International Journal of Scientific Engineering and Technology (ISSN : 2277-1581)
Volume No.3 Issue No.8, pp : 1078-1081 1 Aug 2014

Adopting Rationing of Fuel as an Economical Measure to Enhance Fuel Sustainability and Reduce Vehicular Emissions

Udayashankara T.H., Divya M., Manjula M., Shruthi L., Karthik K.M.
Dept. of Environmental Engineering, SJCE, Mysore

[1]hugstumkur@gmail.com,[2]divyam1512@gmail.com,[3]manjulam992@gmail.com,[4]Shruthikumar1993@gmail.com,
[5]Karthikkm092@gmail.com

Abstract : ***Ever increasing vehicular trends are leading to increasing emissions and depleting air quality. Since fossil fuels are depleting, their preservation is very vital. Monitoring vehicular emissions and the resulting air quality will aid in enhancing fuel sustainability and will help improve air quality. The following study has been conducted in Mysore, India. The purpose of the study is to monitor the air quality in Mysore City due to vehicular emissions and suggesting rationing of fuel as a viable measure to enhance its sustainability.***

Keywords- Air pollution, Vehicular Emissions, Sustainability, Rationing

I. Introduction

With the ever increasing population and urbanization, the numbers of vehicles are also increasing at an alarming rate. In Mysore West alone, the number of vehicles have increased from 2,51,275 to 3,58,978 from 2009 to 2013 which is approximately a 43% increase in five years. This invariably leads to increasing vehicular emissions and more demand on the already depleting conventional fuels. These will lead to much more severe problems like global warming, deteriorating air quality and depletion of fossil fuels and so on.

The most common vehicular emissions are Carbon dioxide, Carbon monoxide, Hydrocarbons, Nitrogen oxides and Oxygen. Higher emissions from engines will lead to a higher fuel requirement and thus reduce their sustainability. Thus vehicular emission monitoring and judicious fuel usage are of utmost importance.

II. Study areas and Methodology

The main objective of this paper is to assess the ambient air quality and fuel utility in different areas of Mysore city. The areas are selected based on the population density, economic development, condition of the roads and the density of the vehicles in that particular area.

Following are the different areas selected for the study

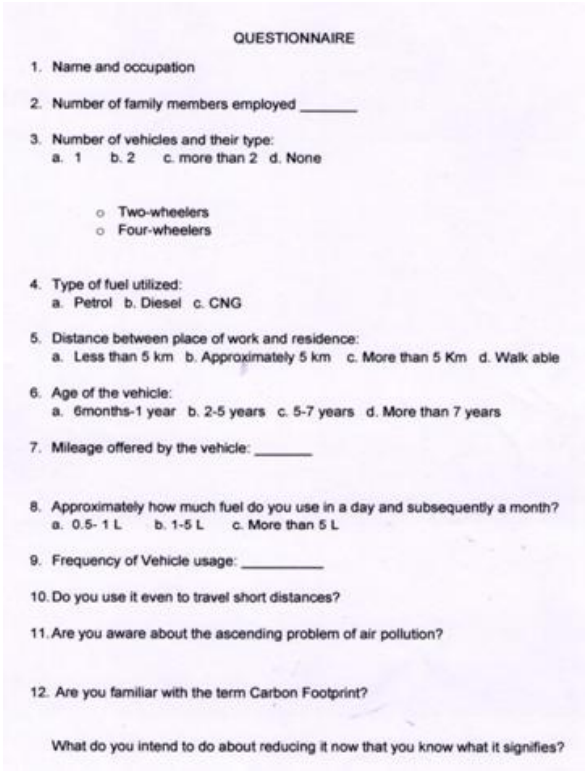
1. Udayagiri
2. Kuvempunagar
3. Vijayanagar
4. Hootagalli
5. Bogadi

The study includes the following methods

1. Survey of the vehicles in the area.
2. Estimation of the emissions from the individual vehicles.
3. Collection of data regarding the number of vehicles registered in the Regional Transport Office of Mysore west
4. Analysis of the ambient air quality (NOX, SO2 and RSPM) at the main City Bus stand rooftop.
5. Analysis of the quality of the fuel in the petrol bunks of selected areas.
6. Assessment of the amount of the fuel sold per month in the petrol bunks.
7. Average vehicles density in the petrol bunk per day.

Ambient air quality is analyzed by the respirable dust sampler. Vehicular emission testing is done using an automotive emission gas analyzer. SO_2 is measured by following the West Geake method and measurement of NO_X is done via Jacob and Hochheiser, modified method. In this study the quality of the fuel is assessed by the filter paper test for individual petrol bunk in the selected area. Additionally, a questionnaire was also prepared to target the mindset of the public.

Questionnaire



QUESTIONNAIRE

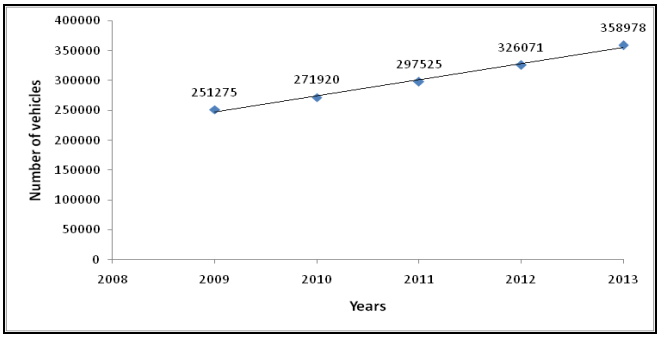
1. Name and occupation
2. Number of family members employed _____
3. Number of vehicles and their type:
   a. 1 b. 2 c. more than 2 d. None
   - Two-wheelers
   - Four-wheelers
4. Type of fuel utilized:
   a. Petrol b. Diesel c. CNG
5. Distance between place of work and residence:
   a. Less than 5 km b. Approximately 5 km c. More than 5 Km d. Walk able
6. Age of the vehicle:
   a. 6months-1 year b. 2-5 years c. 5-7 years d. More than 7 years
7. Mileage offered by the vehicle: _____
8. Approximately how much fuel do you use in a day and subsequently a month?
   a. 0.5- 1 L b. 1-5 L c. More than 5 L
9. Frequency of Vehicle usage: _____
10. Do you use it even to travel short distances?
11. Are you aware about the ascending problem of air pollution?
12. Are you familiar with the term Carbon Footprint?

What do you intend to do about reducing it now that you know what it signifies?

This helped to know the public awareness about the air pollution and vehicular emissions. Furthermore, suggestions to abate these problems were collected from the people.

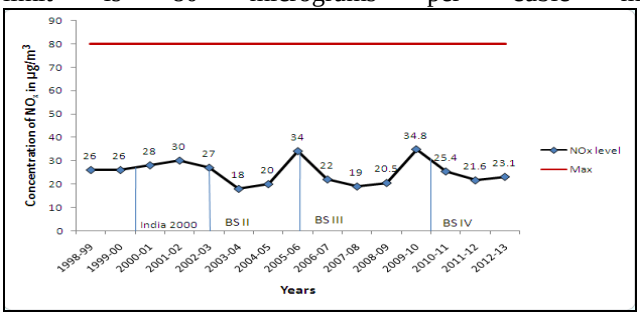
III. Results and Tables

Vehicle density of Mysore city has been taken from the regional transport office (RTO), west. The data obtained is from 2009 to 2013.



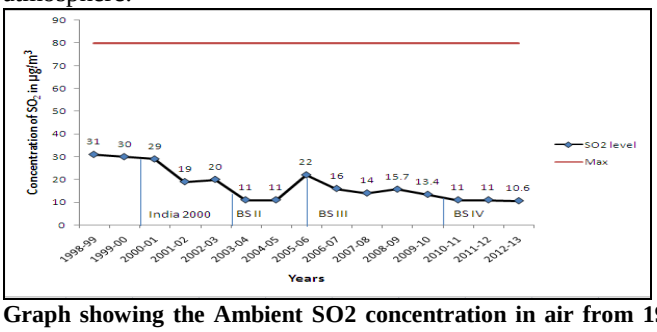
The graph showing the rising trend in vehicle number from 2009-13 (Source: RTO, Mysore West)

We can observe the rising trend of the vehicle number from 2009 to 2013 from about 251275 to 358978. As the vehicle number increases the pollution potential also increases. This is main cause for the air pollution. For the analysis of ambient air quality, (SO_2, NO_X and RSPM), data was collected from the Karnataka state pollution control board (KSPCB) from 1998 to 2013. The air quality data was collected from the sampling station on the KSRTC bus stand rooftop, as these samples indicated air pollution due to vehicles. Below is a graph that shows the variations in the concentration of the NO_X in atmosphere from 1998 to 2013, where maximum permissible limit is 80 micrograms per cubic meters.



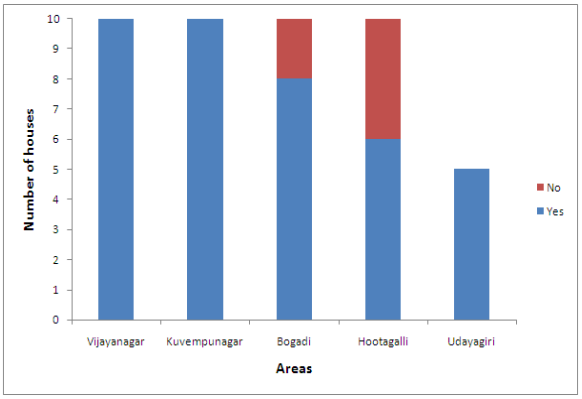
Graph showing the Ambient NO2 concentration in air (1998-2013)

Similarly below is the graph plotted for SO_2 in the atmosphere.

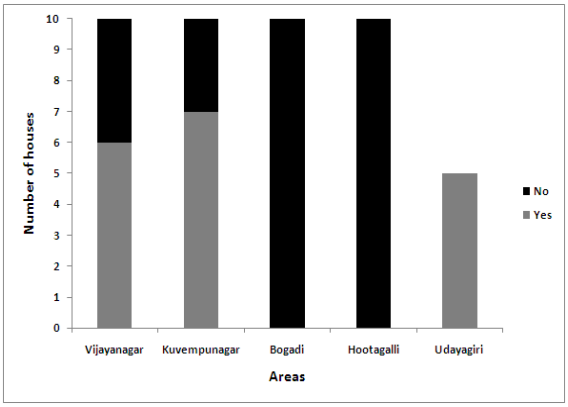


Graph showing the Ambient SO2 concentration in air from 1998-2013

Answers obtained from the questionnaire are plotted as graphs. The questionnaire has been distributed among 10 houses in each area.



Graph showing the number of people who are aware about the ascending problems of air pollution (Survey done for 10 houses in each area). Udayagiri: Only 5 houses responded out of 20 houses visited



Graph showing the number of people who know the significance of Carbon footprint (Survey done for 10 houses in each area). Udayagiri: Only 5 houses responded out of 20 houses visited

Results of emission testing in different zones

Emission testing was carried out in the different zones of Mysore city for approximately 30 vehicles with 10 vehicles having been tested in the morning, afternoon and night each. Only five vehicles from each area are reported here and these show the general trend of emissions from the whole area.

Parameter / VehicleType	CO (%)	CO_2 (%)	HC (ppm)	O_2 (%)	NOx (ppm)
2W,2S	0.66	0.4	900	17.78	0
2W,4S	0.8	1.1	302	18.27	3
2W,4S	0	2.8	99	15.13	0
4W,4S	0.15	3.5	54	15.13	0
Auto	0	1	4000	18.9	0

Table 1. Emission Testing results for vehicles from Udayagiri, Mysore

Parameter / Vehicle Type	CO (%)	CO_2 (%)	HC (ppm)	O_2 (%)	NOx (ppm)
2W,2S	2.46	1.8	1791	14.66	44
2W,4S	0.14	1.2	114	18.98	4
2W,4S	0.01	1.3	169	19.16	0
4W,4S	0.5	4.6	132	13.76	2.2
4W,4S	0	2.8	46	17.24	156

Table 2. Emission Testing results for vehicles from Vijayanagar 3rd Stage, Mysore

Parameter / VehicleType	CO (%)	CO_2 (%)	HC (ppm)	O_2 (%)	NOx (ppm)
2W,2S	0.58	0.5	1119	19.4	9
2W,4S	0.29	1.3	197	18.58	5
2W,4S	1.92	1.2	2963	17.39	7
4W,4S	0	2.4	35	19.06	156
Auto	0	1.2	47	17.47	0

Table 3. Emission Testing results for vehicles from Hootagalli, Mysore

Parameter / Vehicle Type	CO (%)	CO_2 (%)	HC (ppm)	O_2 (%)	NOx (ppm)
2W,2S	0.33	2.2	1288	17.18	0
2w,2S (22 Years)	2.21	1	7947	17.1	0
2W,4S	0.06	1.4	483	17.86	0
2W,4S	0.16	1.1	467	18.38	14
4W,4S	2.86	7.4	2050	5.77	48

Table 4. Emission Testing results for vehicles from Kuvempunagar, Mysore

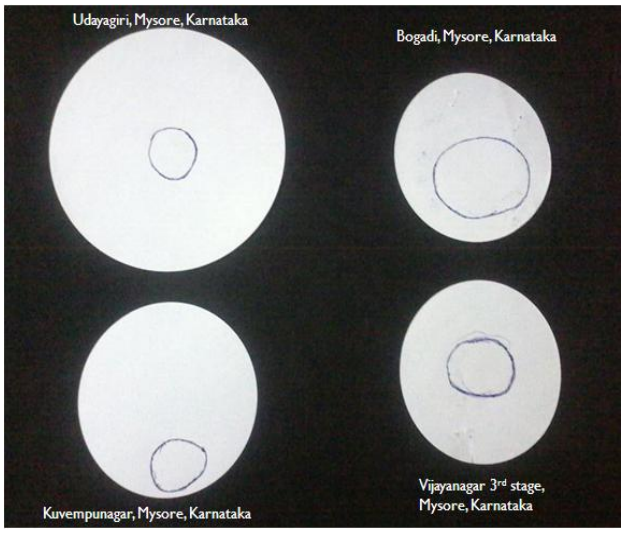
Parameter / Vehicle Type	CO (%)	CO_2 (%)	HC (ppm)	O_2 (%)	NOx (ppm)
2W,2S	1.62	1.7	2349	16.65	2
2W,4S	1.29	0.7	529	18.36	0
2W,4S	0.33	1	302	18.65	0
Auto	0.49	0.4	2792	19.07	2
Auto	0	0.3	50	20.57	0

Table 5. Emission Testing results for vehicles from Bogadi, Mysore.

As per the results, all the vehicles from the five zones (2-wheelers and 4-wheelers) are complying with the emission standards.

Fuel quality

The quality of fuel from the different petrol bunks were analysed using the filter paper test. (Filter paper used-Whatman filter paper). A drop of fuel from the nozzle is dropped onto the filter paper and formation of a stain or residue indicates adulteration of fuel. The picture below shows the fuel quality test result.



None of the filter papers showed any residue and thus it can be concluded that the fuel quality in Mysore City is quite good and acceptable.

Fuel quantity and number of vehicles

Area of the Petrol Bunk	Petrol L/month	Diesel L/month	Vehicles / day (approximate)
Udayagiri Petrol Bunk	1,80,000	3,00,000	7,608
Aishwarya Petrol Bunk Vijayanagar 3rd stage	1,08,500	1,55,000	3,744
Kuvempunagar	1,19,571	1,59,940	6,264
Hootagalli	1,20,000	40,000	1,560
Bogadi Bharath Petroleum	60,000	55,000	1,700

Table 6. Table showing the quantity of fuel used in petrol bunks

The main aim of this study is to reduce the numbers in the second and third column of the above table.

IV. Conclusion

The ambient air quality, emissions from vehicles and fuel quality in Mysore City comply with their prescribed standards. Yet the problem lies with continuous expansion and population increase. How long will the air Quality in Mysore remain acceptable? And now, with the ever increasing need for fuel, how much longer will fossil fuels be available?

Technologies like Exhaust Gas Recirculation, Over7, alternative fuel sources (biofuels, hydrogen fuel vehicles) and hybrid vehicles have reduced emissions. These methods involve extensive research and thorough study before they can be used on a commercial scale. These demand a huge investment and may not be economically viable. Thus, Rationing of fuel can be adopted. This measure involves allotting a pre determined amount of fuel usage to each vehicle owner. Failure to limit fuel

utility within this limit will result in fines or extra payment. This measure will ensure judicious usage of fuel by the consumer, will encourage public transport and other non-fossil fuel intensive modes of transport.

References

i. *Cummins MPG Guide, Secrets of Better Fuel economy, Cummins Ltd.*

ii. *Ezra M. Markowitz and Bob Doppelt, January 2009, Reducing greenhouse gas emissions through behavioral change, Climate Leadership Initiative, Institute for a Sustainable Environment.*

iii. *Feroz Alam, Abhijit Date et al., August 2012, Biofuel from algae- Is it a viable alternative?*

iv. *Frank Will, July 2013, International Journal of Automotive Engineering, Comparing Advanced waste heat recovering system with a novel oil heating system.*

v. *Germa Bel, Jordi Rosell, August 2013, Transport Research Part D: Transport, Volume 25, Effects of 80Kmph and variable speed limits on air pollution in the metropolitan area of Barcelona*

vi. *Jeff Bluette, Katie Dey, Gavin Fisher, July 2008, Assessing vehicle Air pollution emissions.*

vii. *Robert Gross, Phil Heptonstall, Jillian Anable and Philip Greenacre, March 2009, What policies are effective at reducing carbon emissions from surface passenger transport? A review of interventions to encourage behavioral and technological change, UK Energy Research Centre report.*

viii. *Stephano Casereni, Cinzia Pastorello et al., April 2013, Impact of the dropping activity with vehicle age on air pollutants emissions.*

ix. *Xing Wang, August 2011, Characterization of on road vehicular emissions and their impacts on near road way air pollution.*

x. *Zuhdi Salhab (2012), Effect of Exhaust Gas Recirculation on the Emission and performance of Hydrogen fuelled Spark-Ignition Engine, Global Journal of Researches in Engineering, Automotive Engineering, Volume 12*