construction, smoking, unpaved roads, sweeping, hotels, restaurants and long-range transport. By this the quality of air has become so poor that, Bangalore is the result of both high emissions from the vehicles and unfavorable conditions.

Study area

Bangalore is a rapid development in urban area either in demography, migration, transportation, or industrial sector since last two decades. The Bangalore has the highest demography and the only metropolitan city, of Karnataka, which it has 95 lacks of population as per the 2011 census. The intensity, quantity, and frequency of both urban, suburban and movement with other cities are same factor of increasing transportation problem in the Bangalore area; particularly in transportation utility development could not comply with the demand. The dependency of urban population on transportation systems on fossil fuels is quite high. The Bangalore is one of the cities having 41 lacks registered vehicles apart from other vehicles of neighboring city and towns. The vehicle with poor environmental quality continues to grow in multiple ratios. There is an urgent need to address the interrelated problems and obstacles experienced by the people of Bangalore regarding air pollution through the vehicles. The traffic congestion resulting from transportation changes contributes even greater to deteriorating environment in urban communities. In the last few years, about 70% of ambient-air quality degradation in Bangalore is affected by transportation activities.

Present problem

The main problems that are overlooked across the globe are pollution. The Pollution is evident in many different forms, such as, water, sound, light, radioactive, land, and air. The Toxic mix of unbridled vehicular growth, dusty constructions and chemical emission triggers unprecedented air pollution. Rising traffic congestion is a serious issue confronting Bangalore. The combination of population and economic growth of Bangalore contributes to the increased number registered vehicles and miles/kilometers driven. The only way is to reduce the problem of air pollution is the elimination or reduction of fossil fuels used by vehicles. Added to this problem is the fact that there is no rail-based commuter system, which only compounds the situation. Thus, the increases in population, migration, uncontrolled urban expansion, income, economic growth, energy consumption and mobility have created a serious for air pollution problems, in cities throughout the world. The study is to find the emissions from the vehicles and their impact on the environment. This deals with the present scenario of air pollution and the effects on environment in Bangalore city. The worst thing about vehicular pollution is that it cannot be avoided as the vehicular emissions are emitted at the near ground level where we breathe. The problem of vehicular air pollution especially relates to Bangalore. This paper depends on the data of registered vehicles and the emission factors of vehicles.

Objectives

To know the history of growth of increasing population in Bangalore city. To know the effects urbanization on land use and to that of Transportation in Bangalore city. To identify the number of vehicles in Bangalore city. To identify the types of pollutants released from vehicles in Bangalore city. To forecast and suggestion for controlling measures of air pollution in Bangalore.

Methodology

In the present study of Urban Environmental Air Pollution by Emission of Automobiles in Bangalore City, data from secondary as well as primary sources like Bangalore District Census Hand Book, data from Bangalore Road Transport office. And data of Bangalore Metropolitan Area (BMA) covered area has been collected and analyzed. As the study is qualitative in nature simple tables and suitable maps have been generated. Since Bangalore City is a dynamic metropolis there are a series of popular articles published in leading dailies from which information has been elicited.

Urban growth

The population of Bangalore city stands at 6.5 million in 2001 and 9.5 million as per 2011, and continuing with this growth rate, the city's population is expected to reach around 21 and 32 million in 2021 and 2041 respectively. With the Information Technology (IT) boom, Bangalore is one of the fastest growing cities in India and Asia. With the emerging Bio-Technology (BT) boom, Bangalore's population growth may be even faster in the forth-coming decades. Bangalore is booming with other growth which is evident from its nicknames viz. "India's Silicon Valley", "Fashion Capital of India", "The Pub City of India", and so on. All these factors contribute to the growth of population of city.

The spatial extent of Bangalore City in the year 1971 was about 177.30 sq.km. This increased to 365.65 Sq.Km. in 1981 and 445.91 Sq.Km. in 1991 to 531.00 Sq.Km. in 2001 respectively and in 2011 it increased to 800.00 Sq.Km. As it is evident from the census figures (Table 1) urbanization in 1971-81due to expansion of urban area, we can see the

real emergence of city outgrowths. Of course this includes factory type of urbanized areas plus the enormous outgrowth of urbanized fringe villages with new layouts with or without civic amenities. Where the latter is a kind of phenomenon that exists in these newer urbanized areas even at all India level. In the year 1981 the Bangalore City along with its outgrowths has a population of 2.9 million, which increased to 4.1 million in 1991 to 6.5 million and 9.59 million in 2001 and 2011 respectively. It attributes fastest growth in aerial expansion of Bangalore City.

Land use pattern of Bangalore city

The other major effect of urban growth is the change in land use pattern of Bangalore City. In the year 1983 the total land area was 20283.18 hectares, which increased to 28400 hectares in 1990 to 42432 hectares in 2001, further it will be increased to 56462 hectares in 2011. The map below shows the growth of Bangalore from 1537 – 2001. And the table 3 below shows land-use classification of Bangalore City 1983-2011.

Air pollution from transport sources

Air pollution is addition of any harmful gaseous, liquid or solid particles or substances to the atmosphere, which causes the damaging of the environment, human health on quality of life in urban area that can endanger the health of human beings, plants animals, or damage materials reduce visibility or release undesirable odors. By this one of the great problems faced in urban areas throughout the world is the increase in vehicles due to imbalance between the public transport and the increase in population, mobility and last mile connectivity. This increase in the number of vehicles has led to increase in congestion and the increase in pollution by the private vehicles polluting such a natural resource by various human activities will substantially change the composition of air. This may lead to many short term and long term implications on the life of plants and animals. Besides the change in composition, the pollution may directly add some poisonous and harmful gases - which may cause series of health complications.

Transportation is one of the important of economic activity and beneficial social interactions. While the transportation sector is also a major source of air pollution in Bangalore, estimated to account for nearly all of carbon monoxide (CO), more than 80% of nitrogen oxides (NOx), 40% of volatile organic compounds (VOC), 20% of sulfur dioxide (SO2), and 35% of PM10 in 1998. The growing problems related to traffic are congestion, accidents, pollution and lacks of security are also very worrisome. The key question is how to reduce the adverse environmental impacts and other negative effects of transportation without giving up the benefits of transportation. This is due to increase in the automobiles and the mobility of people, rapid urban growth, which is likely to increase travel demand significantly in Bangalore city.

Bangalore is among the top 10 polluted cities in India

Bangalore is among the top 10 polluted cities in the country as found by the Ministry of Environment. The prime cause for pollution is by emissions of motor vehicles. But, there is no mechanism as such to check the increasing vehicular pollution that is affecting the air quality and health of people in the so-called Garden City. Earlier, commuters had to inhale a lot of petrol and diesel exhaust smoke at signals, but now because of increasing LPG-fuel vehicles, they complain of inhaling more gaseous substances. They only check ambient air quality and have issued 20-point directions for vehicle owners and managers which should be compulsorily followed, like no vehicle below Bharat-4 stage are permitted to ply on

Bangalore roads. But the vehicles below BS-4 and polluting private buses and trucks were freely plying on City roads. It's the duty of traffic police & transport department to take action.

Table 1.Choking Lungs-Air quality comparison at different locations of Bangalore City 2010-2013

Pollutant Areas	Pollutant *	2010	2011	2012	2013	Standard
White Field	Sulfur dioxide	16	50	16.5	16.1	19.3
	Nitrogen oxide	37.9	30.4	30.1	31	40
	Dust particles	122	122	86	162	60
City Railway Station	Sulfur dioxide	29.5	40	72.6	83	65.8
	Nitrogen oxide	19.9	15.4	8.9	8.3	50
	Dust particles	72	61	55	99	60
Mysore Road	Sulfur dioxide	15	50	1402	13.9	16.1
	Nitrogen oxide	34.5	29	31.3	31	40
	Dust particles	65	80	58	169	60
Victoria Hospital	Sulfur dioxide	13	20	13.3	12.7	12.6
	Nitrogen oxide	33.4	27.2	28.1	30	30
	Dust particles	59	64	51	152	6

*Pollutants measured as micrograms/metre/cube. Source: Data Compiled from Daily News Paper-Deccan Herald.

Table 2. Details of AQI values and Criteria at Metro Corridors

Name of Stations	*AQI Values	Air Quality Criteria
Yeshwanthpur	256	Severe Air Pollution
Navarang Junction (Rajajinagar)	148	Severe Air Pollution
Seshadripuram / SwastikCirlce	140	Severe Air Pollution
AnandRao Circle	189	Severe Air Pollution
National College / Vanivilas Circle	238	Severe Air Pollution
South End Cirlce	173	Severe Air Pollution
KIMS Circle	146	Severe Air Pollution
Sri Aurobindo Circle (Jayanagar 5th block)	178	Severe Air Pollution
KIMCO Junction Vijay Bus Depot Mysore Road	256	Severe Air Pollution
Vijayanagar Tollgate (Magadi Junction)	140	Severe Air Pollution
Okalipuram	310	Severe Air Pollution
Anil Kumble Circle	76	Heavy Air Pollution
Shanthala Silks (Majestic)	314	Severe Air Pollution
Trinity Circle	232	Severe Air Pollution
Cauvery Bhavan (Mysore Bank Circle)	241	Severe Air Pollution
Old Madras Road	194	Severe Air Pollution

*AQI - Air Quality Index

Environmental health hazards linked with air pollution

Increasing air pollution levels, shrinking greenery and shrinking of lung spaces over the past few years has made Bangalore City the Asthma capital of India. Due to rapid urbanization and pollution has led to increase incidence of Asthma - children are most vulnerable to asthma. According to Pediatric Pulmonologist – "Though asthma can be hereditary, the Environment plays a key role in causing the disease". Changing lifestyle, eating habits and rise in traffic congestion are some of the reason leading to asthma among the urban population. Based on the study conducted over the past 30 years children suffering from asthma increased from 9% in 1979 to 25.6% in 2009. Though there is no cure for asthma, timely intervention, regular medication and appropriate changes in the environment can help contain the disease. **Rising pollution levels in Bangalore City over a period have led to an increase in the number of health ailments among citizens.** Skin diseases, allergies, respiratory problems, etc, are on the rise. Fine dust particles are potential triggers for skin diseases. With the depleting ozone layer, sun burns are quite commonly reported among the people say dermatologists. Those travelling often are at higher risk of suffering from clogged skin pores. Due to exposure to pollution, causes related to pimples and eczemas are on the rise, and possibilities of scalp-related problems like dandruff and itching increased with suspended dust particles. Hence, it is important to take good care of hair and scalp. The same can also lead to critical conditions like skin cancer if ignored in the long run. Extra care is advised for those with sensitive skin.

Air pollution caused by the automobiles has impacts on health and imposes potentially substantial economic costs to society. Most of the health effects from air pollution come from respiratory symptoms in the levels of pollution in Bangalore City and other cities throughout the world. The time-series have revealed the effects of various pollutants (generally PM10= particulate matter smaller than 10 µm in diameter, ozone, CO=Carbon Monoxide, NO2=Nitrogen dioxide, and SO2=Sulpher dioxide.).The Harvard school of public health has assessed health risks found in current and anticipated levels of air pollution Mexico city Metropolitan Area implications of air quality focused on pollutants, mainly by PM10 (particulate matter smaller than 10 µm in diameter) and ozone. The Studies in various cities around the world, including Bangalore City, shows that there is a daily fluctuations in air pollution levels in different parts of the world. It is estimated that for each 10 µg/m3 increase in daily levels 4 of PM10. So, due to increase in particulate matter of air cardiovascular, coronary heart diseases and even premature deaths among the infants will take place. This can be done by reducing 10 percent reduction in PM10 may reduce the death of infants. Several studies revealed that the effect could be several times larger if one considers longer-term responses to particulate matter exposure PM10 concentrations have also been associated with health outcomes including increased cases of chronic bronchitis, respiratory or cardiovascular problems, asthma attacks, symptoms etc. The ozone has significant effects on respiratory function and on respiratory conditions such as asthma. So for this recent research suggests that important factor for human health involves the presence of fine particles (PM2.5). So for the monitoring PM2.5 and to develop an emission in inventory should be given more importance.

Concluding remarks

The rapid population growth of vehicles in multiple ratios continues to be a matter of concern for the Bangalore city as it has manifold effects since the last decade, one of the most important being environment degradation. The unprecedented speed of urbanization of Bangalore has resulted in enormous pressure on the environment with severe adverse

impacts in terms of pollution, and today city is considered as one of the most polluted city in the country. While the projected rate of population increase may be reduced, even moderate population growth is likely to lead to substantial increases due to passenger and freight travel demand in the city, due to introduction of Metro, Monorail, BRTS, fuel price etc. The increasing geographic dispersion of metropolitan population is also likely to increase aggregate transportation demand, since the greater number of trips will also be longer and public transport will be less efficient and universal. So to improve the quality of air and water there is a need of strict enforcement and monitoring program by the Karnataka Pollution Control Board. There is also a need traffic regulations; efficient public transportation system in the city and heavy penalties and seizure of vehicles during violation of rules should be imposed on public. For the protection of environment more emphasis should be laid on compulsory environmental education at school level for the awareness to people know about how and why we need to save environment. In our future this carbon wedge era we should work together in reducing global warming and other efficiencies by reducing vehicle use across all transport sectors.

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