

Impact of Oil-Using Transports on Air Pollution in Madurai Town

Dr. S. ANANTHASELVAM

Assistant Professor, P.G. and Research Department of Economics,
Raja Doraisingam Govt. Arts College, Sivagangai - 630 561.

Abstract:- This study investigates the impact of oil-using transports on air pollution levels in Madurai town. By analyzing vehicular density, fuel consumption, and emission factors, the research quantifies the contribution of different vehicle types to air pollution. Spatial analysis of pollutants and correlation with air quality indices identify critical pollution hotspots. This study focuses its attention mainly on analysing the air pollution caused by automobiles in Madurai town. Air pollution caused by automobiles is so high. Environmental issue is also a basic social issue similar on untouchability, illiteracy, child and women exploitation and bonded labour. The solution to the problem requires technological efforts and social responsibility of all concerned. Education becomes the main media, which can create awareness regarding the utilisation of human resources for environmental monitoring. The findings inform the development of targeted mitigation strategies to improve air quality and public health in Madurai.

Keywords:- Air Pollution, Oil-using Transports, Vehicular Emissions, Air Quality, Public Health, Mitigation Strategies.

I. INTRODUCTION

Air pollution has emerged as a critical global challenge, with devastating consequences for human health and the environment. Transportation, particularly the reliance on oil-based vehicles, is a major contributor to this crisis. The city of Madurai, experiencing rapid urbanization and economic growth, is grappling with deteriorating air quality. While studies have explored the general impacts of transportation on air pollution, a comprehensive investigation focusing specifically on oil-using transports in Madurai is lacking. This study aims to assess the extent of air pollution caused by oil-based vehicles in Madurai, identify the primary pollutants, and evaluate their impact on public health. The findings of this research will contribute to informed decision-making for developing effective air pollution mitigation strategies in the city.

➤ Concept of Air Pollution

Air pollution may be defined as a condition, which is likely to cause adverse effects in man or his possessions. The untoward consequences of atmospheric pollution cover a very wide spectrum ranging from material damage to personal discomfort and illness. Air pollution is an international problem, which cannot be looked in isolation

separately by any country. This is because; the effects of pollution may spread over a wide area. Therefore, without international co-operating and effort this problem cannot be solved. Air pollution, according to the definition developed by the engineers joint council, means the presence in the outdoor atmosphere of one more contaminants such as dust, fumes, gas, mist, odor, smoke or vapor, in qualities' as to be injurious to property, or to interfere unreasonably with the comfortable enjoyment of life and property (William T.Ingram, 2016).

➤ Air Pollution by Automobile

The automobile has revolutionized the entire scenario of commercial, industrial, public and personalized transport system. Transportation source of air pollution includes motor vehicles, rail-mounted vehicles, air-plants and vessels. The major problems of pollution are associated with community activities as opposed to rural activity, because community air is generally more polluted and may contain harmful and dangerous substances affecting property, plant life, and on health. Pollution accused by automobile exhaust fell in this type. High density of transport vehicles gives greater amount of toxic elements, which could determinate human systems (William T.Ingram, 1980).

• The problem, size and nature of pollution caused depends on so many factors, they are:

- ✓ Low grade fuel
- ✓ Defective engine performance
- ✓ Poor Maintenance of engines
- ✓ Lack of traffic planning]
- ✓ Multiplicity of types of vehicles on the same road
- ✓ Degree of industrialization
- ✓ Large number of motor vehicles in use.
- ✓ Density of the population

➤ Petrol Vehicles and Air Pollution

The petrol engine type of motor vehicles was first realized to be an increasingly important source of air pollution as a result of the investigation into Los Angeles Smog. The investigation showed that the petrol engine release the atmosphere both nitrogen oxides and hydrocarbons. Air pollution from both petrol and diesel internal combustion engines are of two kinds: visible smoke and invisible gases include carbon monoxide; un burnt hydrocarbon, nitrogen oxides and sulphur oxide. The major automobile pollutants include carbon monoxide lead, hydrocarbons, and nitrogen oxides, sulphur oxides. The

amount of these substances from auto-exhaust in any given location depends upon the number of vehicles present there. Obviously, cities with greater density of vehicles in India are highly proved to the effect of toxic substances from out exhaust.

In India, the automobiles are heavily concentrated in a few big crowded cities. For instance, in 2006, great Bombay had 1,86,000 motor vehicles playing in an area of 600 sq.km. Since a large proportion of these automobiles are quite old and in poor conditions, their emission rates are several time large than those of their western counterparts (Srinivasan, V. 2011). Today there are innumerable scooters and three-wheelers powered by four strokes engines which are responsible for excessive discharge of unburned hydrocarbons and partially burnt lubricating oils.

➤ Diesel Vehicles and Air Pollution

Apart from the pollutants emitted by petrol driven vehicles, the exhaust by diesel driven vehicles are considered to be large in quantity and the public has a major concern over the environmental hazards produced by diesel driven vehicles. This is because of the abnormal growth of diesel vehicles population and increased consumption of diesel. It is expected that the number of diesel vehicles would double in the recent years. The main reasons for public complaint against diesel exhaust are fourfold. They are (Smith, R.Alan, 1966) :

- The possible danger to health
- Danger to road safety owing to reduced visibility and the frustration of drivers in following transport rules.
- The deposit of black and greasy dirt on other vehicles and passengers, as well as on roadside buildings and vegetation, and;
- Unpleasant and even nauseating smell.

The smoke from diesel engine vehicle is very major air pollution problem when compared with the domestic smoke. At the time care should be made over the control and reduction of smoke, since the number of vehicles on road is on the increase with economic advancement. Diesel engines, which are properly designed, manufactured, adjusted, maintained and operated, could give an exhaust from smoke.

However, it is practically difficult to manufacture, design, maintain and operate diesel engines. Diesel engines are relatively free from carbon monoxide in the exhaust gases compared with petrol engines. But it gives more

nitrogen oxides in the exhaust gases under idling and decelerating conditions while accelerating and cruising it gives considerably less. Smoke from diesel engine arises due to faults in the fuel injection equipment, in the engine cylinder compression or in the air breathing of the engine. Hence adequate maintenance is essential to make the diesel engine is emitted, it must be due to bad maintenance or faulty operation.

II. METHODOLOGY

The present study, which is explorative in nature, confined for its data collection of Madurai town.

➤ Objective of the Study

- To study the over all growth of oil based transport system in Madurai town.
- To assess the quantum of oil consumed and the resultant environmental pollution in this town.

➤ Sources of Data

The present study aimed at estimating air pollution caused by automobiles and evaluating socio-economic conditions of vehicle users through questionnaire by personal interview method. For this purpose the investigator used both the primary data and secondary data.

Primary data relating to the density of vehicles was collected from personal survey. Secondary data relating to the growth of vehicles was collected from the Regional Transport Office, Madurai town. The data relating to quantity of oil (both petrol and diesel) was collected from all the petrol bulks situating in the town. The sales figures of petrol and diesel were collected for the period of one month (January 2023).

III. RESULTS AND DISCUSSION

➤ Oil Consumption in Madurai Town

Madurai, a burgeoning metropolis, faces escalating environmental challenges. Oil consumption, primarily driven by transportation and industrial activities, has surged in recent years. This study delves into the pattern of oil consumption in Madurai, examining its implications for air quality, public health, and economic growth. By understanding the city's oil dependency, effective strategies can be formulated to mitigate its negative externalities and promote sustainable development.

Table 1 Sales Figure of Petrol and Diesel in the Month of January 2023 in Madurai Town

Dealers	Sales of Petrol (in litres)	Sales of Diesel (in litres)
Bharat Petroleum	1,17,128	1,10,536
Hindustan Petroleum	1,16,848	2,42,032
Indian Oil Corporation	56,640	3,01,880
Bharat Petroleum, Railway Station	91,840	2,01,596
Hindustan Petroleum Thallakulam	86,808	1,11,740
Total	4,69,264	9,67,784

Source: Petrol Bulks in Madurai Town.

From the above table 1, it is observed that, the sales figure of Petrol and Diesel in Madurai Town in the month of January 2023. For this purpose, the investigator collected the monthly sales figure from various bulks situating in Madurai town. From this, the conclusion is that, in Madurai town the consumption of diesel is more than the consumption of petrol

➤ *Growth of Vehicles' Density and Emission Load of Different Vehicles in Madurai Town*

Madurai, like many urban centers, experiences a rapid surge in vehicle population. This study examines the correlation between the escalating number of vehicles and their corresponding emission loads. By analyzing different vehicle categories, we aim to identify the primary contributors to air pollution in Madurai. Understanding this relationship is crucial for developing targeted mitigation strategies to improve air quality and public health in the city.

Table 2 Vehicular Density in Madurai Taluk as on 31.02.2023

	Type of Vehicle	In Numbers	
I Transport:			
	Stage Carriage	12	
	Mini Buses	37	
	Goods Vehicles	1017	
	National Permit Goods Vehicles	104	
	Tourist Taxi	181	
	Maxi Cab	234	
	Auto-Rickshaw	322	
	Private Service Vehicles	130	
	Educational Institution Vehicles	31	
	LMV Government Vehicles	289	
	(Not covered by permit NCP)		
	Omni Buses	2	2,397
II. Non-Transport			
	Motor Cycles	9029	
	Mopeds	14002	
	Scooters	6634	
	Cars	1303	
	Jeeps	145	
	Tractors	281	
	Trailers	214	
	Three Wheelers	160	31,768
	TOTAL	34,165	34,165

Source: Regional Transport Office, Madurai.

In this table 2, the vehicle density is classified in to two parts namely transport vehicles and non-transport vehicles. Transport vehicles which are used for commercial purposes and they should get permit from Regional Transport Office (RTO). Non-transport vehicles which are used for the

personal uses and they need not get permit from RTO. The total number of transport vehicles is 2397 and non-transport vehicles are 31768. In total, 34165 vehicles are permitted by RTO at the end of the year 2023.

Table 3 Growth of Vehicles in Madurai Taluk

Year	Mopeds	Scooters	Motor Cycles	Cars	Jeeps	3 Wheelers	Buses	Goods Vehicles	Others	Grand Total
2015-16	593 (30.99)	385 (20.12)	633 (33.08)	62 (3.24)	7 (0.36)	14 (0.73)	4 (0.20)	128 (6.69)	87 (4.54)	1913 (100)
2016-17	718 (31.40)	417 (18.24)	749 (32.76)	76 (3.32)	11 (0.48)	21 (0.91)	5 (0.21)	169 (7.39)	120 (5.24)	2286 (100)
2017-18	664 (28.27)	440 (18.73)	821 (34.96)	83 (3.53)	12 (0.51)	9 (0.38)	7 (0.29)	199 (8.47)	113 (4.81)	2348 (100)
2018-19	1456 (38.57)	565 (47.97)	1198 (31.74)	173 (4.58)	21 (0.55)	27 (0.71)	12 (0.31)	198 (5.24)	124 (3.28)	3774 (100)
2019-20	2560 (49.47)	848 (16.38)	1132 (21.87)	201 (3.88)	17 (0.32)	57 (1.10)	14 (0.27)	180 (3.47)	148 (2.86)	5174 (100)
2020-21	2607 (54.25)	774 (16.10)	918 (19.10)	169 (3.51)	15 (0.02)	49 (1.01)	8 (0.16)	83 (1.72)	182 (3.78)	4805 (100)
2021-22	2972	636	714	197	19	64	13	112	201	4928

	(60.30)	(12.90)	(14.48)	(3.99)	(0.38)	(1.29)	(0.26)	(2.27)	(4.07)	(100)
2022-23	3015 (54.39)	722 (13.02)	865 (15.60)	213 (3.84)	8 (0.14)	59 (1.06)	17 (0.30)	126 (2.27)	518 (9.34)	5543 (100)

Source: Regional Transport Office, Madurai.

Table 4 Vehicle Density During the peak Hours Per Day in Madurai Town (in numbers)

Places	LTV	MTV	HTV	TOTAL
Railway Station Opposite	2025 (79.1)	440 (17.2)	95 (3.7)	2560 (100)
By-Pass Road	1740 (63.8)	780 (28.6)	205 (7.6)	2725 (100)
Thallakulam	1695 (95.2)	85 (4.8)	* (0)	1780 (100)
Melur Road	1185 (72.7)	290 (17.8)	155 (9.5)	1630 (100)

Source: Primary Data

LTV – Light Tonnage Vehicle

MTV – Medium Tonnage Vehicle

HTV – Heavy Tonnage Vehicle

Figures in the parentheses are average to the total

* No entry to HTV

Table 4 explains the vehicle density during the peak hours at various places in Madurai Town. At the place Sivan Sannathi, 79.1 per cent of vehicles belong to the LTV, 17.2 per cent of vehicles belong to MTV and 3.7 per cent of vehicles belong to the HTV. Similarly, in all the places mentioned in the table, the LTV's density is very high as compare to the MTV and HTV. To conclude the density of LTV is more than others as such as MTV and HTV.

The standard emission factors of Indian vehicles are given in the table 5.

Table 5 Standard Emission Factors of Indian Vehicles (in μ / m^3)

Type of Vehicles	CO	NO _x	SO ₂
LTV	10.28	--	0.23
MTV	12.6	2.04	0.02
HTV	4.63	8.76	1.52

Source: Pundir, P.P. Amar K. Jain, Dinesh K. Gogia, (1994).

CO – Carbon monoxide NO_x – Nitrogen Oxides (=Nitric oxide + Nitrogen- dioxide) SO₂ - Sulphur-dioxide

➤ Emission Rate Formula

$$\text{Emission Rate} = \text{Emission Factor} \times \frac{\text{Number of Vehicles}}{\text{Speed of Vehicles}}$$

Table 6 Per Day Emission Load of Different Vehicles in Madurai During Peak Hours (in μ / m^3)

Place	Type of Vehicles	Emission		
		CO	NO _x	SO ₂
By pass Road * 25 km. Speed	LTV	832.68	--	18.63
	MTV	221.76	35.90	0.35
	HTV	17.60	33.28	5.78
Melur Road * 50 km. Speed	LTV	357.40	--	8.00
	MTV	196.56	31.82	0.31
	HTV	18.98	35.92	6.23
Railway Station Opposite * 20 km. Speed	LTV	871.23	--	18.68
	MTV	53.55	8.67	0.08
	HTV	--	--	--
Thallakulam * 40 km. Speed	LTV	304.54	--	6.81
	MTV	91.35	14.79	0.15
	HTV	17.94	33.95	5.89

Source: Computed by the study

* assumed level of average speed

Regarding pollution load of different type of vehicles in different areas are explained in Table 6. All the four areas LTV are causing higher pollution load of CO i.e., 832.68, 357.40, 871.23 and 304.54. While looking into account NO_x emission, HTV are causing higher pollution load. SO_2 is

lower regarding MTV in all four areas compared to other type of vehicles. Thus while analyzing the pollution load aspect, MTV are preferable because they are emitting less pollutants and causing pollution too.

Table 7 Total Emission Load of Selected Areas in Madurai Town (in μ / m^3)

Place	Emissions		
	CO	NO_x	SO_2
By pass Road * 25 km. Speed	1072.04 (35.93)	69.18 (35.60)	24.76 (34.91)
Melur Road * 50 km. Speed	572.94 (19.21)	67.74 (34.86)	14.54 (20.50)
Railway Station Opposite * 20 km. Speed	924.78 (30.99)	8.67 (4.46)	18.76 (26.46)
Thallakulam * 40 km. Speed	413.83 (13.87)	48.74 (25.08)	12.85 (18.13)
Total	2983.59 (100)	194.33 (100)	70.91 (100)

Source: Computed by the study

* assumed level of average speed

Figures in the parentheses are average to the total From the table 7 CO is very high in all areas when compared to all of the emissions. The SO_2 is very meager in all areas when compared to all of the emissions. It is found that By pass Road is more pollution load area when compared to all of the places in Madurai Town. Its contribution in terms of percentage share is 35.93, 35.60 and 34.91 by emitting CO, NO_x and SO_2 respectively. At the same time Melur Road is less pollution load area when compared to all of the places in Madurai Town. Its contribution in the percentage in terms of share is 13.87, 25.08, and 18.13 by emitting CO, NO_x and SO_2 respectively.

- [4]. Sendilvelan, S. (2002), Indian Journal of “Environmental Protection”, Vol.22, No.3, p.5.
- [5]. Tamil Nadu: An Economic Appraisal, Various Issues Tamil Nadu Government Publications.

IV. CONCLUSION

It is concluded that this study has demonstrated that the rapid growth of the automobile population in Madurai has led to significant air pollution. The emission of harmful pollutants such as carbon monoxide and nitrogen oxides poses a serious threat to public health and the environment. To mitigate these adverse effects, it is imperative to implement comprehensive air quality management strategies, including promoting public transportation, improving vehicle efficiency, and enforcing stricter emission standards. Further research should focus on the long-term health impacts of exposure to specific pollutants and the effectiveness of different mitigation measures.

REFERENCES

- [1]. Alan R.Smith (1966), “Pollution caused by road vehicles”, Air pollution society of chemical Industry, London, pp.3-5, p.111, p.118.
- [2]. Dhulasi Birundha Varadharajan, (1993), “Air Pollution and Road Transport”, Ashish Publishing House, New Delhi, pp.78-84.
- [3]. Murthy, B.S., (2001), “The Hindu Survey of Indian Industry 2001”, p.253.