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Environmental Impact of Automobiles in India

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Abstracts: **Most of the activities related to the automobile industry, directly or indirectly, have significant impact for the environment. Direct activities are connected to the production and use of the vehicle, while indirect are related to all other activities that are not controlled by the sector but influence its overall picture such as the production and distribution of raw materials. Automobile manufacturers are aware of the problem and the steps towards a more sustainable sector are obvious. In the present paper, environmental impact of Automobiles and some safety measures in Indian context has been critically analyzed.**

Keywords: Environment, Automobile, Pollution, Safety.

1. INTRODUCTION

Air pollution may be described as contamination of the atmosphere by gaseous, liquid, or solid wastes or by-products that can endanger human health and welfare of plants and animals, attack materials, reduce visibility and produce undesirable odors. Although some pollutants are released by natural sources like volcanoes, coniferous forests, and hot springs, the effect of this pollution is very small when compared to that caused by emissions from industrial sources, power and heat generation, waste disposal, and the operation of internal combustion engines. Fuel combustion is the largest contributor to air pollutant emissions, caused by man, with stationary and mobile sources.

The major pollutants which contribute to air pollution include radon, volatile organic compounds, formaldehyde, biological contaminants, carbon monoxide, carbon dioxide, sulfur dioxide, hydrocarbons, nitrogen oxides sulfur dioxide, ozone, total suspended particulate matter, lead and toxic pollutants.

When discussing about the environmental impacts of vehicles the focus is primarily on air pollution created during the utilization phase, It is the stage of the vehicles operation where the greatest emissions of various pollutants occur [1,2,3,4]. Direct exhaust emissions of hazardous substances like carbon monoxide, nitrogen oxides and small particles are important contributors to many environmental problems like smog creation and biodiversity disturbances. Those emissions affect the natural ecosystem at a more local level. At a global level, the transportation sector is pretty much related to greenhouse gas (GHG)emissions and global warming since the utilization of the vehicle and other activities related to the sector are responsible for a significant amount of carbon dioxide emitted to the atmosphere [1,2]. More than 16% of human made CO_2 emissions are caused by road transportation in general whereas another 7% to 10% is assigned to passenger cars only [4].

The rapid urbanization in India has 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. 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 the country has to face in tackling the problem of urban air pollution. These include, the transport features which are different from the developed countries particularly in terms of the types of vehicles commonly used, the manner in which the road network is operated and sharing of the limited space by pedestrians and non-motorized modes with modern vehicles in Indian cities. Vehicles in India are often much older and usually comprise technologies considered as out-dated in the developed world. The institutions responsible for managing urban air quality are also not as well developed as those in the developed countries.

The paper analyzes the vehicular emission problems in Indian cities, the Global emission of Green house gases from transport sector, contribution of various modes of transportation in building green house gases, vehicular emission load in Urban areas, safety measure undertaken and overall impact of these measures.

2. GLOBAL EMISSIONS OF GREEN HOUSE GASES FROM TRANSPORT SECTOR

Transport sector contributes around 14% towards the global emissions of green house gases. Carbon dioxide represents the largest proportion of basket of greenhouse gas emissions. During, the past three decades, carbon dioxide emissions from transport have increased faster than those from all other sectors and are projected to increase more rapidly in future. The Road transport alone emits around 16% of the global CO_2 emissions [5]. From 1990 to 2004, carbon dioxide emissions

from the world's transport sector have increased by 36.5%.For the same period, road transport emissions have increased by 29% in industrialized countries and 61% in the other countries [6]. The global emissions of GHG's from different sectors have been shown in **Fig. 1**

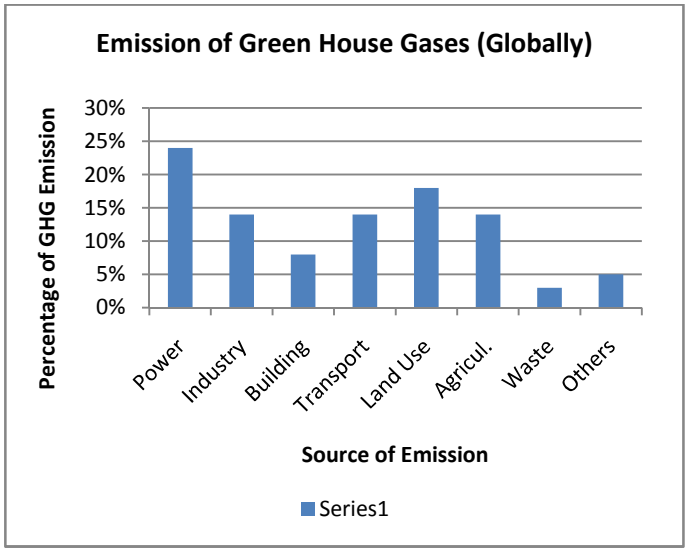

Fig. 1 Emission of Green House Gases (Globally)

The CO_2 emissions in India during 1980 to 2030 is shown in **Fig.** 2 The figure shows that the global CO_2 emissions are likely to increase in India owing to its due economic growth as well rising human population. The rising trends of CO_2 based on the observation using solar Infrared Spectroradiometer[7] are presented in Fig. 3. It may be seen that the trend is similar. However the observation using solar Infrared Spectrora diometer measure integrated column of CO_2.

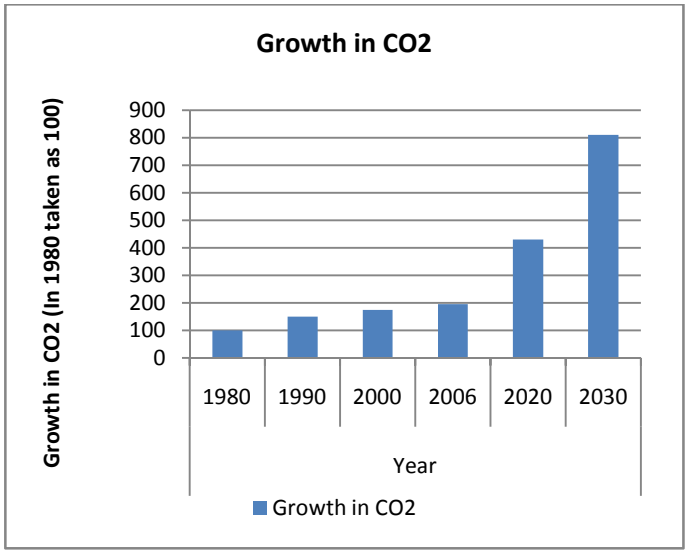

Fig. 2 Growth in CO_2 in India(IEA 2008 World Energy Outlook)

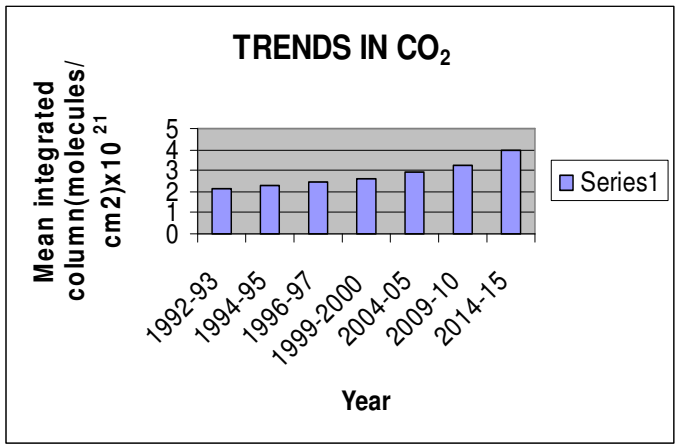

Fig. 3 Trends in CO2 (Sharma et al. 2013)

The mode wise distribution of CO_2 emissions amongst transport section is shown in Fig. 4. It reveals that road transport contributes major share of around 73% towards total CO_2 emissions from transport sector. Aviation, International shipping & Railways sector emissions of CO_2 from transport sector are about 11%, 9% & 2% respectively[8].

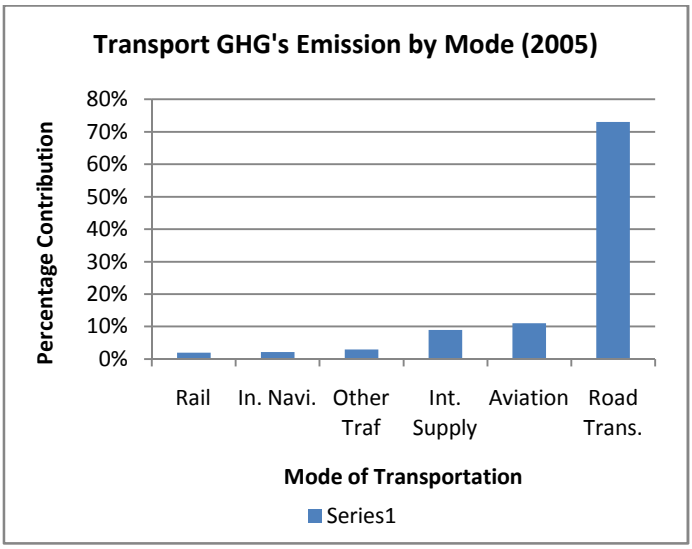

Fig. 4 Mode wise emission of CO_2 (Globally)

3. VEHICULAR EMISSIONS LOAD IN INDIA

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. Two wheelers, combined with cars (four wheelers, excluding taxis) (personal mode of transportation) account for approximately four fifth of the total vehicular population. Though two wheelers sales in India have been growing in the past few years at double-

digit rates and in 2011 surpassed ten million vehicles a year mark, however in 2012-13 sales have been flat may be on account of higher interest rates. This slow down continues to date.

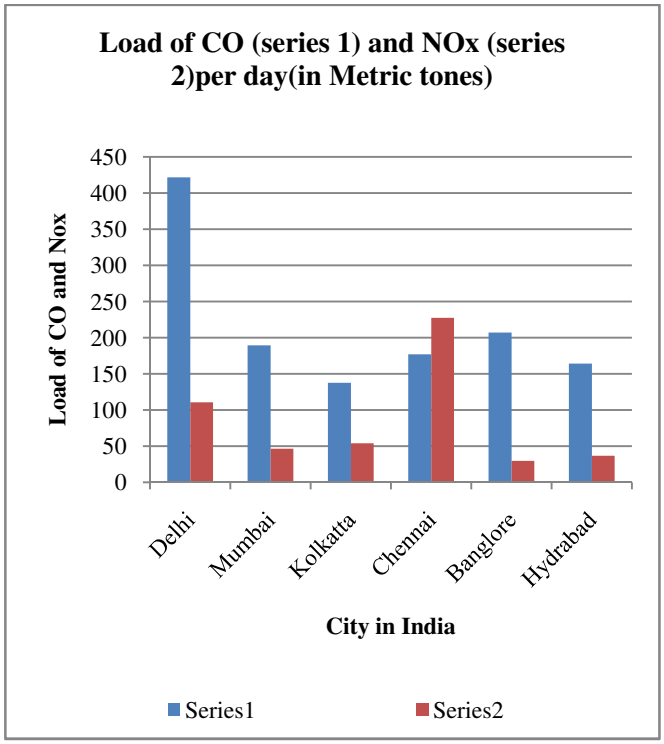

Fig. 5 Vehicular emission load in India

The problem has been further compounded by steady increase in urban population [10] and larger concentration of vehicles in these urban cities specially in four major metros namely, Delhi, Mumbai, Chennai and Kolkatta which account for more than 15% of the total vehicular population of the whole country, whereas, more than 40 other metropolitan cities (with human population more than 1million) accounted for 35% of the vehicular population of the country. Further, 25% of the total energy (of which 98% comes from oil) is consumed by road sector only. Vehicles in major metropolitan cities are estimated to account for 70% of CO, 50% of HC, 30-40% of NOx, 30%of SPM and 10% of SO_2 of the total pollution load of these cities, of which two third is contributed by two wheelers alone. These 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[10,11]. The trends in Nitrogen Oxides and PM_{10} are presented in Figure 6 and 7 respectively. The annual average for Nitrogen Oxides has been 40 µg/cm3 and for PM_{10} is 60µg/cm3. It may be seen that the concentration of Nitrogen Oxides and PM_{10} are significantly higher than the national average, which is a serious environmental concern.

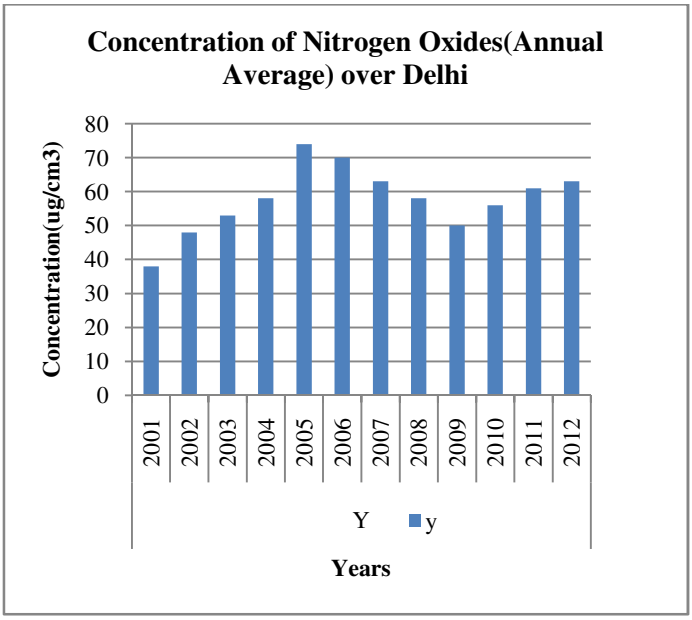

Fig. 6 Trends in Nitrogen Oxides over Delhi (standard limit 40 µg/cm^3.) Source: CPCB

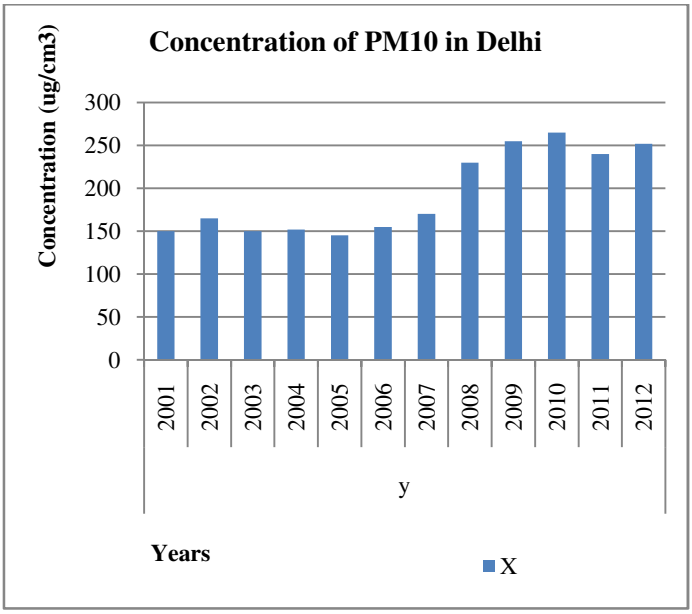

Fig. 7 Trends in PM_{10} over Delhi (standard limit 60 µg/cm^3.) Source: CPCB

4. SAFETY MEASURE

Since air pollution is directly related to the human health and welfare of plants and animals and so safety measure in regards to alternate fuels and technological advancement in design and development of internal combustion engine with in tolerance range of emission of harmful gases is the need of hours. The alternate fuels have to meet the following criteria:

1. Technical Acceptability
2. Economically Competitiveness
3. Environmentally acceptability
4. Safety and Availability

The important fuel that are considered as meeting the above criteria include Natural Gas (CNG/LNG), Propane (LPG), Ethanol, Methanol Diesel, Electric fuel, Hydrogen, Di-methyl Ether(DME), P-series, Fuel Cell and Solar fuels. Indian Government has taken various initiatives time to time for the development and promotion of cleaner alternative to conventional automotive fuels i.e. diesel and gasoline [12].

To adhere to the stringent emission norms, it is imperative that both fuel specification and engine technologies go hand in hand. Fuel quality specifications have been laid down by the BIS (Bureau of Indian Standards) for gasoline and diesel for the period 2000-2005 and beyond 2005 for the country (13,14). Given the increased usage of diesel in our country, it becomes necessary to reduce its Sulphur content, which for Bharat IV has been reduced to 50 ppm. For gasoline, lead was phased out in the entire country w.e.f. February 01. 2000.

In India, the Petroleum Conservation and Research Association (PCRA), an autonomous research body under the Union ministry of petroleum and natural gas, has signed a memorandum of understanding with the Bureau of Energy Efficiency to develop fuel economy standards under the Energy Conservation Act, 2001. The fuel efficiency standard is applicable for all types of vehicles, including cars, trucks and buses. According to government projections, the country could save up to $36 billion if fuel efficiency is improved by 50% by 2030 in all sectors.

Also Inspection and Maintenance plays an important role in control of emission. It is possible to reduce 30-40% pollution loads generated by vehicles through proper periodical inspections and maintenance of vehicles (15). Inspection and Maintenance measures for in-use vehicles are an essential complement to emission standards for new vehicles. In India, the existing mechanism of Inspection and Maintenance is inadequate. Thus, there is a great need to establish effective periodic Inspection & Maintenance programme.

5. SUMMARY

This paper analyzes the impact of Transport sector on environment. The increasing demand of vehicles on account of rapidly increasing population in India is adding the load on the environment particularly in Urban area. The high growth rate of vehicular population attributes to degradation of the atmospheric conditions which are responsible for a number of diseases. The increasing concentration of CO_2, CO and Nitrogen Oxides is of serious concern. Public awareness and improvement in fuel efficiency may maintain the environment sustainable.

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