



**INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH
TECHNOLOGY**

Assessment of Air Quality Associated with Adulteration in Akola City, Maharashtra

Mr. A.P.Gawande*, Dr.J.P.Kaware

*Research Scholar, Dept. of chemical Engineering, C.O.E.T, Akola, India

Principal, Bhonsla College of Engineering & Research, Akola, India

apg.coeta@gmail.com

Abstracts

Motor vehicle emission occupy a special place in discussion of air pollution because they contribute more than 70% outdoor air pollution and are also the major sources of suspended particulate matter and many other pollutants because of imperfectly consumed gases such carbon monoxide and hydrocarbons which are offensive, not only to the occupants of the vehicle, but to persons in the street.

The alert, rising in the present paper is not about this well established fact that “Air Pollution Kills”. The real bad news is that even though ALL of us – which includes policy makers, industrialists, common citizens — are conscious of this horrible, life-threatening menace, the action agenda to get rid of it is practically non-existent. Oh, the government (along with the corporate houses!) keep coming up with announcements, alerts and clean-air drives..... But the truth is none of us really know what to do, in fact no one is serious about it. More over, India’s capacity to monitor and assess the problem of air pollution remains abysmally weak.

The present paper aims on assessing the air quality of the city and to correlate it with the increasing rate of motorization especially auto rickshaws running on adulterated fuel.

Keywords: Air Quality; Emissions; Pollution; Adulteration.

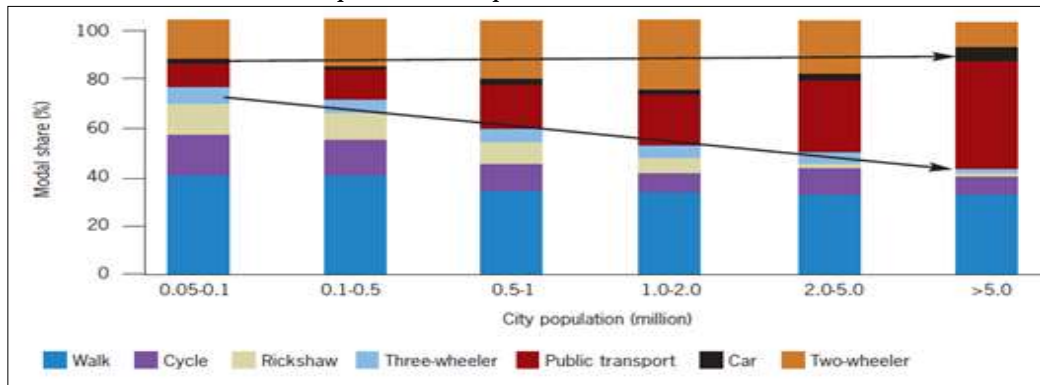
Introduction

Cities of India are locked in a motor race at a time when air pollution has already become the fifth largest killer and seventh biggest illness burden in the country — as estimated by the Global Burden of Disease (GBD) report, released in early 2013. Scarier is the evidence from the new cancer registry released by the Indian Council of Medical Research in 2013, which points to a high incidence of lung cancer in cities.

Environmental considerations have forced many countries to introduce regulations to limit the pollution caused by motor-vehicles. It is claimed that emissions

from motor-vehicles, damage human health, plant life and the environment. This problem is particularly severe in areas where the geographic and climatic conditions create an atmospheric envelop which traps the pollutants. In the India a physical and cultural environment has developed in which use of the motor vehicle is indulged with virtual total disregard for its effect on people. The solution to this is often seen as investment in new public transport systems, but at enormous public expense.

Graph 1:- How People Travel In Indian Cities



Though a very large number of people in our cities commute by walking, cycling or on public transport, motorisation is galloping at a rate faster than population and urbanisation. This, in turn, is hurtling cities towards massive energy use and large-scale generation of heat-trapping gases. India is faced with the challenge of importing almost all its crude oil by 2030, hence saving fuel and energy independence have become urgent concerns. But the motorisation trends in urban India are making this more and more difficult.

Smaller cities are experiencing a more rapid shift to personal vehicles, as they have not invested adequately in organised public transport. Two wheelers, whose numbers are growing in these cities, are the stepping stones towards personal motorisation. If their numbers are added to that of cars, the rate of personal motorisation in Indian cities exceeds that of cities in the West.

Vehicles, the face of unsustainable growth:

Motorisation is the face of growth in India. In the decades 1961-2011, while urban population increased by five times and the number of cities and towns by three times, the number of vehicles went up 214 times!

Metro cities in grip of rapid motorisation:

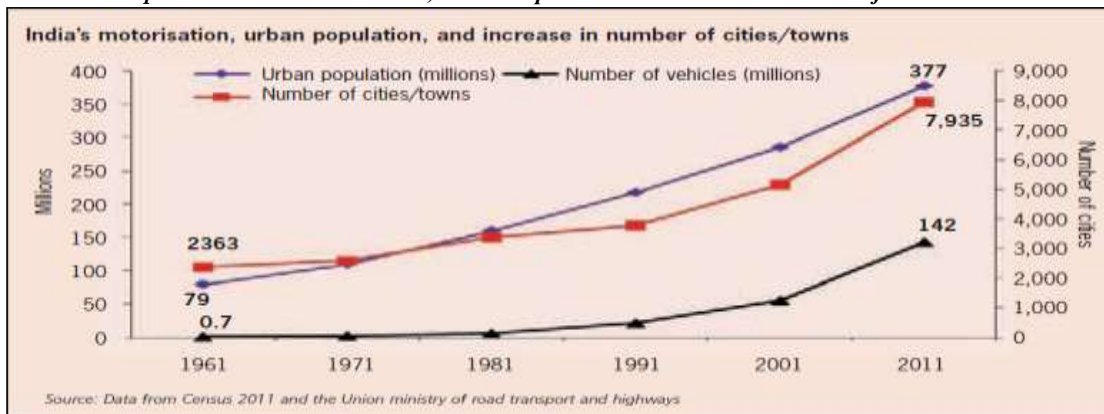
Predictably, vehicle numbers have grown more rapidly in mega and metro cities. Delhi has the highest number of vehicles among all metro cities. Growth has been the fastest in this city, which has delayed decisions on public transport and has encouraged low-density urban sprawl increasing distances.

Vehicles operated by gasoline/Diesel motors are not a very success at the present time. Motor vehicle produced 570 Kg of air pollutants on every tone of fuel consumed. These pollutants are made up of carbon monoxide (88%), hydrocarbons, oxides of nitrogen and lesser amounts of aldehydes, organic acids and solids. Pollutants produced from petrol-driven motor also form a photochemical smog which can irritate eyes and respiratory tract.

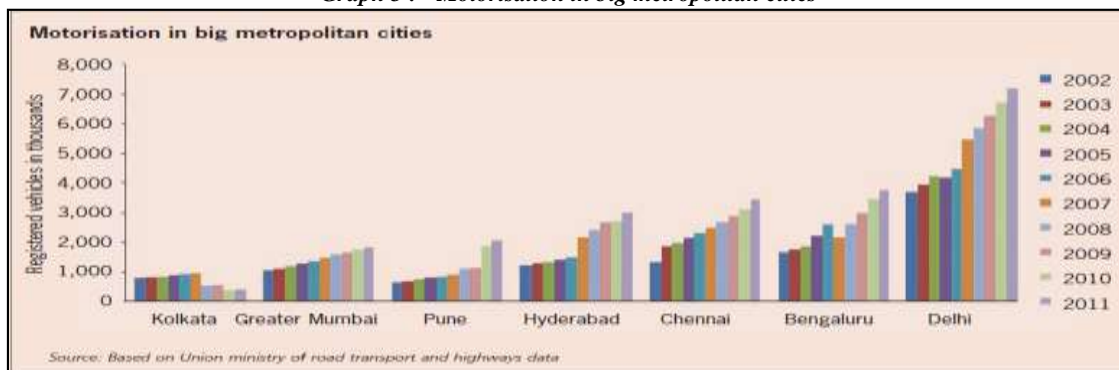
The Reality

When at outdoor we breathed in a lungful of Air, we sucked in a deadly cocktail of poisonous gases, made up of ozone, a gas known to be 'extremely hazardous for human health', nitrogen oxides, carbon monoxide, benzene, a range of polycyclic aromatic hydrocarbons, and a variety of volatile organic compounds. And as a side order, we inhaled huge

Graph 2 :- India's Motorisation, Urban Population & Increase In Number Of Cities/Towns



Graph 3 :- Motorisation in big metropolitan cities



quantities of ultrafine particles emitted from automobile exhaust emissions, that may entered our lung and caused serious injuries.

All this can actually happen if you just breathe in too deeply, or too often in the streets of Akola or it may be Delhi, or Kolkata, or Raipur, or Kanpur, or any other metro or small town you live in. Adulteration of petrol with kerosene is very common in Akola. It increases the tailpipe emissions of harmful pollutants from vehicles.

The Face of Motorisation

Let us have a look on growth of motorization in Maharashtra state, India. The rapid urbanization in Maharashtra 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. The figures below show a tremendous growth of motorized vehicles in Maharashtra. There was a whopping 63% increase in span of only 5 yrs.

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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.

Graph 4 :- Vehicle numbers: Explosive already and more coming.

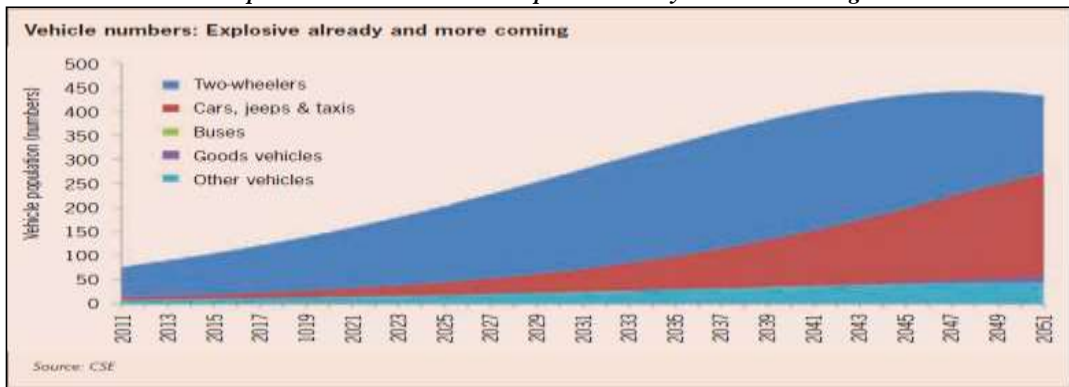


Table 1. Motor Vehicles on Road in Maharashtra State as on 31st March, 2006 To 2011 (In Numbers)

S N.	Category	As on 31 st March						+/- (%)
		2006	2007	2008	2009	2010	2011	
1	Two Wheelers	7691856	8573679	9394869	10212360	11181762	12429011	11.15
2	Cars / Jeeps	1479877	1648379	1822458	1979191	2182969	2440404	11.79
3	Taxi Cabs	122389	133309	149526	157916	168307	168496	0.11
4	Auto - Rickshaws	534535	555118	574625	598013	626332	640700	2.29
5	Stage Carriages	48714	50955	55281	57353	60387	64549	6.89
6	School Buses	3218	3834	4154	4698	5222	7415	42.00
7	Priv. Ser. Vehicles	8494	9568	10154	8762	9103	8326	-8.54
8	Ambulances	6328	6830	7453	8260	9104	9571	5.13
9	Trucks & Tankers	621971	700356	780992	845617	896397	973788	8.63
10	Tractors	229362	250950	276438	302249	331694	371075	11.87
11	Trailers	204733	220284	238080	252409	270078	293576	8.70
12	Others	14957	17729	21331	24080	27066	27188	0.45
13	Total	10966434	12170991	13335361	14450908	15768421	17434099	10.56
% (+/-) over previous yr.		10.37	10.98	9.57	8.37	9.12	10.56	

Fuel Frenzy

Looking over the vehicle explosion of west Vidarbha region of Maharashtra state, India, we can find that peoples are getting more and more fond of motorized vehicles, which in turn results in tones of emissions in the outdoor atmosphere. All these auto exhaust emissions are acting as a silent killers, Making the outdoor air pollution as fifth largest killer in the world. (Global Burden of Diseases Report, 2013)

Since from yr 2006, there was a clear 08–10 % increase (over the previous year) in the number of vehicles in Akola district. A total of 40% increase in just 5 years (2006-2011). Categorization based on the fuel type shows our negligence towards use of cleaner fuel for a healthy environment. Only 0.47% vehicles are running on cleaner fuel. (See Table 3). Vehicles running on dirty diesel are on one position while gasoline powered vehicles occupy second position followed by others (Kerosene).

Graph 5. Motor Vehicles on Road as on 31st March, 2006 to 2011 in West Vidarbha Region, Maharashtra

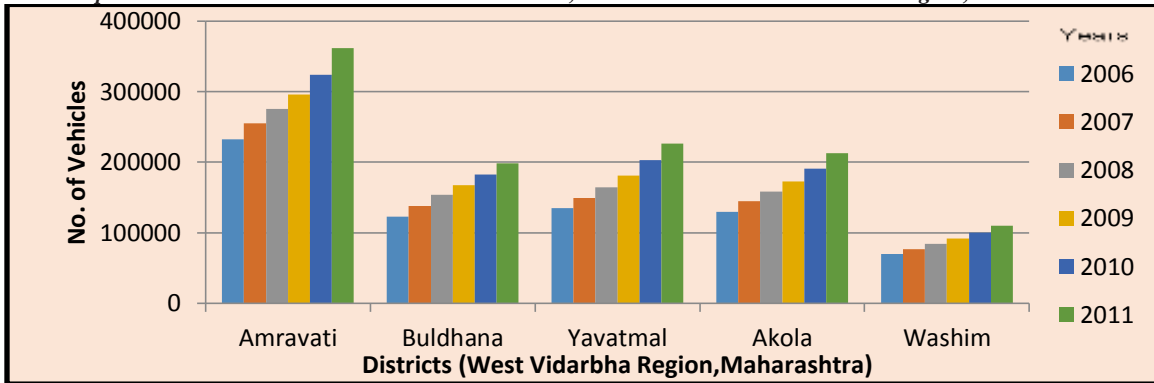


Table 2. Category wise Motor Vehicles Population on Road in West Vidarbha Region, Maharashtra (as on 31st March, 2011.)

SN	Category	Amravati	Buldhana	Yavatmal	Akola	Washim	AMRAVATI Region
1	Motor Cycles	175263	116222	110798	100487	59609	562379
2	Scooters	44288	9417	28838	34532	10089	127164
3	Mopeds	75802	22801	39691	31096	15134	184524
	Total 2 wheelers	295353	148440	179327	166115	84832	874067
4	Motor Cars	16282	4817	9271	10787	3162	44319
5	Jeeps	5063	3806	4210	3839	2234	19152
6	Station Wagons	338	186	38	8	2	572
7	Taxi meter fitted	29	145	20	42	2	238
8	Taxi Tourist Cabs	1262	1478	1149	1865	503	6257
9	Auto rickshaws	15040	11193	10797	9828	5738	52596
10	Stage Carriages	532	440	395	449	0	1816
11	Contract Carriages	264	133	263	164	32	856
12	School Buses	61	98	87	76	28	350
13	Priv. Ser. Vehicles	28	20	74	28	0	150
14	Ambulances	178	126	85	130	52	571
15	Arti. & Multi.Veh	0	0	328	3	0	331
16	Trucks & Lorries	6078	2350	3798	3791	958	16975
17	Tanker	224	55	115	71	25	490
18	Delivery Van (4 W)	3764	3290	2572	2648	1260	13534
19	Delivery Van (3 W)	3110	2729	2202	2000	1048	11089
20	Tractors	8083	11488	6415	6114	5711	37811
21	Trailers	5811	7570	5031	4613	4113	27138
22	Others.	246	142	60	216	26	690
23	Total	361746	198506	226237	212787	109726	1109002

Table 3. Number of Diesel, Petrol, L.P.G. & C.N.G. used Vehicles in Akola District as on 31st March, 2011.

SN	Category	No. of vehicles based on fuel				Others	Total
		Diesel	Petrol	LPG	CNG		
1	Motor Cycles	0	100487	0	0	0	100487
2	Scooters	0	34532	0	0	0	34532
3	Mopeds	0	31096	0	0	0	31096
	Total 2 wheelers	0	166115	0	0	0	166115
4	Motor Cars	4299	5588	900	0	0	10787
5	Jeeps	3839	0	0	0	0	3839
6	Station Wagons	8	0	0	0	0	8
7	Taxi meter fitted	42	0	0	0	0	42
8	Taxi Tourist Cabs	808	1057	0	0	0	1865
9	Auto rickshaws	3136	6588	104	0	0	9828
10	Stage Carriages	449	0	0	0	0	449
11	Contract Carriages	164	0	0	0	0	164
12	School Buses	76	0	0	0	0	76
13	Priv. Ser. Vehicles	28	0	0	0	0	28
14	Ambulances	130	0	0	0	0	130
15	Arti. & Multi.Veh	3	0	0	0	0	3
16	Trucks & Lorries	3791	0	0	0	0	3791
17	Tanker	71	0	0	0	0	71
18	Delivery Van (4 W)	2648	0	0	0	0	2648
19	Delivery Van (3 W)	719	1281	0	0	0	2000
20	Tractors	6114	0	0	0	0	6114
21	Trailers	0	0	0	0	4613	4613
22	Others.	216	0	0	0	0	216
23	Total	26541	180629	1004	0	4613	212787

In a city like Akola, where the public transport system is very inefficient, most of the people travelling inside the city prefer Auto rickshaws to travel from one place to another. Another reason for using these motorized tricycles, as a preferable one, lies in its cost effectiveness and connectivity inside remote areas of the city.

Considering outdoor air pollution in which share of vehicular pollution is about 70%, Auto rickshaws are of main concern, as most of them in the region are running on adulterated gasoline.

As fuel prices rise, the public transport driver cuts costs by blending the cheaper fuel into highly taxed Fuel. The blending may be as much as 40-50 %. For a low wage driver, adulteration can yield short term savings that are significant over the month. The consequences to long term air pollution, quality of life

and effect on health are simply ignored. Also ignored are the reduced life of vehicle engine & higher maintenance costs, particularly if the Auto-rickshaw or taxi is being rented for a daily fee.

Tale of a Tail

Navigating the endless traffic, swarming through the city roads, is quite a daunting task. But if you are a street walker or on a two-wheeler and trailing an auto, your problems will be compounded by the thick bluish and black fumes that these vehicles emit. One of the main reasons for these autos emitting the toxic fumes is the fuel adulteration. To cut their costs, some auto drivers are mixing PDS kerosene, a cheaper fuel, with petrol.

Price of petrol is increasing continuously, but our fares are not revised in the same fashion. With prices

increasing every day and without extra remuneration we are forced to use kerosene," an auto driver said. "I am aware that using kerosene will reduce the life of the engine and emit more smoke but I cannot afford to

this is possible if we use pure petrol". Most of the drivers contend that the shuttle system, not being as profitable to them as the metered system, is the main reason why they have to adjust the cost by fuel adulteration.

So can traffic police check this menace? Traffic police can only check the 'pollution under control' certificate, and if an auto driver holds a valid certificate he can go scot free. "Police does not issue a challan based on the actual emission. The only thing that we can do is to charge an auto driver with a challan of Rs. 300 if he fails to produce a certificate," a police official said.

But if an auto is emitting thick smoke, how can the driver obtain a pollution certificate?

Tricks & Tactics

There are many variables, like not inserting the probe fully inside the exhaust nozzle and reducing the RPM of the engine during the testing, which can help a driver in obtaining the certificates. "To reduce the pollution and to implement the rules, people affected by them should be involved in the process. Without the cooperation of the drivers, curbing the menace of pollution is impossible,"

While fuel adulteration is the major reason for the excess emission, there are other factors involved. 'Issues like driving practices employed, load that a vehicle is bearing and the average speed of the traffic also affects the levels of emission'. Auto Rickshaw drivers run their vehicles on maximum capacity and as traffic cannot move at an optimal speed of 30 to 40 km per hour in the city, autos will emit more smoke. Most auto rickshaws in Akola, especially those plying in central area and on the city outskirts, are running on fuel that contains at least 50% kerosene.

Case Study:-

According to sources, auto rickshaws use kerosene largely bought from the black market. Here it costs between Rs 40 to Rs 50 / litre against the PDS price of Rs 15.64 / litre. Due to a rise in domestic gas connections, the government has cut down the quota of kerosene required in Akola and presently, against a demand of 3,500 kilo litres per month, the city receives only 1,020 kilo litres of kerosene. As a result, there is a major shortage of kerosene. Naturally, the ration shop owners take advantage of this situation and sell

think on it when my own family depends on my earnings," he said.

On discussion on adulteration, he feel wronged and says "People want to travel from one end of the city to another in five rupees, but don't wonder how kerosene to black markets.

An auto rickshaw driver, requesting anonymity, pointed out that in the last four months petrol price has increased by almost Rs 10 and explained the economics behind using kerosene as fuel. "My fuel expenditure for a day is about Rs 200 to Rs 300. The 2T oil costs Rs 10. After a 50km run, I earn Rs 500. Running the auto on petrol is definitely a costly affair. So I mix kerosene with petrol," he said. He was least worried about the pollution caused by the kind of fuel he uses every day. Number of auto rickshaws running in the city is about 9828 out of which 6588 autos are running on petrol.

This huge number is of the main concern to understand the practice of adulteration.

According to the general practice, out of these 6588 minimum 70% auto rickshaws drivers are associated with adulteration. The economic development of the country is depends on the tax collected.

Lets have a look on

'Who Gets What'

- The central government levies a fixed excise duty of Rs 14.78 on every litre of petrol.
- While state government of Maharashtra has a tax of about Rs.26.58/- per litre + Rs. 1 per litre cess. Total of about Rs.42.36/- per litre
- Current petrol price is about Rs.81.93/- per litre
-

The Economy Incorporated:-

According to various surveys, Economy associated nationwide with adulteration of fuel is about Rs. 75,000 Crores per annum, whether environmental losses, health losses and loss of productivity are not considered.

Let's calculate the fact about Akola

- Average number of auto rickshaws running on adulterated petrol (70% of 6588) = 4610 Nos.
- Avg. run of an auto rickshaw (Per Day) = 50 km.
- Avg. mixing of kerosene with petrol / litre = 50%.
- Avg. running of auto per liter of petrol = 25 kms.
- Therefore Average requirement of fuel for running of 50 kms = 2 litres.
- Out of which 1 litre is petrol & 1 litre is kerosene
- Therefore petrol required = 4610 litre
- Kerosene required = 4610 litre

- Cost of Petrol required (@ Rs.82 per litre) = Rs.3,78,020/-
- Cost of PDS kerosene required (@Rs.30 per litre) = RS. 1,38,300/-
- ❖ **Case 1:-** Loss of revenue (Free kerosene against PDS kerosene)= Rs.38 per litre

- Total Loss (if kerosene is used) = Rs. 1,75,180/-
- ❖ **Case 2:-** Loss of revenue (in terms of taxes on petrol) per day = Rs.1,95,280/-
- If we consider case 2:-**
 Total losses(Tax) attributed due to adulterations in Akola District per year = **Rs.7,12,77,200/-**

Table 4:-Ambient Air Quality Monitored at Collage of Eng. And Technology Akola (Architecture branch) by MPCB

Concentration of Air Pollutants													
Sr.No.	Date	SO2 µg/m ³			NOx µg/m ³			RSPM µg/m ³			SPM µg/m ³		
Standards		80.00			80.00			100.00			---		
June													
1	20-06-2014	9			10			160			181		
2	21-06-2014	10			10			159			179		
3	27-06-2014	10			9			166			180		
4	28-06-2014	10			10			158			177		
Total		Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
4		9	10	9.75	9	10	9.75	158	166	160.75	177	181	179.25

‘Mission Emission’ :-

Adulterated fuel increases [tailpipe emissions](#) of hydrocarbons (HC), carbon monoxide (CO), oxides of nitrogen (NO_x) and particulate matter (PM). Air toxin emissions — which falls into the category of unregulated emissions — of primary concern are benzene and polyaromatic hydrocarbons (PAHs), both well known carcinogens. Kerosene is more difficult to burn than gasoline; its addition results in higher levels of HC, CO and PM emissions even from catalyst-equipped cars. The higher sulfur level of kerosene is another issue.

The assessment of ambient air quality of city is carried out at various locations through Maharashtra State Pollution Control Board- a state agency responsible for regulating and controlling the emissions, daily with respect to SPM, RSPM, SO₂ and NO. One of the station recordings establishes the fact that pollution level is increasing tremendously. "Pollutant concentrations in terms of suspended/respirable particulate matter (SPM and RSPM) in urban atmosphere of Akola city have been found to be two times higher than national standards". But on observing the readings displayed by MPCB, the question arise that how is it possible that quantity of aerosols is double than the standards, while that of SO₂ & NO_x is only 9-12 % of the national standards. (Table 4)What is the reason for this vast difference.

Our finding says that these recordings are far away than the actual one. Because the instruments placed on the Architecture branch of College of Engg.

& Tech. Akola, those used for sampling and analyzing the emissions, are not placed near any active source of emissions, which can draw the real picture of the present environmental status of the area.

The Number Game:-

- As said earlier, amount of emission releasing from burning of one tonne of gasoline is about 570 kg. If we consider adulteration of gasoline with kerosene (50:50), there will be minimum 20% rise in emissions.

- Therefore we can say that quantity of all the pollutants discussed above is rising daily by burning of 9220 litres of fuel (8391 kg approx.)

Considering Auto rickshaws

- Pollutants emitted due to burning of 8.391 tonnes of fuel (570 x 8.391) = **4782.87 kg**
- 20% rise due to adulteration, quantity of pollutants emitted = 5236 kg = **5.739 tonnes per Day.**
- Emissions only due to auto rickshaws (Associated with adulteration) =**2094.73 Tn. per annum**

Our environment is not capable of holding and clearing this much amount of burden which is increasing each coming day.

Conclusion

Air we breathe in is more polluted now: Thick smog shrouded the Akola city, amplifying concerns that a steady growth in the number of vehicles might be neutralising city’s environmental gains from the

slight shift to compressed natural gas as an optional fuel for public transport. An abrupt drop in wind speed (which occurs many times) prevented normal dispersal of fine dust particles and vehicle emissions, generating a haze that obscured visibility across the city throughout year.

Forsake your private vehicles and go for 'pool' transport. The drastic increase in vehicular pollution in residential areas of Akola is due to substantial increase in vehicles plying on city roads. Going for pool transport could be the contribution of "Akolains" towards saving the environmental quality. The assessment of Air quality of Akola does not portend well for health of Akolains.

It shows that the current product quality monitoring system is extremely weak and stems largely from weak regulations and enforcement, skewed market prices of petroleum products and lack of accountability in the petroleum sector. Unless this is corrected, the root cause of the problem cannot be eliminated. Immediate intervention is needed in the operational, technical and economic areas. While there is consensus that skewed prices are responsible for adulteration, no solutions have been possible so far for political reasons. This study clearly shows that, unless we take serious steps to improve the system to prevent and check adulteration, we will not even begin to touch the profitable business of adulteration. The current system gets compromised — from testing methods that are not adequate to detect adulteration to penalty systems designed to let the manufacturers go scot-free. Some other concerns:-

- Make oil companies accountable for the quality of fuel at the retail end.
- Improve testing procedures and tighten fuel quality standards.
- Develop alternative testing procedures for more accurate detection.
- Cap the number of new vehicles entering over the roads.
- Search for alternate ecofriendly fuel such as bio diesel etc.
- Permanent detention of vehicle or heavy fine, if found using adulterated fuel.

By the Evidences It is proved that Vehicular Air Pollution kills more people in India than several communicable diseases, yet no one is serious about it

References

- [1] 'A report on the independent inspection of fuel quality at fuel dispensing stations, oil depots and tank lorries' Centre for Science and Environment, 05/02/2002

- [2] 'Good News and Bad News-clearing the air in Indian cities', A.Roychoudhari, Centre for Science and Environment, Down to Earth publications.2013
- [3] Anon 2001, Automotive fuels – Assessment of petrol and diesel quality – Fuel quality monitoring systems (FQMS), European Standard Draft prEN 14274, European Committee for Standardization, Management Centre: rue de Stassart, 36 B-1050 Brussels, November
- [4] P K Mukhopadhyay 2000, Report of Working group on Fuel quality submitted to the Chairman Central Pollution Control Board, December, pp 150-152.
- [5] Fuel Adulteration Consequences In India : A Review Amit P. Gawande & Jayant P. Kaware Sci. Revs. Chem. Commun.: 3(3), 2013, 161-169 Issn 2277-2669
- [6] C. Osueke and I. Ofondu, Fuel Adulteration in Nigeria & Its Consequences, Int. J. Mechanical & Mechatronics Engg., 2(4), 08 (2011).
- [7] Parivesh, Transport Fuel Adulteration, CPCB, India Newsletter (2003).
- [8] A.Gupta, Fuel Adulteration-complexities and Options to Combat, Proceedings of 4th Int. Petroleum Conferences and Exhibition, New Delhi (2001) pp. 162-165.
- [9] The World Bank Publication, South Asia Urban Air Quality Management Briefing Note No. 7, Catching Gasoline & Diesel Adulteration (2002).
- [10] D. Mohan, A. Agrawl and R. Singh, Standardization for Automotive Exhaust Pollution: some Issues in Indian Perspective, J. Instrumentation Engg., 86, 39-43 (2006).
- [11] R. Ramchandran, Petrol Adulteration- Muck In The Tank, A Report for weekly, 'Out Look Express', Issue Dt. 29/08/2005.
- [12] C. Khadka, Adulterated Economy, Report on Fuel Adulteration for Nepal Times, Issue., 105 (02/8/2002 -08/8/2002).
- [13] Analysis of Exhaust Emissions from Gasoline Powered Vehicles in a Sub-urban Indian Town Saini B.1, Verma R.2, Himanshu S. K.1 and Gupta S. International Research Journal of Environment Sciences ISSN 2319-1414 Vol. 2(1), 37-42, January (2013)
- [14] Indian Emission Regulation Booklet, The Automotive Research Association of India, 2013
- [15] <http://mahatranscom.in/statistics.aspx>
- [16] <http://www.downtoearth.org.in/>