EXHAUST GAS EMISSIONS ANALYSIS IN DESSIE TOWN PER VEHICLE CATEGORY

Bayne Alemayehu[1*], Anteneh Mohammed[2], Seid Endro[3], Prabhakar. S[4]

[1*]MSC, Kombolcha Institute of Technology, WOLLO University, Kombolcha-208, Ethiopia.
[2]Dean, Mechanical department, Kombolcha Institute of Technology, WOLLO University, Kombolcha-208, Ethiopia. Email: anteneh67@gmail.com
[3] Head, Mechanical department, Kombolcha Institute of Technology, WOLLO University, Kombolcha-208, Ethiopia. Email: seidendro@gmail.com
[4] Associate professor, Mechanical department, Automotive Engineering Stream,   Kombolcha Institute of Technology, WOLLO University, Kombolcha-208, Ethiopia. Email: praba.rockson@gmail.com

Abstract

This study was carried out to ascertain the level of urban pollution caused by automobile exhaust gases in dessie town. The exhaust gases were trapped using gas sampler and analyzed for the concentration of carbon monoxide, CO, nitrogen oxides, NO_2, sulphur oxides, hydrocarbons, HC and H_2S. Increased gasoline consumption in automotive engines have triggered the emissions of greenhouse gases (GHG) especially carbon dioxide (CO_2) from automotive exhausts. These exhaust emissions depend on factors like the engine combustion design and operating conditions, fuel grade and lubricant, the state of maintenance and local road conditions and continue to affect the concentration of pollutants emitted by automotives like CO_2 and un burnt hydrocarbons which are very toxic to humans, leading to environmental pollution. In pursuant of improved efficient engine and less toxic emissions, the use of gasoline blends and biofuels are not the panacea since the exhaust-gas concentration and its constituent are not indicative of the contribution of the constituent to the overall emission due to variations in exhaust-gas flow rate with different engine types and automotive sources. Moreover real-time monitoring, turbo charging technologies, fuel injection strategies and catalytic exhaust after treatment may reduce emissions if compared to base engines but significant risk of CO_2 induced climate change continue to persist, while CO_2 capture technologies such as adsorption and absorption are limited in contrast to new developments in engine and exhaust technologies that are cheaper and locally sourced and could become the next trajectory.

1.Introduction

In the last century, the level of carbon dioxide in the atmosphere has increased by more than 30% as a result of human activities. The effects of climate change are becoming more pronounced and they include droughts, floods, heat waves and changes in the weather patterns. Global temperatures have increased by almost 0.8°C over the past 150 years. Without any global action, it is expected that temperatures will increase further by 1.8 — 4 °C by 2100 (IPCC, 1996).

The primary air pollutants found in most urban areas are carbon monoxide, nitrogen oxides, sulphur oxides, hydrocarbons and particulate matter (both solids and liquids). These pollutants are dispersed throughout the world's atmosphere in concentrations high enough to gradually cause serious health problems.(Avid & Manisli, 1987.Some commercial activities that are inherently associated with environmental (air) pollution arise from two main sources of pollutants in urban areas through transportation (predominantly automobiles) and fuel combustion in stationary sources, including residential, commercial, industrial heating and cooling and coal-burning power plants. Motor vehicles produce high levels of carbon monoxides (CO) and are the major source of hydrocarbons (HC) and nitrogen oxides (NOx), whereas, fuel combustion in stationary sources is the dominant source of sulphur dioxide (SO2). (Miller, 1989). Coppalle et al (2001) also wrote that motor vehicles cause most of the air pollution, except during cooler months when wood fires contribute significantly. Fossil fuel combustion, particularly as it occurs in automobile, occurs in two ways, such as exhaust emissions which include dangerous gases such as carbon monoxide, oxides of nitrogen, hydro-carbons and particulates, and evaporative emissions such as vapors of fuel which are released into the atmosphere, without being burnt (Coppalle et al 2001). For some pollutants, such as lead and carbon monoxide, the transport sector is often a major contributor, while for fine particulate matter the transport sector is typically one of several sources of emissions. In her publication, Rachael, (1959) also reported that combustion of fossil fuels produces extremely high levels of air pollution and is widely recognized as one of the most important 'target' areas for reduction and control of environmental pollution. [5] discussed a project, Proton Exchange Membrane (PEM) energy unit are progressively being refered to by governments as a conceivable pathway to the decrease of ozone depleting substance outflow. It is one of the forthcoming force hotspots for car applications, prepare machines, stationary cogeneration frameworks, and portable electronic gadgets. Be that as it may, the dryness of the film of a PEM power device diminishes

the ionic conductivity, bringing about execution decrease. In this work, a two-dimensional model is utilized to examine the fundamental and collaboration impacts of five outline factors, at three levels in a proton trade layer (PEM) energy unit. Investigation is directed for working possibilities of 0.7 and 0.6V and a scope of current densities. An engine that picks up its energy from a hydrogen tank and a power device Stored in a tank. The substance vitality from the hydrogen will be changed over into electrical vitality by the power device to push the prepare at up to most extreme speed of 80km/hr. Prepare apparatuses like Fans, lighting may likewise keep running on PEM energy unit. This new hydrogen prepare is along these lines ideal for shorter, calmer extends of the system that jolt hasn't yet come to.

2. Equipment set up and measurement

The CAP 3200 station is made up of a CAP3200, an opacity measurement cell and trolley. The CAP3200 has an LCD screen, a gas analysis module for petrol vehicles, a keyboard and a printer. The measurement cell is connected to the station by a power supply and data cable. It is packaged in the form of a small metal briefcase mounted on legs.

Figure 1

3. Results and Discussion

The results of the air pollution gas analysis in parts per millionth of air (ppm) from dessie town in south wollo using the Uv/vis spectrophotometer Cecil model 1000 is presented in table 3.1. The subscribes represents the various locations in the town while X, the average values in Dessie town. The increasing rate of registered motor vehicles (M.V) and motor cycles from 2008 to August, 2011 in dessie town is represented in table3.2

Table 3.1: Composition of Clean, Dry Air near Sea Level

Parameters	GASES							
	HC	H2S	SO2-SOX	NO2-NOX	CO2- co	03	Ki	Xe
CONCENTRATION	1.0-1.2	0.5	0.08-0.10	02-O5	0.1	0.01-0.05	1.0	0.08

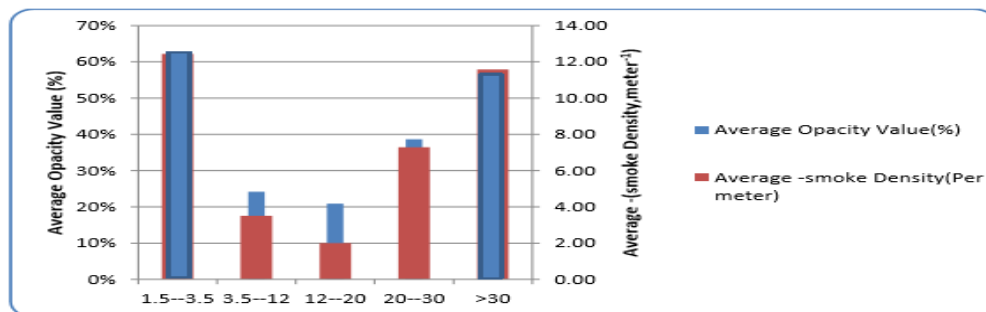Table 3.1 Result of Exhaust Gas Analysis (ppm) or Concentration Values (ppm) of the Pollutants from Dessie (X),

Gases	Sample sites		
	XI	X2	X
HC	2.22	0.02	2.62
H2S	0.67	0.66	0.63
SO2- sox	4.71	4.84	4.78
NO2-N OX	4.20	4.40	4.30
CO2-C O	9.55	9.68	9.62

KEY
HC H2S- Hydrocarbons Hydrogen
 SO2-SOX - Sulphide Sulphur dioxide/oxide
COrCO - Carbon dioxide/monoxide
NO2-N OX- Nitrogen dioxide/oxide

Table 3.2: Registered Motor Vehicles & Motor Cycles in dessie from 2008 to August, 2011

Town	Year								Total	
Dessie	**2008**		**2009**		**2010**		**2011**		**MV**	**MC**
	MV	**MC**	**Mv**	**MC**	**MV**	**MC**	**MV**	**MC**		
	500	**800**	**900**	**1500**	**1400**	**2500**	**1400**	**2800**	**4200**	**7600**

Opacity values vs. smoke densities vs. carrying capacity groupThe estimated smoke opacities of the ton groups 1.5-3.5 ton are found to especially emit i.e. 63 %.

4 Discussion

The results of the analysis of the concentration (ppm) of the exhaust gases from dessie towan. Dessie being the centre of activities in the state contributes the highest amount of all the pollutants with the concentration of CO2-CO (15.00pprn) been the most active, with the exception of NO2-NOx been contributed highest next contributor of these pollutants and having the bar of CO2-CO as the tallest by its histogram plot. The least contributor of these pollutants with H2S as the least bar and C02-CO as the tallest bar by its histogram plot. The total average concentration values of the town's shows clearly that CO2-CO is the most dominant pollutant in air. The presence of the other pollutants are in the magnitude of SO2-Sox greater than NO2-NOx greater than HC greater than H2S in dessie lies in a valley resulting in acceleration out of the town, For a healthy air free of contamination, the

concentration of the elements should have the values (in ppm) given in Table I, but these values are higher, and this is detrimental to human health, livestock, crops and the generation yet unborn.

5. Reference

[1] Stern N.; 2006.*The Economics of Climate Change* available at www.sternreview.org.uk. Suresh Pandian.; SharadGokhale.;Aloke Kumar Ghoshal.; 2009.

[2] *Evaluating effects of traffic and vehicle characteristics on vehicular emissions near traffic intersections,* Transportation Research Part D, 180 — 196.

[3] Wei-Chin Chen.; Sen-Wei Chiang.; Charles J.-L. Wang.; 2008.

[4] Characteristics and source identification of roadside suspended particles, *Transport Research Part D, Elsevier 531 — 538*

[5] Christo Ananth, "Analysis and Optimization of PEM fuel cells Design", Smashwords Publishing, Los Gatos, California, United States, ISBN: 978-81-910-749-7-0, September 2017, pp: 1-36.

[6] *Health Effects of Transport—related air pollution,* edited by Michal Krzyzanowski, Birgit Kuna-Dibbert *and* Jurgen Schneider.

[7] WNCSD, World Business Council for Sustainable Development.; 2001.

[8] Mobility 2001 — World Mobility at the end of the Twentieth Century and its Sustainability., *WBCSD,*

[9] *Yunbo, Z; Xiaoting, L; Hongmei, C; Bibo, X; Lu, Z. Caiting, Li; Guangming, Z. Source identification and potential ecological risk assessment of heavy metals in PM2.5 from Changsha. Science of the Total Environment 493 (2014) 109-115.*

[10] *Pant, P; Harrison, R.M. Estimation of the contribution of road traffic emissions to particulate matter concentrations from field measurements: A review. Atmospheric Environment (2013) 78-97 Vol 77.*

[11] *Ahmed, F.H. Assessment of air pollution elements concentrations in Baghdad city from periods (May-December) 2010. International Journal of Energy and Environment (2015) 191-200 Vol 6 Issue 2.*

[12]   *Sonal, S.V; Birva, D. Effect of Meteorological Conditions on Air Pollution of Surat City. Journal of International Environmental Application & Science (2008) 358-367 Vol. 3 (5).*

[13]   *Rhys-Tyler, G.A; Legassick, W; Bell, M.C. The significance of vehicle emissions standards for levels of exhaust pollution from light vehicles in an urban area. Atmospheric Environment 45 (2011) 3286-3293.*