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Assessment of the Impact of Vehicular Pollution by Automobiles on Ambient Air Quality

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ABSTRACT- Nagpur is located in Maharashtra, India. It is also known as Orange City. Nowadays Nagpur has become the Metropolitan City. Nagpur has the distinction of being the geographical center of the Indian Peninsula. Nagpur is situated on the Deccan Plateau at an elevation of 310 meters above sea level, and it is the 3 largest city and Maharashtra is a major commercial and political center of the state. It is also the seat of the annual winter session of the Maharashtra State Assembly. Agriculture (especially oranges and Ayurvedic medical processing) makes up a large part of their economy. Other areas include information technology, manufacturing, transport systems, mining and power generation. As it is located in central India and close to the coal belt, electricity generation is an important area of our economy. They are maximum number of industries, factories, power plants etc. located near by Nagpur City. These industries, factories, power plants etc. responsible for maximum create Emission or pollutate gases. In Nagpur Maximum number of Vehicles also responsible for CO_2 Emission & deforestation also playing big role in Emission. In this study we detailed discussed about vehicular emission in Nagpur City with their minimization use of different techniques & Compare Future Scope from India's Capital "New Delhi".

KEYWORDS- Vehicular Pollution, Motor Vehicles, Air Pollution, Nagpur City, Global Warming

I. INTRODUCTION

Vehicular pollution is the introduction of harmful material into the environment by motor vehicles. These materials, known as pollutants, have several bad effects on human health and the ecosystem. Transportation is a major source of air pollution in many countries around the world due to the high number of vehicles that are available on the roads today. An increase in purchasing power means that more people can now afford cars and this is bad for the environment. Vehicular pollution has grown at an alarming rate due to growing urbanisation in India. The air pollution from vehicles in urban areas, particularly in big cities, has become a serious problem. The pollution from vehicles has begun to tell through symptoms like cough, headache, nausea, irritation of eyes, various bronchial and visibility problems. Environmental concerns have become one of the most impotant issues in transport policy debates. Significant quantities of CO, HC, NOx, SPM and other air toxins are emitted from the motor vehicles into the atmosphere causing serious environmental and health impacts. Air pollution from motor vehicles in many countries, has replaced coal smoke as the major cause for concern. However, continuing growth in vehicle use means that efforts to reduce emissions from individual vehicles are being overtaken by increase in the volume of traffic. Vehicular traffic has become a major source of air pollution in urban areas.Transport sector contributes around 14% towards the global emissions of greenhouse gases (CPCB, 2010). Carbon dioxide represents the largest proportion of basket of greenhouse gas emissions. With rapid urbanization, road transport related CO2 emissions from urban areas are likely to increase further in coming years mainly due to inadequate public transport system, high vehicle density in urban areas and increasing share of private vehicles vis-a-viz public transport vehicles in developing countries (Sharma et al., 2010). During, the past three decades CO2 emissions from transport have increased faster than those from all other sectors and are projected to increase more rapidly in future. From 1990 to 2007, CO2 emissions from the world's transport sector have increased by 36.5%. Also, for the same period, road transport emissions have increased by 29% in industrialized countries and 61% in the other countries (CPCB, 2010). Worldwide, transport sector is responsible for approximate 23% of energy related CO2 and 13% of all GHGs emitted from various sources. Further, CO2 emissions is expected to increase by 1.7% a year from 2004 to 2030 largely attributable increased demand for mobility in developing countries where it is expected to grow with an average of 2.8% a year for the same period.

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| Volume 10, Issue 3, May 2023 |

II. LITERATURE REVIEW

2.1 INTRODUCTION

There is a vast literature on vehicular emission and its impact on environment. A large number of these studies also relate themselves to the questions of socio-economic causation. It is not our intention to give an encyclopedic view of the entire literature in this chapter. Our aim is rather modest. We wish to concentrate only on a few studies that are relevant for the
exercise we have undertaken in this dissertation.

We divide our review into three subsections-
a) a synoptic view of the literature of vehicular emission in general
b) vehicular emission in developing countries and
c) vehicular emission in Nagpur.

2.2 VEHICULAR EMISSION IN GENERAL

Faucet and Sevingny (1998) have argued at the same conclusion that inefficient transportation is the major culprit of air pollution accounting for over 80% of total air pollutants. This is a clear indication that vehicle emissions are a major source of ambient air pollution. The form of urban growth in most developing countries has tended to increase the use of motorized transport, particularly road transport, which leads to increase environmental impacts.

The composition of traffic on city roads also affects emission." The future trend in vehicle growth can have serious implications and fuel consumption patterns," warns VSN Shrinivasan, an energy expert from TERI (Tata Energy Research Institute). A large number of private vehicles for example, are two-wheelers, which are cheap and reliable but also high on emissions. Different studies have been done in the field of motor vehicular emissions in the different regions of the world, especially to establish the level of air pollution from the operation of motor vehicles and the general urban air quality as a whole. Three of such studies which have relevance to this study are: the vehicle activity study in Nairobi, Kenya, conducted in March 2001 by the U.S. EPA, CE-CERT5, and GSSR6 the evaluation of evaporative emissions from gasoline powered motor vehicles under South African conditions, conducted in 2003 by Van des Westhuisena et al. (2004); and the impact of automobile emissions on the level of platinum and lead in Accra, Ghana conducted in 2001 by Kylander et al. (2003). All of these find strong correlates between air pollution and vehicular efficiency (in the fuel use).

Ambient temperature and local meteorology influences the concentration and location of vehicle-emitted pollutants. For example, elevated sulphur dioxide levels are typically reported in the winter and elevated ground-ozone levels in the summer (Goldberg et al. 2001; Rainham et al. 2005). Cold weather can result in higher levels of pollutants in ambient air due to reduced atmospheric dispersion and degradation reactions. The genotoxic effects of PM2.5 and PM10 have also been found to be greater in the winter months (Abou Chakra et al. 2007). Dispersion of pollutants is also affected by other meteorological factors like humidity, wind speed and direction and general atmospheric turbulence.

Many studies have found that chronic exposure to high levels of traffic noise significantly increases the risk for cardiovascular diseases and death by myocardial infarction (Babisch 2000, Fogari 1994 and Davies 2005). A study in Denmark of 28,744 men with lung cancer found an increased risk among taxi drivers and truck drivers when compared with other employees, after adjustment for socioeconomic factors (Hansen et al. 1998). Other studies have found similar effects for lung cancer in taxi, truck, and bus drivers (Borgia et al. 1994, Guberan et al. 1992, Jakobsson et al. 1997, Steenland et al.1990). A similar study confirms that there is a prevalence of chronic bronchitis and asthma in street cleaners exposed to vehicle pollutants in concentrations higher than WHO recommended guidelines, thus leading to significant increase in respiratory problems Rachou (1995). Other studies in Ethiopia, Mozambique, and Kenya found significantly higher prevalence of asthma in urban school children exposed to traffic pollution compared to rural child (Bekele 1997, Mavale-Manuel 2004 and Ng'ang'a 1998). **In 2004, Toronto Public Health released** a study that calculated the burden of illness associated with ambient (outdoor) levels of air pollution in Toronto. The study estimated that smog-related pollutants from all sources contributed to about 1,700 premature deaths and 6,000 hospitalizations each year in Toronto. The study indicated that these deaths would not have occurred when they did without chronic exposure to air pollution at the levels experienced in Toronto. TPH stuff used the Air Quality Benefits to determine the burden of illness and economic impact from traffic related air pollution.

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| Volume 10, Issue 3, May 2023 |

In 2008, Erica Moen conducted a survey on "Vehicle Emissions and Health Impacts in Abuja, Nigeria" and put a question on the seasonal variation of pollution and fond that the greatest percentage of respondents (42%) reported that their symptoms are more severe in the dry season. This implies that documented concentrations may actually be lower than what is observed in the dry season, which is supported by similar monitoring studies.

Several studies reported significant health risks and increased morbidity and mortality rates and hospital admissions because of cardio respiratory diseases, oxidative stress, and an increase in the incidence of cancer among the urban population (Maynard 1999). Aside from exposures while traveling inside a vehicle, a significant proportion of the population are exposed through occupations that lead to extended periods of time on or near roads and highways or close to traffic like asphalt workers (Randem et al. 2004), traffic officers (de Paula et al. 2005; Dragonieri et al. 2006; Tamura et al. 2003, Tomao et al. 2002, Tomei et al. 2001), street cleaners (Raachou-Nielsen et al. 1995), street vendors, and tollbooth workers. Health impacts are greater for these groups who work close to traffic than for those that are not occupationally exposed. The ill-effects of this pollution are mainly by the people who came close contract with it (such as constables, street venders, shop-keepers etc.). A study in Copenhagen found that street cleaners had a greater risk for chronic bronchitis and asthma when compared with cemetery workers (Raaschou-Nielsen et al. 1995). It has been reported that traffic policemen present with airway inflammation and chronic respiratory symptoms at higher rates than in non-exposed groups (Dragonieri et al. 2006 and Tamura et al. 2003). Asphalt workers have also been reported to have an increased risk of respiratory symptoms including lung function decline, and chronic obstructive pulmonary disease (COPD) as compared with other construction workers (Randem et al. 2004).

Individuals living close to major roads are at increased risk of exposure to traffic related pollution and related health effects. In fact, residential proximity to a major road has been associated with a mortality rate advancement period of 2.5 years (Finkelstein et al. 2004). Of particular concern are communities close to border crossings, where traffic levels are high and include a large proportion of transport trucks. For example, individuals living close to the Peace Bridge, one of the busiest US-Canada crossing points, show a clustering of increased respiratory symptoms, particularly asthma (Lwebuga-Mukasa et al. 2005; Oyana et al. 2004 and Oyana et al. 2005). Moreover, street vendors frequent high traffic intersections, working both on the sidewalk and walking through the intersections during slow traffic. Street vendors, therefore, may be at high risk of developing health effects, which has been documented by a study in India (Chantanakul 2006).

Traffic wardens, part of the Federal Capital Territory Area Command (FCTAC), were included in the study to link measured pollutant concentrations with health impacts. Wardens are the highest exposure group because they stand in intersections and direct traffic, so they are directly and frequently exposed to vehicle emissions. Thus, it is reasonable to expect their health status to directly reflect that level of exposure. There are roughly 300 active traffic wardens in Abuja who work on average 8 hours per day between the hours of 7am and 8pm, 5-7 days per week, with 2 weeks of vacation per year (Akoni 2008).

2.3 VEHICULAR EMISSION IN DEVELOPING COUNTRIES

A Case Study on Beijing is done by Hao and Wang (2005) urban air pollution is one of the major environmental issues. Air pollution problems are induced by high-speed urbanization, rapid economic growth, and explosive motorization. Chinese cities pose a direct threat to long-term economic sustainability and social benefit. Air pollution problems in Chinese cities are serious, especially in large cities.

From the CPCB report of 2010, air pollution is one of the serious environmental concerns of the urban Asian cities including India where majority of the population is exposed to poor air quality. Most of the Indian Cities are also experiencing rapid urbanization and the majority of the country's population is expected to be living in cities within a span of next two decades. Since poor ambient air quality is largely an urban problem this will directly affect millions of the dwellers in the cities. The rapid urbanization in India has also resulted in a tremendous increase the number of motor vehicles. The vehicle fleets have even doubled in some cities in the last one decade. This increased mobility, however, come with a high price. As the number of vehicles continues to grow and the consequent congestion increases, vehicles are now becoming the main source of air pollution in urban India.

The developing countries suffer more than the developed countries from air pollution which happens from vehicle emissions. High levels of lead, primarily from vehicle emissions, have been identified as the greatest environmental

danger in a number of large cities in the developing world. For them the problem is becoming more acute as the numbers of motor vehicles are growing rapidly. Delhi's inhabitants inhale the most polluted air in the country and vehicular pollution is responsible for 64 percent of the pollutants which make it so (Bhattacharyya et. al. 2002). At any point of time, the quality of air i.e. ambient air quality would be determined by the amount of pollutants present, the rate at which they are released from different sources and also how quickly the pollutants get dispersed into the environment. There have been lot of research on assessment and establishment of baseline ambient air pollution and also there have been lot of research studies to study the impact of meteorological parameters on air pollutant. Lately there have been research studies on air dispersion modelling.

Previous researches have used various mathematical models or simulations to assess air pollution, its dispersion in the environment and the impact on overall air quality in the region so as to able to estimate the level of pollution concentration. Such models then result in assisting designing of effective control strategies to reduce emissions of harmful air pollutants (Singh et al., 2006). To study the impact of vehicular pollution on ambient air quality, literature was reviewed extensively from different sources such as Ministry of Environment and Forests Library, Central Pollution Control Board, IIT, Delhi – Library, Indian Road Congress Publications, Ministry of Road Transport and Highways, Google Scholar etc. The literature gave reference of around 200 studies related to air pollution, and for the purpose of our study we have mentioned around 120 studies which are more closely related to impact of vehicular pollution on ambient air quality. In Europe and United State, Small and Kazimi (1995) reported that motor vehicles emission account for 92 – 98% of national emission of CO. Furthermore, Cline (1991) stated that transportation accounts for an important fraction of greenhouse gases (especially CO2) emission. As per an estimate, air pollution contribution of transport sector was about 72% in Delhi and 48% in Mumbai (Goyal et al., 2006).

The origin of urban air pollution is mainly in anthropogenic emission sources, which include automobiles, industries, and domestic fuel combustion. In arid and semi-arid regions, deserts contribute to urban air pollution as does the sea in coastal regions. The air pollutants so generated are detrimental to human health. In addition, they cause negative impacts directly or indirectly, if at high concentrations, on vegetation, animal life, buildings and monuments, weather and climate, and on the aesthetic quality of the environment (Stern, 1976; Godish, 1985; Takemura et al., 2007, Shen et al., 2009). Rates of increase of air pollutant concentrations in developing countries such as India are higher than those in developed countries and hence atmospheric pollution is often severe in cities of developing countries all over the world (Mage et al., 1996).

In India extant researches have been carried out to establish baseline traffic and transport scenario and to understand impacts on ambient air quality in urban areas. Saini et al. in 1994 monitored suspended particulate matter in Chandigarh to study deteriorating air quality. Atmospheric concentrations of the SPM in the Chandigarh city and its industrial area were measured from April to December 1993. The data collected was investigated and its statistical distribution, the weekly, daily and monthly variations was studied. On the whole a resident of city was exposed to over the maximum desirable level of 200 µgm/m3 for about 126 day whereas a person in the industrial area was exposed to over the stipulated limit of 500 µg/m3 for about 13 day. Later Bansal in 1996 monitored NO2 Concentration to establish ambient air quality of Bhopal city with reference to nitrogen dioxide.

In the commercial areas maximum NO2 was recorded as 96.4 µgm/m3 . Corresponding value in the industrial area as 66.3 µgm/m3 and 53.5 µg/m3 in the residential area. Das et al. in 1997 monitored SO2, NO2 and CO concentration during evening peak traffic hours in Jaipur to study the rapid assessment of air quality in Jaipur city and to identify critical zones for evolving a proper environmental management strategy. Later Panwar et al. in 1997 monitored SPM, SO2 and NOx in 62 cities across India to study ambient air quality status of various cities in India. The air quality levels were compared against the prescribed standards to draw inferences regarding the pollutant (s) of concern and the severity of the problem at various cities/towns in the country. Analysis of the data reveals the prevalence of high SPM pollution levels in most of the cities, while only a few of them have high SO2 or NOx problem.Transport is a vital component of any vibrant city. With the case study of Ahmedabad, the primary reasons for pollution and lack of management in respect of transport are lack of integration between land use and transport planning, concentration of economic and other activities in the core of the city, lack of scientific design of road networks, high rate of growth of vehicles, mixed traffic on roads, and low quality and adulterated fuels (Brar 2004).

The pressures on transport systems are increasing in most developing countries, as part of the process of growth. It is even worst in urban areas where population densities are higher Motor vehicle ownership and use are growing even

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| Volume 10, Issue 3, May 2023 |

faster than population, with vehicle ownership growth rates of 15 to 20 % per year common in some developing countries (World Bank 1995).

Shariff (2012) expressed his concern that private vehicles today have become the main means of travel of urban living in developing countries. Consistent economic growth, rising incomes, and urbanization have led to rapid growth in vehicle ownership and usage. Private vehicle ownership is also associated with externalities such as traffic congestions, accidents, inadequate parking spaces and pollutions. Rising vehicle congestion and slower travel speeds are the most obvious impact of rapid motorization. With the increase in vehicle ownership, it has been emphasized that the demand for travel to central city areas would grow far beyond the capacity of the road network. Hence air pollution and other environmental hazards are another important concern.

According to WHO report published in 1994 the Indian capital is the fourth most polluted city in the world. And no wonder, the amount of pollutants the transport sector pumps into Delhi more than the sum of vehicular pollutants emitted in Mumbai, Bangalore, and Kolkata. However, the Delhi has taken stringent steps recently that brought down the vehicular pollution to a considerable extent. India is moving on a fast track with the increase in GDP by 2.5 times, industrial pollution by 8 times over the last two decades (Pattanaik and Pattanaik 2002). Noise, air and water pollution are all serious problems in Indian cities, and transport sources contribute all three kinds. Heavy transportation in metropolitan cities is a major contributor to environmental pollution in addition to industrial and commercial activities. Indian cities face a transport crisis characterized by levels of congestion, noise pollution, traffic facilities and injuries, and inequality far exceeding those in most European and North American cities. India's transport crisis has been exacerbated by the extremely rapid growth of India's largest cities in a context of low incomes, limited and outdated transport infrastructure, rampant suburban sprawl, sharply rising motor vehicle ownership and use, deteriorating bus services, a wide range of motorized and non-motorized transport modes sharing roadways, and inadequate as well as uncoordinated land use and transport planning (Pucher et. al. 2004).

According to India Development Report of 1997 the reasons for deterioration of urban air quality throughout the Indian cities are growing industrialization without any priority for pollution abatement, and rising number of motor vehicles especially of poorly maintained vehicles that used leaded fuel. The rate of generation of solid waste in urban centers has outpaced population growth in recent years with the wastes normally disposed in low-lying areas of the city's outskirts (India: State of the Environment 2001). Vehicles are a major source of pollutants in cities and towns. A three-fold increase in the number of motor vehicles has been found in India in the last decade. The concentration of ambient air pollutants in the metro-politan cities of India as well as many of the Indian cities is high enough to cause increased mortality. The life of the urban dwellers of India may become more miserable which may be the cause of health hazards and worst devastation.

In all the four metro cities SPM was found highest along with the problem of solid wastes. The noise pollution was noticed more than the prescribed standard in all the four metro cities. Five and more person residing in a room was faced by more than one fourth population of Mumbai followed by a little less than one fifth population of Kolkata and about 10% population of Delhi and Chennai both. India's urban future is grave (Maity and Agarwal 2005). The total pollution load from transport sector has increased from 0.15 million tones in 1947 to 10.3 million tones in 1997 (TERI 1997). Like many other parts of the world, air pollution from motor vehicles is one of the most serious and rapidly growing problems in urban centers of India (UNEP/WHO, 1992). In India, the number of motor vehicles has grown from 0.3 million in 1951 to approximately 50 million in 2000, of which, two wheelers (mainly driven by two stroke engines) accounts for 70% of the total vehicular population.

According to UNEP-WHO report, 1992 and the World Development Report 1992 vehicles are nowhere the principal cause but its relative importance is growing rapidly over time. In World Bank's report of 1992 the Bank expressed the premonition that such economic growth will be associated with applying environmental damage. Degraded air quality would be one of such impending damage that may cripple the developing country.

According to the report of CPCB in 2010, air pollution is a major environmental risk to health and is estimated to cause approximately 2 million premature deaths worldwide per year. The high level of pollutants are mainly responsible for respiratory and other air pollution related ailments including lung cancer, asthma etc., which is significantly higher than the national average (CSE, 2001 and CPCB, 2002).

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| Volume 10, Issue 3, May 2023 |

2.4 VEHICULAR EMISSION IN NAGPUR

Now coming to Nagpur, condition is not at all better. Traffic problem in Nagpur seems to be on its way to accruing the dimension of cities like Mumbai, Kolkata, Delhi, where commuters more or less live in their vehicles, bathing and getting dressed for works while inching their way through nightmarish traffic jams. Nagpur's citizens already spend hours gulping down fumes while stuck in traffic jams. During the last decade the road length has not increased significantly in Nagpur. So Traffic jam occurs.

As Traffic moves slowly, slow moving vehicles emit more carbon monoxide, the problem is more surmounted for the Nagpur by the lack of adequate data availabity. This co-effect is toxic to human's body. It reacts with the hemoglobin of blood and affects oxygen supply to the brain. They have also observed that the air of Nagpur is polluted differently in different seasons. During the monsoon season (July-October) the air is comparatively clean due to heavy rainfall and during the summer (April-June) high winds blow away the pollutants.

The population residing in the vicinity of the city, daily commuters, and business people are always exposed to the traffic air containing particulate matters, inorganic gases, and volatile and semi volatile organic compounds .

One of the major causes for road congestion and therefore, vehicular emission is the massive increase in the vehicular pollution plying in and around the Nagpur city area. According to the report published in the recent Telegraph 7.12.99, the aggregate registered vehicular population in Kolkata has increased from 6, 34,835 in 1997 to 9, 50,000 by the end of 1997, in 2006-07, it has increased massively. Due to this huge vehicular pollution growth, the energy demand (both diesel and petrol) increased manifold. One of the major factors that determine vehicular emission is the speed of the vehicles.

According to the eminent scientist there exists a critical speed at which the emission is less of the vehicles. If the speed is well below or well above that critical one then the emission will rise significantly. So vehicle pollution is one of the important components in air pollution. Citing a study by NEERI they found that the main concentration levels for various atmospheric pollutants have increased in all the major cities. According to the World Resource Report (1996-97) the motor vehicles are responsible for 90% emission of (CO), 85% of sulfur dioxide (SO2) and 37% of (SPM) in Delhi.

According to the same report, automobiles caused about 52% of the total (NO2) emissions, 5% (SO2) emissions and 24% of SPM emission in Mumbai in 1992. In the year 1993-94, the share of automobiles in total pollutant load was as high as 64% in Delhi and 52% in Mumbai. The share was 30% in Kolkata in 1988-89. According to a report of the National Commission on urbanization 1988, the increase in projected travel demand per day in Kolkata in 2001 will be 63% compared to the 1981 base.

2.5 REVIEW/ RESEARCH ARTICLE

[1] Reviewing the Impact of Vehicular Pollution on Road-Side Plants—Future Perspectives (2021)
With population explosion, automobiles have also exploded and so has pollution due to vehicular emissions. Road-side plants and highway vegetation are the first targets of these vehicular emissions. This review briefly presents a snapshot of how vehicular emission can affect plants. On the contrary, the positive perspective of how road-side plants may be able to affect and influence the harmful effects of vehicular emissions has also been discussed. Ways and means by which plants can become potential bio indicators of air pollution have also been speculated. The fact that the nanocarbon particulate aspect of automobile pollutants and their interactions with road-side plants and more so on road-side agricultural crops, has not been appropriately investigated has been raised as a key concern. The need to arrive at mitigation methods to identify permanent solutions to these rising concerns has been highlighted.

[2] Assessment of Impact of Vehicular Pollution on Ambient Air Quality A Case Study of Nagpur City (2021)
The rapid development in urban India has resulted in a tremendous increase in the number of motor vehicles. In some cities, this has doubled in the last decade. Rapid urbanization and growth of motor vehicles impose a serious effect on human life and the environment in recent years. Motor vehicles are a significant source of urban air pollution and are increasingly important contributors of anthropogenic carbon dioxide and other greenhouse gases. Transport sector contributes a major sector, contributing 90% of total emissions. Air pollution is a serious environmental health threat to humans. Adverse effects range from nausea, difficulty in breathing and skin irritations, birth defects,

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| Volume 10, Issue 3, May 2023 |

immunosuppression and cancer. All these situations indicate that air pollution becoming a major problem in Indian context and there is an essential need to build up healthy environment and increase the level of research around the world. Indian cities are facing the problem of severe air pollution and vehicles are a major source. The economically vibrant cities like Delhi, Bengaluru, Chennai, Hyderabad, Mumbai provide numerous job opportunities and hence have a large vehicle population. These cities thus contribute the largest share in emissions of pollutants. Other growing cities like, Jaipur, Pune, Coimbatore, Nagpur are also emitting a lot of pollutants. The present study is a case study of an increase in vehicular pollution in Nagpur.

[3] A review of vehicular pollution in urban India and its effects on human health (2014)

The rapid development in urban India has resulted in a tremendous increase in the number of motor vehicles. In some cities, this has doubled in the last decade. Rapid urbanization and growth of motor vehicles impose a serious effect on human life and the environment in recent years. Motor vehicles are a significant source of urban air pollution and are increasingly important contributors of anthropogenic carbon dioxide and other greenhouse gases. Transport sector contributes a major sector, contributing 90% of total emissions. Air pollution is a serious environmental health threat to humans. Adverse effects range from nausea, difficulty in breathing and skin irritations, birth defects, immunosuppression and cancer. All these situations indicate that air pollution becoming a major problem in Indian context and there is an essential need to build up healthy environment and increase the level of research around the world. The present study is a review of an increase in vehicular pollution in India and its effect on human due to increasing road transport.

[4] Study on the effect of vehicular pollution on the ambient concentrations of particulate matter and carbon dioxide in Srinagar City (2022)

The present study was carried out to monitor the ambient concentrations of particulate matter and carbon dioxide caused by vehicular pollution in Srinagar City of Jammu and Kashmir, India, for a period of 12 months from June 2019 to May 2020 as the major contributions in these areas are due to vehicular movement. Out of five, four locations (viz. Dalgate, Jehangir Chowk, Parimpora and Pantha Chowk) had highest traffic density in the city and the fifth location (Shalimar) had low traffic volume. The sampling was done on every fortnight using AEROCET 831—aerosol mass monitor and CDM 901—CO2 monitor with each sampling being carried out three times a day, i.e. morning (9:00 am–10:30 am), afternoon (1:00 pm–2:30 pm) and evening (4:30 pm–6:00 pm) with three replications at each site based on the peak traffic hours. The results show that during the whole period, average PM1 concentrations ranged from 15.10 to 108.9 µg/m3, PM2.5 (28.70–577.50 µg/m3), PM4 (44.50–780.87 µg/m3), PM10 (57.13–1225.53 µg/m3), total suspended particulates (77.77–1410.27 µg/m3) and CO2 (332.4–655.0 ppm). The average concentrations of these parameters showed that the maximum PM1 concentration was found at Dalgate (53.77 µg/m3) and PM2.5 had its maximum average concentration at Jehangir Chowk (140.13 µg/m3). Other parameters like PM4, PM10, TSP and CO2 had a maximum average values at Jehangir Chowk (240.23 µg/m3, 633.40 µg/m3, 853.50 µg/m3 and 533.20 ppm, respectively). The pollution load was observed to be maximum during winter season followed by autumn, summer and spring. The lowest concentration of all pollutants except CO2 was observed in April 2020 and this might be due to COVID-19 lockdown observed in the country during the same period.

[5] Research on the Vehicle Emission Characteristics and Its Prevention and Control Strategy in the Central Plains Urban Agglomeration, China (2021)

With rapid economic development and urbanization in China, vehicle emissions are increasingly becoming one of the major factors affecting air quality. The Central Plains Urban Agglomeration (CPUA), which has undergone a fast increase in vehicle population and has an advantageous geographical location, was selected as the study area. Vehicle emissions estimated based on the COPERT IV model in this area changed greatly between 1999 and 2015, during which time the emissions of NOx, CO2 , and NH3 increased markedly. Passenger cars and light-duty vehicles were the main contributors to pollutants CO and non-methane volatile organic compounds (NMVOC) emissions. Heavy-duty trucks and buses were the important contributors to pollutants NOx, PM2.5, and PM10. Passenger cars were the major contributors to CO2 , CH4 , N2O, NH3 , and SO2 . The city with the most emissions is Zhengzhou, followed by Luoyang, Shangqiu, and Zhoukou. The spatial distribution of vehicle emissions has formed around or tended to concentrate in urban centers. Then, this study also predicts the vehicle emissions from 2015 to 2025 and designs ten policy scenarios for the prevention and control of emissions to evaluate the emission reduction effect. The radical integrated scenario was most effective for controlling CO, NMVOC, NOx, PM2.5, PM10, CO2 , N2O, and NH3 emissions than any one scenario by itself.

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| Volume 10, Issue 3, May 2023 |

[6] Impact of Vehicle Emission A Case Study of Delhi- "The Smog City" (2018)

The current paper aims to examine the amount of toxicity of environmental pollution and measures taken to control it in the mega city "Delhi". The trend of Environmental Pollution and their causes will be studied through secondary data-based research consisting mainly of reports and official data. The analysis depicts the rapid population growth and urbanization continues to be a matter of serious concern as it has many manifold effects, one of the most important being environmental pollution through the use of heavy vehicles by the overgrowing population. As the number of vehicles continues to grow and the consequent congestion increases, vehicles are now becoming the main source of air pollution. Densely populated and rapid rate of growing vehicles in Delhi is often entombed in a pool of pollution. Although, the air quality can be improved through a combination of technical and non-technical measures, legislative reforms, institutional approaches and market-based instruments, there are certain unique challenges which our country has to face in tackling the problem of air pollution. Improvements are required right from the improvement in the fuel quality, formulation of necessary legislation and enforcement of vehicle emission standards, improved traffic planning and management. The recent pollution control measures and vehicular pollution control device which could control the pollution & report online to the controlling agency about pollution emissions about any vehicle taken by central government reduced the environmental pollution up to some extent.

[7] Assessing Mumbai's in-use vehicular characteristics, current emissions, and future projections under various policy interventions (2022)

Vehicular emissions are the major source of air quality deterioration in Indian megacities. However, there is uncertainty in vehicular emission estimation due to the paucity of vehicular use and travel characteristics, and there is no specific methodology to assess the same. Thus, this study presents a methodology to capture the urban in-use vehicular characteristics. Additionally, it evaluates current vehicular emissions in Mumbai and estimates future emission levels for the year 2030, taking into account various policy interventions. Data for the study were collected via questionnaire surveys at fuel stations across Greater Mumbai – a first in western India. Exhaust and non-exhaust vehicular emissions were developed using the "bottom-up" methodology. Six scenarios were tested for exhaust vehicular emissions and energy consumption under various policy interventions. Monte-Carlo Simulations (MCS) were carried out to find the uncertainties in the vehicular emission estimation. Results showed that approximately 66% of the registered vehicles ply on Mumbai roads, and the on-road fuel efficiency is 12–33% less than the reported lab-based studies. Our study findings suggest that conducting surveys at three fuel stations is adequate for determining urban in-use vehicular characteristics with <5% bias. Reduction in vehicular emissions calls for stringent norms for private passenger vehicles and regulation of non-exhaust vehicular emissions. Given projected vehicular emissions for 2030, urban cities like Mumbai will have to inevitably replace conventional vehicles with electric vehicles to achieve the Paris agreement, which is to limit global warming well below 2 °C.

III. CONCLUSION

The above studies clearly reveal that pollution have a numerous effect on the life of man. However, pollution itself is a result of a complex socio-economic process. Our aim in the project is to understand some of the aspects of vehicular emission in the context of Nagpur.

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