

Environmental Impact Assessment of Some Vehicles Pollutants in Sohar, Oman

Miqdam T Chaichan and Kadhim A H Al-Asadi

Abstract—At present, the numbers of transport vehicles on the road are increasing all around the globe despite its environmental pollution. The variety of vehicles on the road leads to the emission of different types of greenhouse gasses and particulate matter. These severely affect the environment and significantly affect the concentration of pollutants in the atmosphere. In Oman, at the end of 2014 the number of new cars increased by 8.6%. In Sohar, which is in the Al-Batinah region, around 48882 per day vehicles pass through Al-Batinah highway in Sohar.

The research study tries to establish a relation between the vehicles pollutants came from traffic volume as some air pollutants like NO_x, smoke and noise concentrations in and around the Al-Batinah highway near Sohar city. An attempt is also made out of that to generate awareness and investigate the resident willingness to reduce greenhouse gasses.

Index Terms—pollutants, greenhouse gasses, NO_x, PM, Al-Batinah, Oman

1 INTRODUCTION

Traffic on roads consists of pedestrians, and mainly different types of vehicles while using the public way for purposes of travel that is regulated by rules and policies. There are many factors affect the traffic volume size such as urban development that increased the demand for vehicles. The traffic congestion that is increased every year is causing a rise in air pollution, wasting of time and increasing health problems such as respiratory diseases. Moreover, the reduction in traffic congestion requires a financial investment and time. However, neglecting the traffic crowd problem would increase the social and other descends problems among citizens [1], [2]. Traffic congestion is a global problem that does much more than test our patience. It has a significant drain on our wallets as well our economies.

Due to previous causes, an enormous clear impact on the environment, human health and economy occur. For example environmental effect (air pollution), which lead people suffering from many diseases like asthma and lung cancer. Moreover, the loss of times, the car consumes more fuel and reduce productivity are the popular impact on the economy [3].

Air pollution produced from cars and trucks throughout their life, including pollutants emitted during vehicle operation, refueling, manufacturing, and disposal. Additional more emissions are coming from second-hand cars [4].

One of the important effects and results of the traffic jam is the greenhouse gases effects since the vehicles emissions one of the primary source of fossil fuels burning. The greenhouse gases (GHG) are gasses in the atmosphere that absorbs and emits radiation within the thermal infrared range. The greenhouse gases include (carbon dioxide (CO₂), water vapor (H₂O), Ozone (O₃), methane (CH₄), Nitrous Oxide (N₂O)) [5].

If we take the US as an example, around 27% of the greenhouse gases emissions in 2013 came from the transportation sector as shown in Fig. 1. Greenhouse gases act like a blanket

around the Earth, trapping energy in the atmosphere and causing it to warm. Many valuable studies declared that the buildup of greenhouse gases changes the earth's climate and produce serious effects to human health, welfare and the ecosystems [6].

Oxides of nitrogen (NO_x) are a gas primarily emitted from fossil fuel combustion at many power and industrial facilities. Transportation also is one of its emissions sources. Oxides of Nitrogen affected human health when it inhaled during the respiration process. NO_x accompanied with Sulfur Dioxide is the major precursors of acid rain. Acid rain results in the soil futile; water accelerated corrosion of buildings and monuments, and reduced visibility [7].

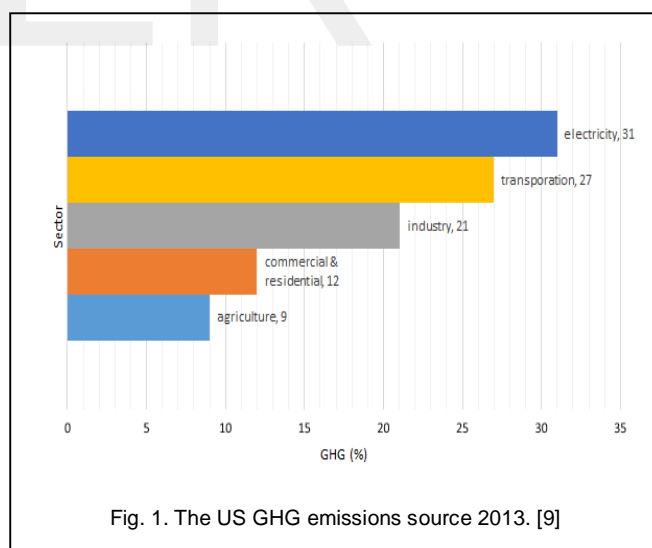


Fig. 1. The US GHG emissions source 2013. [9]

The traffics engines burn organic substances emit smoke. Smoke isa cloudy, hazy emanation consists of solid and/or liquid particles or droplets. These particles are so small that they tend to remain suspended in the air for extended periods of times varying from seconds to years. Smoke is often visible to the human eye; however, much of it is not. The size and content of the particles or droplets comprising smoke very much affect our ability (as well as the ability of optical instruments) to "see" it [9]. Opacity is a measure of light reduction/loss

- Miqdam T Chaichan is currently Assistant Prof. in Mechanical Eng. Dept., University of Technology, Iraq. E-mail: miqdam_tc@uotechnology.edu.iq
- Khadem A H Al-Asadi is currently Prof. in Collage of Art, Basrah University, Iraq. E. mail: khademalasaki@yahoo.com

over a smoke column path usually expressed as a percentage. An opacity of 10% means that 90% of the source light power remains and 10% has been lost after passing through the measurement path. The 90% (0.9) term (the light remaining) is referred to as Transmittance [10], [11].

The combustion process causes noise, which is a pollutant that might cause a direct impact on surrounding environment. Noise may cause physiological change and immediate annoyance [12]. Combustion noise transpires in two forms, direct and indirect. The region undergoes the turbulent combustion causes the direct noise. The direct noise results from the turbulent combustion that results in a vibration results from the released heat from the reacting operation. This heat release fluctuation generates pressure waves. In the other hand, the indirect noise results in the combustion region also. It is caused by the interplay between different temperatures streamlines. The direct or indirect sounds depend on the device. The engine noise results from the vibration in different frequencies that cause heard noise by the human ear [13].

The aim of the recent study is to evaluate the effect of traffic domestic gases in and around the Al-Batinah highway near Sohar city on NO_x, smoke and noise concentrations in this area.

2 METHODOLOGY

The area of study is Al- Batinah highway section near Sohar city as shown in Fig. 2. The measurement has been taken and recorded for one month starting from 1st September 2009. The recorded results analyzed.

NO_x concentrations data obtained from the Multigas model 4880 emissions analyzer system. The smoke meter "MOD .SMOKY" used to measure smoke opacity. A microphone located at an elevation of about 1 meter above the highway road located on the sidewalk near the highway. This microphone has a cover to prevent it from the excessive acoustic reflection.



Fig. 2. The study Area

3 RESULTS AND DISCUSSION

An in-depth analysis of the traffic data as in Fig. 3 reveals that the traffic started to increase after 6:30 AM since most of the people is going to their work. Heavy volume of traffic movement in the morning and reverse their direction in the afternoon since traffic flows in opposing direction are almost equal throughout the day. The heavy vehicles started their motion late in the morning at 7 am and their volume almost constantly continues for the midday and fall off somewhat in the late afternoon. From the huge number of the cars passed through the highway, it reached around 13468 vehicles per

day.

Fig. 4 illustrates that the NO_x concentrations reached their peak that is about 710 ppm at 12 AM. This peak value at this time is expected, where the vehicular traffic starts to reach its maximum values. The day average calculated NO_x concentration was 375.375 ppm that is high in all environmental measures and it needs regulations to limit it.

Similar trends are reported for smoke opacity as Fig. 5 declares. Smoke opacity reaches its peak at 1 PM that is about 7.4%. This value is considered high, and if it is added to the high NO_x concentration it provides a good environment for smog formation.

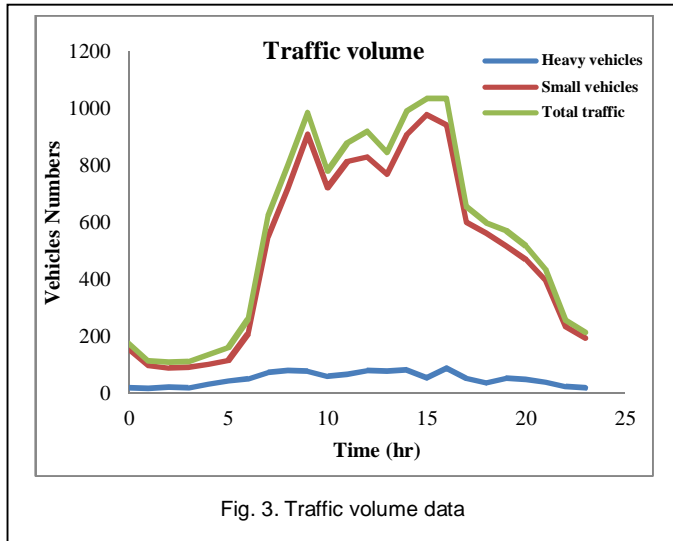


Fig. 3. Traffic volume data

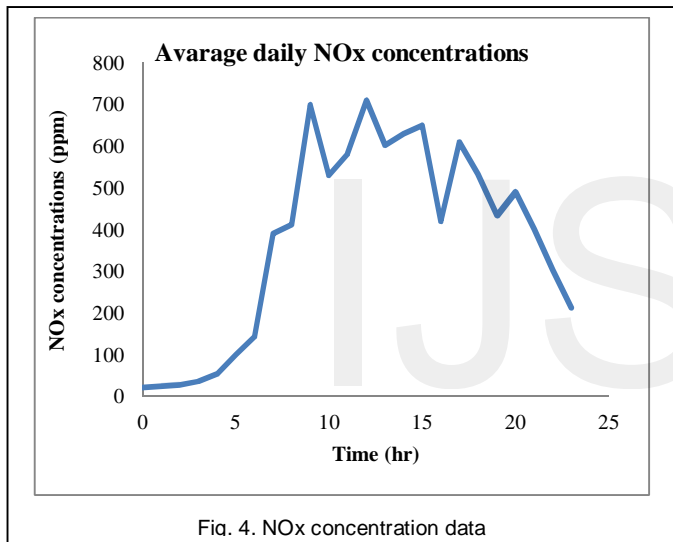


Fig. 4. NOx concentration data

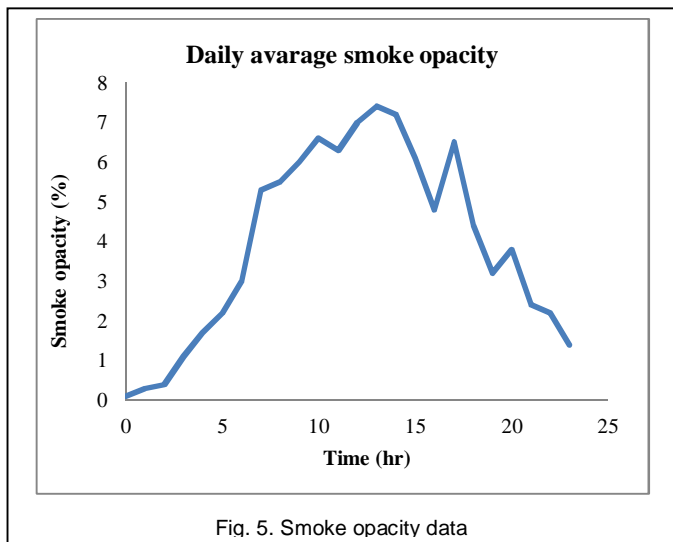


Fig. 5. Smoke opacity data

from the vehicular movements that impact the residents near the highway. The traffic noise increases to its peak value at day time causing high disturbance. This vehicles noise must be reduced and limited by legislation and laws.

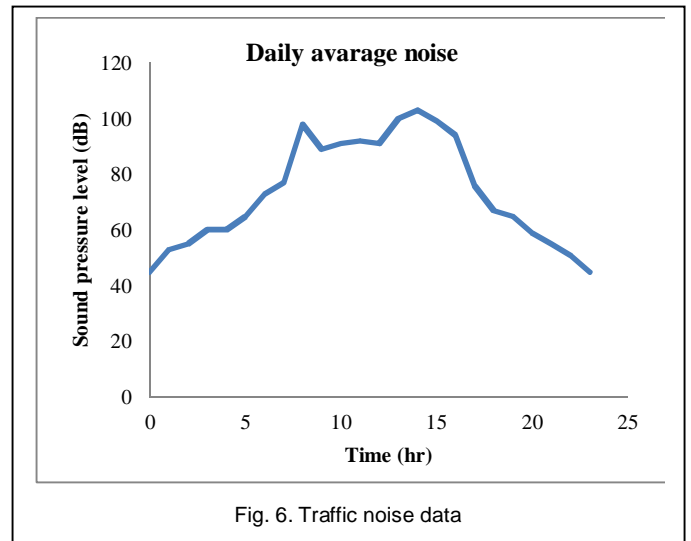


Fig. 6. Traffic noise data

4 CONCLUSIONS

The vehicular traffic data state that around 13468 vehicles pass on the road per day, which include 1221 heavy vehicles. These heavy vehicles consist of heavy trucks and buses powered by diesel fuel. Diesel fuel can generate significant amounts of NOx and smoke emissions compared to gasoline engines. The Ministry of Road and Transport has planned to dedicate a road for the heavy vehicles to reduce its bypass through residential areas and to avoid congestion.

There is a direct relation between the NOx concentration and smoke opacity in the air for the same day of the study. The accumulation of these gases in the air can harm the surrounding when it passes the standard limit.

The vehicular traffic noise declares a very serious need for regulations and legislation limited the emitted NOx and smoke from the vehicles in addition to reducing its noise. Many countries now started to think in alternative ways for the transportation management to reduce their environmental and health impacts. The solutions of traffic impact are diverse from city to another, depending on the city's infrastructure and the culture of the residents.

REFERENCES

- [1] J. Wargo, L. Wargo, N. Alderman, "The Harmful Effects of Vehicle Exhaust: A Case for Policy Change," Jane Bradley, Environment and Human Health, Inc. 2006.
- [2] Essays, UK, (November 2013), Causes and Effects of Traffic Congestion Tourism Essay, Retrieved from: <http://www.ukessays.com/essays/tourism/causes-and-effects-of-traffic-congestion-tourism-essay.php?cref=1>.
- [3] G.C. Hegerl, U. Cubasch, "Greenhouse Gas Induced Climate Change," *Environmental Science and Pollution Research*, vol. 3, no. 2, pp. 99-102, 1996.
- [4] Air pollutant: Sulfur Dioxide (SO₂), Minnesota pollution control agency, Retrieved March 2015 from:

Fig. 6 represents the overall sound pressure for the measured period. The results indicated that high noise generated

<http://www.pca.state.mn.us/index.php/air/air-quality-and-pollutants/general-air-quality/state-implementation-plan/air-pollutant-sulfur-dioxide-so2.html>.

- [5] G.Swagarya , S.Kaijage , R.S. Sinde, "A Survey on Wireless Sensor Networks Application for Air Pollution Monitoring," *International Journal of Engineering And Computer Science*, vol. 3. No. 5, pp. 5975-5979, 2014.
- [6] Opsissystem, C&M consulting engineer, Retrieved March 2015 from: <http://www.airpolguys.com/products/analytical-equipment/41-products/allproducts/95-opsis>
- [7] Chaichan M T, Performance and emission study of diesel engine using sunflowers oil-based biodiesel fuels, *International Journal of Scientific and Engineering Research*, vol. 6, No. 4, pp: 260-269, 2015.
- [8] Vehicles and Fuels, Clean air world, Retrieved May 2015 from: <http://www.cleanairworld.org/TopicDetails.asp?parent=24>
- [9] Sultanate of Oman. Argaam. Retrieved April 2015 from: <http://www.argaam.com/article/articledetail/478904>.
- [10] Chaichan M T & Faris S S, Practical investigation of the environmental hazards of idle time and speed of compression ignition engine fueled with Iraqi diesel fuel, *International J for Mechanical and Civil Eng.*, vol. 12, No. 1, pp: 29-34, 2015.
- [11] Sources of Greenhouse Gas Emissions, EPA, Retrieved May 2015 from: <http://www.epa.gov/climatechange/ghgemissions/sources/electricity.html>.
- [12] M. Harrison, Vehicle refinement, controlling noise and vibration in road vehicles", SAE International SAE ISBN 0768015057, 2004.
- [13] Chaichan M T, Al-Zubaidi D S M, Operational parameters influence on resulted noise of multi-cylinders engine runs on dual fuels mode, *Journal of Al-Rafidain University Collage for Science*, vol. 35, pp: 186-204, 2014.

IJSER