A report on

PERFORMANCE EVLUATION OF BIOSIGNAL RING FOR REDUCTION OF POLLUTION LEVEL IN DIESEL AND PETROL ENGINES

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Certificate

This is to certify ANKIT JAIN, RACHIT KRISHNA, SURBHI JAIN, TEJASVINI AHUJA, YUKTI SHARMA AND NIDHI PATHAK, B. Tech. students in the Department of Environmental Engineering has submitted a project report on "PERFORMANCE EVLUATION OF BIOSIGNAL RING FOR REDUCTION OF POLLUTION LEVEL IN DIESEL ENGINES" in partial fulfillment of the requirement for award of degree of Bachelor of Technology in Environmental Engineering, during the academic year 2016-17.

It is a record of the student's research work prepared under my supervision and guidance.

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Declaration of Originality

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Abstract

Air pollution has become a growing problem in megacities and large urban areas throughout the globe, and transportation is recognized as the major source of air pollution in many cities, especially in developing countries. Contribution of automobiles is reported in the range of 40 to 80% of the total air pollution. The challenge facing megacities is how to reduce the adverse environmental impacts and other negative effects of transportation without giving up the benefits of mobility. This research paper includes the testing of a biosignal ring developed by Wellan International Limited. The ring when attached to the inlet of the engine acts on the fuel through biosignals, the biosignals help in atomization of the fuel and reduces the pollutants by further enhancing the combustion process, and thus reducing the unburnt pollutant particles from the engine exhaust. The ring was tested on diesel and petrol engines. For diesel engine reduction in smoke was measured, while in the petrol engine parameters such as CO, CO_2, SO_x and NO_x were measured before and after attaching the ring. The percentage reduction of the pollutants obtained from the ring for the diesel engine is about 15%, and in petrol engine, significant reduction in the pollutants is observed. If this device is incorporated in the vehicles, it can substantially reduce the pollution emitted from the vehicles and can even increases the efficiency of the engine.

***Keywords*:** biosignal, vehicular pollution, efficiency of engine,atomization,diesel engine, petrol engine

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List of Symbols, Abbreviationsand Nomenclature

g/kmhr	Grams per kilometre hour
g/kwhr	Grams per kilowatt hour
g/km	Grams per kilometre
PM	Particulate matter
NO2	Nitrous oxide
C_xH_y	Hydrocarbons
CO	Carbon mono oxide
SO2	Sulphur dioxide
N (%)	Opacity of smoke
K (m^{-1})	Smoke density factor
t (^oC)	Oil Temperature
T (^oC)	Heating chamber temperature
T_c (seconds)	Time taken to consume 100 mL of fuel

Chapter 1
INTRODUCTION

1.1 BIOSIGNALS

A biosignal is any signal in living beings that can be continually measured and monitored. The term biosignal is often used to refer to bioelectrical signals, but it may refer to both electrical and non-electrical signals [1, 2, 3]. The usual understanding is to refer only to time-varying signals, although spatial parameter variations (e.g. the nucleotide sequence determining the genetic code) are sometimes subsumed as well.

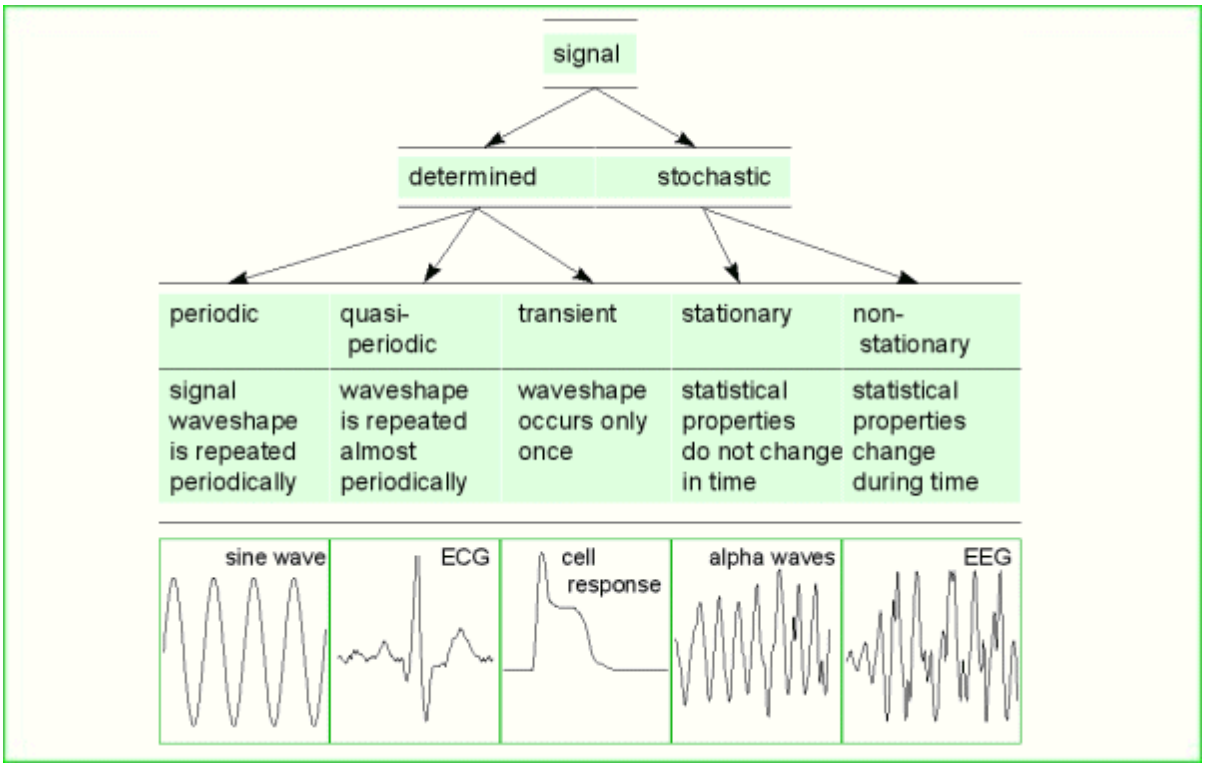


Figure 1.1: types of signals

1.2 ELECTRICAL BIOSIGNALS

Electrical biosignals, or bioelectrical time signals, usually refers to the change in electric current produced by the sum of an electrical potential difference across a specialized tissue, organ or cell system like the nervous system[4,5]. Thus, among the best-known bioelectrical signals are:

1.2.1 Electroencephalogram (**EEG**): It is an electrophysiological monitoring method to record electrical activity of the brain. EEG measures voltage fluctuations resulting from ionic current within the neurons of the brain.

1.2.2 Electrocardiography (**ECG**): It is the process of recording the electrical activity of the heart over a period of time using electrodes placed on the skin [6].

1.2.3 Electromyography (**EMG**): It is an electro diagnostic medicine technique for evaluating and recording the electrical activity produced by skeletal muscles.

1.2.4 Mechanomyogram (MMG): It is the mechanical signal observable from the surface of a muscle when the muscle is contracted. At the onset of muscle contraction, gross changes in the muscle shape cause a large peak in the MMG.

1.2.5 Electrooculography (**EOG**/**E.O.G.**): It is a technique for measuring the cornea-retinal standing potential that exists between the front and the back of the human eye. The resulting signal is called the electrooculogram [7,8].

1.2.6 Electro dermal activity (**EDA**): It is the property of the human body that causes continuous variation in the electrical characteristics of the skin.

1.2.7 Magneto encephalography (**MEG**): It is a functional neuroimaging technique for mapping brain activity by recording magnetic fields produced by electrical currents occurring naturally in the brain, using very sensitive magnetometers.

EEG, ECG, EOG and EMG are measured with a differential amplifier which registers the difference between two electrodes attached to the skin. However, the galvanic skin response measures electrical resistance and the MEG measures the magnetic field induced by electrical currents (electroencephalogram) of the brain [9].

With the development of methods for remote measurement of electric fields using new sensor technology, electric biosignals such as EEG and ECG can be measured without electric contact with the skin. This can be applied for example for remote monitoring of brain waves and heartbeat of patients who must not be touched, in particular patients with serious burns.

Electrical currents and changes in electrical resistances across tissues can also be measured from plants.

1.3 NON ELECTRIC BIOSIGNALS

Biosignals may also refer to any non-electrical signal that is capable of being monitored from biological beings, such as:

1.3.1 Mechanical signals (e.g. the mechanomyogram or MMG)

1.3.2 Acoustic signals (e.g. phonetic and non-phonetic utterances, breathing)

1.3.3 Chemical signals (e.g. pH, oxygenation)

1.3.4 Optical signals (e.g. movements).

1.4 APPLICATIONS OF BIOSIGNALS

1.4.1 Non-invasive diagnosis

In recent years, a particular challenge has arisen in non-invasive medical diagnostic procedures. Because biosignals recorded on the body surface reflect the internal behavior and status of the organism or its parts, they are ideally suited to provide essential information of these organs to the clinician without any invasive measures [10-12]. This approach was used for classifying pre-processed ECG signals to identify patients who were at high-risk of developing ventricular tachycardia (VT).

1.4.2 Potential for direct interfaces and health monitoring

Biosignals are harnessed to enable enhanced computer interfaces. In particular, biosignals can serve for passive health monitoring for the elderly who want to remain at home but need some level of support as they age. Such devices can directly manipulate computer interfaces to give people with limited peripheral mobility some control over their environment. In contrast to the biosignal interfaces based on voluntary peripheral nerve signals, brain-to-computer interfaces are also being researched.

1.4.3 Biosignal monitoring system for mobile telemedicine

A prototype integrated mobile telemedicine system has been designed that is compatible with existing public mobile telecommunication network, CDMA 1xEVDO. The mobile telemedicine system consists of two parts. One is a physiological signal measuring part, and the other is a PC system for the signal processing and telecommunication. The system uses NetMeeting to transmit video, audio and patient biosignals from a moving ambulance to a hospital and delivers to the personal computer of the doctor. The patient biosignals are non-invasive blood pressure (NIBP), arterial oxygen saturation, respiration pattern, electrocardiogram (ECG), heart sound, body core temperature and blood glucose concentration. For the emergency medicine, vital signs are focused and the remote medical monitoring, consulting, and health care are intended. The mobile telemedicine system was implemented, and tested for real time medical consultation during ambulance transport. This PC based mobile telemedicine system is flexible enough to accommodate newer components in wireless communication and portable sensing technologies. The present study suggests that the mobile telemedicine system using CDMA 1xEVDO is aids to patient monitoring and diagnosis as well as a convenient means of communications in the ambulance for the emergency medical care.

1.4.4 Ways of interactions using biosignals

A prototype earphone was developed with three kinds of biosignals - pulse wave, electromyogram (EMG) and acceleration sensors. Using this system three new applications were invented, namely, automatic music selection, tactile and visual communication and automatic metadata annotation.

1.4.5 Water purification

WELLAN RINGS work through bio-signals, which have been stored in the rings' interior. These signals penetrate all pipes and tubes to influence the water which is passing through. As a result, the vibrations or oscillations created in the water are changed in such a way that lime, rust, scale or bio-fouling matter no longer accumulate within a piped system and are washed out in minute particles.

Chapter 2
LITERATURE REVIEW

2.1 POLLUTION CONTROL BY BIOSIGNALS

Each elemental molecule has its own specific natural atomic/molecular oscillation. In simple terms, oscillations are best described as vibrations or waves that are given off by that element.

Molecules are formed when atoms of different elements fuse together because of natural affinity. This attraction is caused by the oscillations emitted by the atoms. In other words, elements recognize each other by their unique oscillations. If the oscillations of various atoms are neutralized their attraction ceases [13,14,15]. This is the basis of pollution control by biosignals.

The molecules of the fuel are targeted in order to reduce pollution cause by combustion of these particles. When the fuel particles are acted upon by the biosignals, it leads to the atomization of the fuel. So, when the fuel is burned in engine, it leads to the better and uniform combustion.

High frequency biosignals are modulated and stored into an appropriate device which is basically high-quality information storage materials (base material crystals) which are capable of storing such vibrations for indefinite periods of time and releasing them again. These biosignals penetrate any kind of material and they are absorbed by the fuel as interference or resonance vibrations. Whenever extra atoms are forcibly fused to form a molecule by the use of a catalyst, the resultant molecule is unstable and will break apart. Biosignal emissions cause such a situation, resulting in a breakdown within molecules. The dispersed atoms are then targeted by the ring to keep from restructuring.

The high frequency oscillations that are generated by the energy field interact with the molecular structure of the fuel, removing harmful elements from your fuel and oil. This causes the fuel to become cleaner and finer, leading to better combustion and lesser number of unburnt particles or pollutants and hence reducing pollution.

2.2 FUNCTIONING OF THE POWER RING

WELLAN power ring consists of high-quality information storage materials (base material crystals) which are capable of storing such vibrations for indefinite periods of time and releasing them again. These vibrations penetrate any kind of material and they are absorbed by the water as interference or resonance vibrations (hydrogen bridges or water molecules). Within fractions of a

second, this information passes through the pipe into the water and is effective even with high flow rates.

WELLAN power rings can be deployed for water of any quality. No chemical substances, magnetic fields or electromagnetic radiations are released into the environment [16].
The basis of this technology is the realization of the latest knowledge of modern quantum theory.
Frequency patterns from the ultra-fine range (quantum vibrations) are modulated onto WELLAN RINGS by means of a laser technology.
Elements recognize each other by their unique oscillations. Thus, a water molecule is formed when oxygen is attracted to combine with 2 atoms of hydrogen. **If the oscillations of various atoms are neutralized their attraction ceases. That is the function of Wellan emissions.**
Whenever extra atoms are forcibly fused to form a molecule by the use of a catalyst, the resultant molecule is unstable and will break apart. Wellan emissions cause such a situation, resulting in a breakdown within molecules [17]. The dispersed atoms are then targeted by the ring to keep from restructuring.

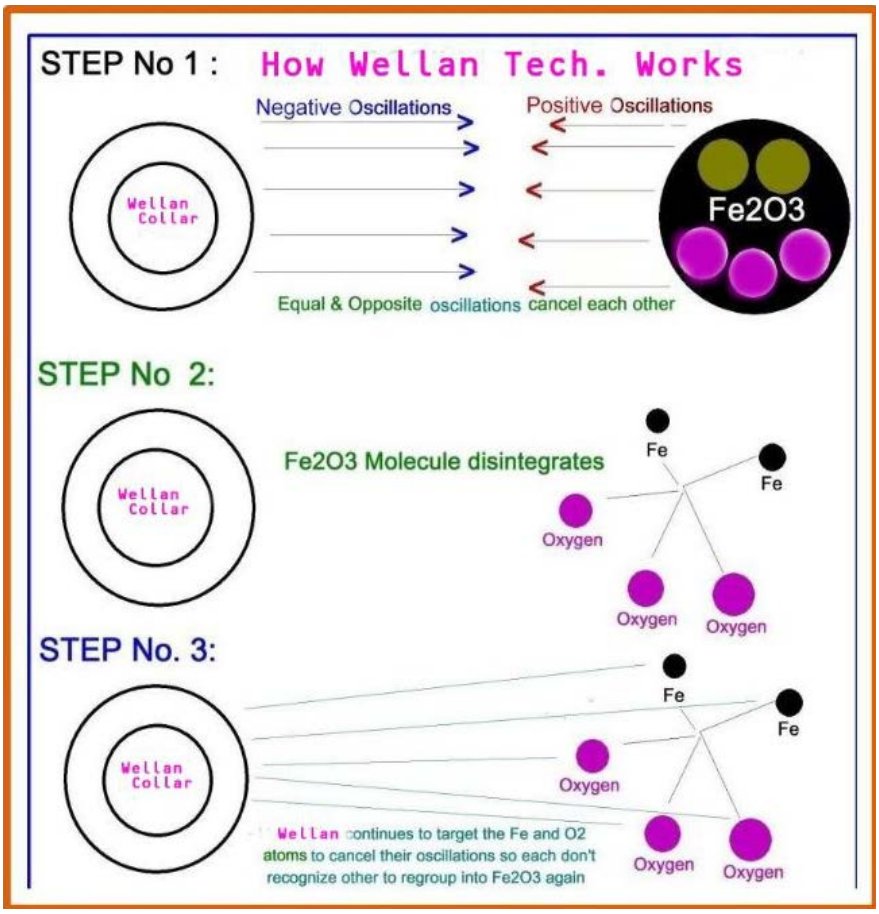


Figure 2.1 Functioning of a biosignal ring

How are the signals harnessed

The molecular fundamental oscillations of various substances has been isolated, mapped and stored in the Ring. Wellan technology works using specifically modulated molecular oscillations not dependent upon magnetic forces or electrical pulses.

Based on these oscillations of elements and molecules, Wellan has developed new opposite/equal active oscillations. The aim is to influence the original oscillation of the element that has been targeted through new active oscillations in such a way that the physical properties of the element or of the molecules are modified [18,19].

These manufactured oscillations are then programmed into the Wellan Ring and super imposed by a proprietary Laser Technology. This alloy can store an almost unlimited number of active oscillations and emit these to a liquid in a constant and stable format, independent of the ambient temperature. The active oscillations create a field within the ring, which penetrates all piping material and thus passes into the water or fluid [20-22]. The Principle results in an 'Interference' or 'Overlaying' of natural oscillations emitted by pollutants in the liquid.

Interference and Overlaying can best be described as cancelling sound using equal and opposite waves or playing two adjacent musical notes together to create another note.

Interference

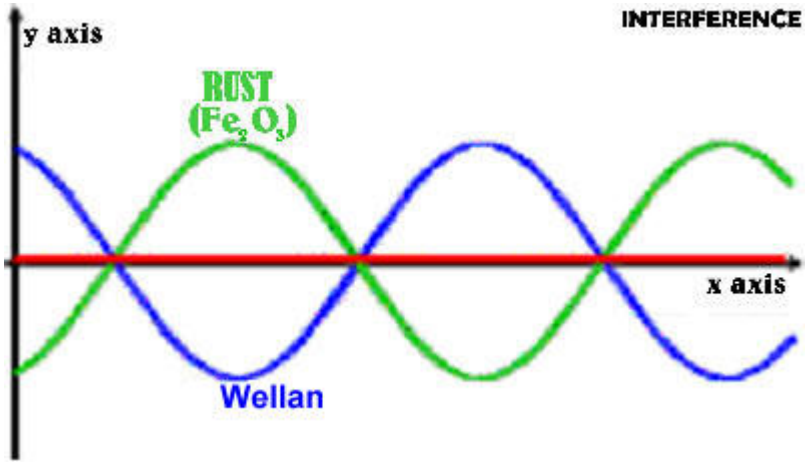


Figure 2.2 Interference of natural oscillations emitted by pollutants

Green represents natural oscillations emitted by a Rust Molecule

Blue represents active oscillations emitted by Wellan Rings as interference

Red represents the final oscillation results thus changing the physical properties of Rust

Overlaying

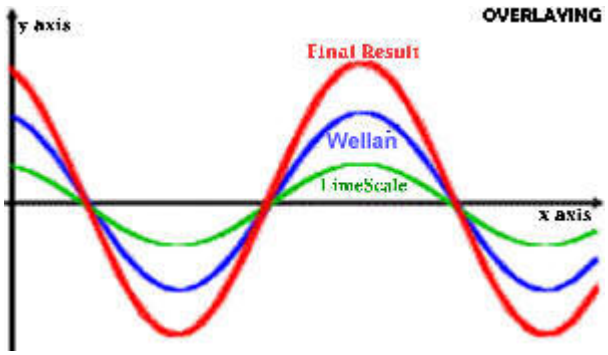


Figure 2.3overlaying of natural oscillations emitted by pollutants

Green represents natural oscillations emitted by the Lime Scale Molecule

Blue represents active oscillations emitted by Wellan Rings called “overlaying”

Red represents the final oscillation results thus changing the physical properties of Calcium carbonate.

2.3 POLLUTION CONTROL FROM VEHICLES

The large majority of today's cars and trucks travel by using internal combustion engines that burn gasoline or other fossil fuels. The process of burning gasoline to power cars and trucks contributes to air pollution by releasing a variety of emissions into the atmosphere [23]. Emissions that are released directly into the atmosphere from the tailpipes of cars and trucks are the primary source of vehicular pollution. But motor vehicles also pollute the air during the processes of manufacturing, refueling, and from the emissions associated with oil refining and distribution of the fuel they burn.

The principal air-quality pollutant emissions from petrol, diesel, and alternative-fuel engines are carbon monoxide, oxides of nitrogen, un-burnt hydrocarbons and particulate matter. It is emissions of these pollutants that are regulated by the Euro emissions standards. Modern cars, if kept in good condition, produce only quite small quantities of the air quality pollutants, but the emissions from large numbers of cars add to a significant air quality problem [24-26]. Carbon monoxide, oxides of nitrogen, and un-burnt hydrocarbons are gases, and are generally invisible. Particulate matter is usually invisible although under certain operating conditions diesel engines will produce visible particles, appearing as smoke. Petrol engines will also produce visible particles if they are burning engine oil or running “rich".

2.4 PARAMETERS OF VEHICULAR POLLUTION

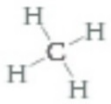
Cars and trucks produce air pollution throughout their life, including pollution emitted during vehicle operation, refueling, manufacturing, and disposal. Additional emissions are associated with the refining and distribution of vehicle fuel [27-30].

Air pollution from cars and trucks is split into primary and secondary pollution. Primary pollution is emitted directly into the atmosphere; secondary pollution results from chemical reactions between pollutants in the atmosphere. The following are the major pollutants from motor vehicles:

2.4.1 Particulate matter (PM)

These particles of soot and metals give smog its murky colour. Fine particles — less than one-tenth the diameter of a human hair — pose the most serious threat to human health, as they can penetrate deep into lungs [31]. PM is a direct (primary) pollution and a secondary pollution from hydrocarbons, nitrogen oxides, and sulphur dioxides. Diesel exhaust is a major contributor to PM pollution. Fine particles have an adverse effect on human health, particularly among those with existing respiratory disorders. Particulate matter is associated with respiratory and cardiovascular problem. 29,000 deaths a year in the UK are attributable to fine particulate pollution.

2.4.2 Hydrocarbons (HC)



These pollutants react with nitrogen oxides in the presence of sunlight to form ground level ozone, a primary ingredient in smog. Though beneficial in the upper atmosphere, at the ground level this gas irritates the respiratory system, causing coughing, choking, and reduced lung capacity [32,33]. Hydrocarbons contribute to ground-level ozone formation leading to risk of damage to the human respiratory system. Some kinds of hydrocarbons, in addition, are both carcinogenic and indirect greenhouse gases.

2.4.3 Nitrogen oxides (NOx)

These pollutants cause lung irritation and weaken the body's defenses against respiratory infections such as pneumonia and influenza. In addition, they assist in the formation of ground level ozone and particulate matter. Oxides of nitrogen include nitrogen dioxide (NO2) and nitrogen oxide (NO): NO reacts in the atmosphere to form nitrogen dioxide (NO2) which can have adverse effects on health, particularly among people with respiratory illness [34,35]. High levels of exposure have been linked with increased hospital admissions due to respiratory problems, while long-term exposure may affect lung function and increase the response to allergens in sensitive people. NOx also contributes to smog formation, and acid rain, can damage vegetation, contributes to ground-level ozone formation and can react in the atmosphere to form fine particles (‘secondary particles’).

2.4.4 Carbon monoxide (CO)

This odourless, colourless, and poisonous gas is formed by the combustion of fossil fuels such as gasoline and is emitted primarily from cars and trucks. When inhaled, CO blocks oxygen from the brain, heart, and other vital organs. Fetuses, new-born children, and people with chronic illnesses are especially susceptible to the effects of CO [36]. Carbon monoxide reduces the blood's oxygen-carrying capacity which can reduce the availability of oxygen to key organs. Extreme levels of exposure, such as might occur due to blocked flues in domestic boilers, can be fatal. At lower concentrations CO may pose a health risk, particularly to those suffering from heart disease.

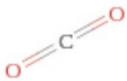
2.4.5 Sulphur dioxide (SO2)

Power plants and motor vehicles create this pollutant by burning sulphur-containing fuels, especially diesel. Sulphur dioxide can react in the atmosphere to form fine particles and poses the largest health risk to young children and asthmatics.

2.4.6 Hazardous air pollutants (toxics)

These chemical compounds have been linked to birth defects, cancer, and other serious illnesses [37]. The Environmental Protection Agency estimates that the air toxics emitted from cars and trucks — which include Benzene, acetaldehyde, and 1, 3-butadiene — account for half of all cancers caused by air pollution.

2.4.7 Greenhouse gases



Motor vehicles also emit pollutants, such as carbon dioxide, that contribute to global climate change. In fact, cars and trucks account for over one-fifth of the United States' total global warming pollution; transportation, which includes freight, trains, and airplanes, accounts for around thirty per cent of all heat-trapping gas emissions.

2.5 STANDARDS OF VEHICULAR POLLUTION

The standards are set by Central Pollution Control Board under the ministry of Environment and Forests and climate change. These are called Bharat Stage Emission Standards that regulate the output of the air pollutants from internal combustion engine equipment. These standards based on European regulations were first introduced in 2000.The standard active now is Bharat Stage-IV norms which has been implemented since 2012.These norms help in bringing down pollution

levels[38]. Exposure to air pollution can lead to a number of cardiovascular and respiratory diseases.

Norms	CO(g/km)	HC+ NOx(g/km)
1991Norms	14.3-27.1	2.0(Only HC)
1996 Norms	8.68-12.40	3.00-4.36
1998Norms	4.34-6.20	1.50-2.18
India stage 2000 norms	2.72	0.97
Bharat stage-II	2.2	0.5
Bharat Stage-III	2.3	0.35(combined)
Bharat Stage-IV	1.0	0.18(combined)

Table 2.1 Emission norms for passenger cars

Norms	CO(g/km)	HC+ NOx(g/km)
1991Norms	12-30	8-12 (only HC)
1996 Norms	4.5	3.6
India stage 2000 norms	2.0	2.0
Bharat stage-II	1.6	1.5
Bharat Stage-III	1.0	1.0

Table 2.2 Emission norms for two or three wheelers

Norms	CO(g/kmhr)	HC (g/kmhr)	NOx (g/kmhr)	PM(g/kwhr)
1991Norms	14	3.5	18	-
1996 Norms	11.2	2.4	14.4	-
India stage 2000 norms	4.5	1.1	8.0	0.36
Bharat stage-II	4.0	1.1	7.0	0.15
Bharat Stage-III	2.1	1.6	5.0	0.10
Bharat Stage-IV	1.5	0.96	3.5	0.02

Table 2.3 Emission norms for heavy diesel vehicles

Chapter 3
METHODOLOGY

3.1 MEASUREMENT OF VEHICULAR POLLUTION

There are three approaches available today to measure vehicle emissions. The first approach involves bringing vehicles into a laboratory, placing the vehicles on a dynamometer, and measuring their emissions as they are operated. The second approach is to place emission measurement and exhaust flow measurement equipment onto the vehicles and measure emissions from the vehicles as they are operated in the field. The third option is to use remote sensing to detect emissions from vehicles as they drive by.

The traditional way to measure emissions from vehicles is to bring them into the laboratory and measure emissions as they are operated on a dynamometer. In the better laboratories, the dynamometers can vary the load that they place on a vehicle on a second by second basis. Some older dynamometers are only capable of maintaining a steady load that can be changed, but only while the vehicle is not being tested. In either case, a load is placed on the vehicle that is equivalent to a load that the vehicle might experience while it is operating on a roadway and the emissions are measured from the vehicle. The actual emission measurements are typically made using a Constant Volume Sampling (CVS) system. This system works by pulling a constant volume of air that is larger than the amount of gases emitted by the vehicle being tested through a sampling duct. The exhaust gases from the vehicle being tested are mixed with this makeup air. The makeup air must, of course, be free of gases and particulate matter in order to not distort the testing process.

On-road vehicle emissions measurement equipment has only become realistically available since about 2003. The equipment is often referred to as portable emissions measurement equipment or PEMs.

Remote testing of vehicles offers another useful option for measuring vehicle emissions. The positive attributes of remote sensing for vehicle testing is that there are no vehicle acquisition difficulties and many hundreds or thousands of vehicles can be tested in a short timeframe. The negatives are that the emission measurements are less precise especially for the measurement of mass emissions and the range of emissions under different vehicle power demands that can be measured are limited.

The most common remote testing involves placing a beam across a lane of road and looking at the absorption spectrum from the exhaust. The roadway can be a freeway on-ramp or almost any type of street where a single lane can be isolated. The concentration of CO, VOC, NOx, and CO2 in the

exhaust can be estimated based on the concentration data that is collected from the vehicle exhaust plume.

3.2 METHODOLOGY

The methods of testing emissions from petrol engine and diesel engine are different:

3.2.1 Measurement Procedure for Diesel Engine(IS 8118:2008)

1. The test shall be carried out on an engine installed on a test bench or on a vehicle.
2. The engine shall first be brought to normal operating conditions during a road run or dynamic run 2 on the test bench. The test shall be carried out immediately after completion of the warming-up period.
3. The combustion chamber shall not be cooled or fouled by a prolonged period of idling preceding the test.
4. The engine oil temperature should be measured' and test should be allowed to proceed only after the engine oil temperature reaches 60°C.
5. During each free acceleration, maximum no load speed reached shall be within a band width of ± 500 rpm of average value in respect of three wheeler vehicles and ±3oo rpm of the average value for all other categories of vehicles. The average value of rpm is calculated from last four readings, out of six readings during the initial flushing cycles.
6. With the engine at idling, the accelerator control shall be operated quickly, but not violently, so as to obtain maximum delivery from the injection pump. This position shall be maintained until maximum engine speed is reached and the governor gets activated comes into action. As soon as this speed is attained the accelerator shall be released until the engine resumes its idling speed and the opacity meter reverts to .the corresponding conditions.
7. The operation specified in 6 shall be repeated not less than six times in order to clear the exhaust system and to allow for any necessary adjustment of the apparatus. Subsequently, the maximum opacity values obtained in each successive acceleration shall be taken as the values obtained while, after, each acceleration, the engine shall be kept at idling. The values obtained shall be considered as stabilized when four of such consecutive readings are situated within a band width of 0.25/m and do not form a decreasing sequence. The absorption coefficient so recorded shall be the arithmetical mean of these four valid readings.
8. The web cam photo of the vehicle number-plate should appear in the emission certificate.

3.2.2 Measurement Procedure for Petrol Engine

To test the increased efficiency of the fuel by the installation of the Power Ring, the following procedure is followed. Low gas analyzer was used to measure the emissions from petrol Engine. The test also gives the reduction in air pollution due to incorporation of the Ring. The test sequence is as follows:

1. Test a vehicle for the emissions at the exhaust pipe without installing the Power Ring.
2. Start the motor with empty gear. (if the vehicle is automatic, please set the gear to N)
3. Let the motor warm up for at least 30min.
4. Monitor the value of the emissions on the monitor.
    4.1. Monitor the cooling water temperature and wait for a while until the temperature stabilized. It must warm up to 90°C.
    4.2. Then, the emissions are to be monitored. If the values of emissions are stable, record the values.
5. Fill exactly the same amount of fuel into the tank as before installing the Power Ring.
6. Install one or more Power Rings on the fuel pipe i.e., at the inlet of the engine.
7. Repeat the steps 1-4 from above.
8. Compare the emission values of the both results.

3.3 INSTRUMENTS USED

3.3.1 Diesel Engine

The smoke meter primarily measures the opacity of the smoke received. Opacity is the degree to which smoke blocks light, it is the measure of light reduction or loss over a smoke column path. It is expressed as percentage. An opacity of 10% means that 90% of the source light power remains. Smoke meter also measures K, which is the smoke density factor in units of inverse length, and L is path length of the measured smoke sample column. Conceptually, the smoke density term represents the exponential light loss sensitivity per unit length of the smoke column. Table 4.1 shows the readings obtained from the smoke meter with and without the ring

3.3.2 Analysis for Petrol Engine

Low gas analyzer was used for the measurement of emissions from petrol engine. Various parameters were recorded from the low gas analyzer. Table 4.2 gives the readings of various parameters recorded from the instrument.

Chapter 4
Data analysis, comparison, results and discussion

4.1 Data analysis

Diesel Engine (using smoke meter)						
WITHOUT RING						
S.No	**N (%)**	**K(m^{-1})**	**T(^oC)**	**n(min^{-1})**	**t(^oC)**	**R.P.M.**
1	17.3	0.42	52	972	25	974
2	16.9	0.41	55	972	26	974
WITH RING						
S.No	**N (%)**	**K(m^{-1})**	**T(^oC)**	**n(min^{-1})**	**t(^oC)**	**R.P.M.**
1	14.4	0.36	55	970	24	974
2	14.6	0.37	56	970	24	972

Table 4.1 Testing on diesel engine

Petrol Engine (using Low gas Analyser)							
WITHOUT RING							
S.No	**CO**	**NO**	**C_xH_y**	**SO_2**	**NO_x**	**Fuel Efficiency (%)**	**T_c**
1	277.1	42.3	1306	1.5	160.1	90.40	144s
WITH RING							
S.No	**CO**	**NO**	**C_xH_y**	**SO_2**	**NO_x**	**Fuel Efficiency (%)**	**T_c**
1	265.1	87.5	975.4	0	114.9	95.30	158s

Table 4.2 Testing on petrol engine

4.2 Comparison

The emissions from petrol engine and diesel engines before and after installation of the WELLAN Power Ring are as follows. A significant reduction in the emissions can be seen in both petrol and diesel engines.

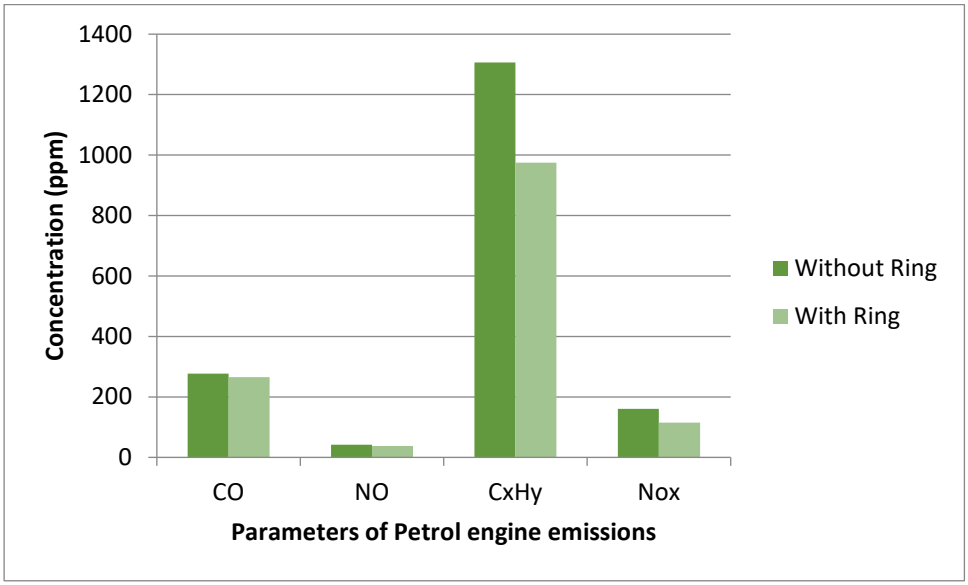


Figure 4.1 Petrol engine emissions

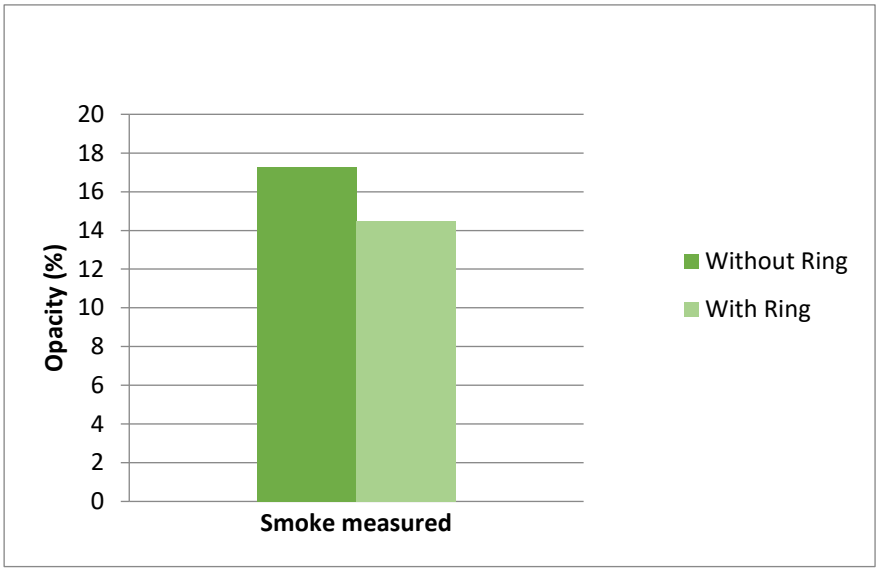


Figure 4.2 Diesel engine emissions

4.3 Results

PETROL ENGINE		DIESEL ENGINE	
Parameters	**Reduction (%)**	**Parameter**	**Reduction (%)**
CO	4.3		
NO	11.3	**Opacity**	16.18
C_xH_y	25.3		
No_x	28.3		

Table 4.3 Percentage reduction in emissions

4.4 Discussion

This purpose of the study was to find the performance evaluation of biosignal ring to reduce the level of pollution in diesel and petrol engines. According to the tests performed on the diesel and petrol engine, it can be observed that a significant decrease in the pollutants released by the engine can be achieved with the help of the ring. The overall reduction in diesel engines with the aid of the ring was found to be about 16.18%, which shows that if these rings are fitted in diesel engine it can give a remarkable outcome in alleviating pollution levels. In case of petrol engine, considerable reduction in the value of various parameters was observed. The reduction percentage in hydrocarbons is about 25.3% and that in nitrogen oxides is 28.3%. It is also noteworthy to see that besides reducing pollution levels, the fuel efficiency of the petrol engine has also increased from 90.40% to 95.30% as recorded from the instrument. It was also observed that time taken by the engine to consume 100 mL of fuel without the ring was 144 seconds, and on the application of the ring the time was reduced to 158 seconds. This goes on to show that the application of the ring is of importance not only in reducing pollutants from engine but also in increasing the efficiency of the engine.

Chapter 5
Conclusion

From the results obtained, we see that the Power Ring is very efficient in reducing the pollutants from the atmosphere. Various parameters constituting the smoke have significantly decreased in the engine exhaust after installation of the ring. The ring works effectively on diesel as well as petrol engines. In petrol engines, maximum reduction is in the oxides of nitrogen. Besides reducing the pollution, it proves to be economical to install the ring into to engine inlets of the motor vehicles. It is so because an increase in burning capacity of the fuel is observed. This indicates increase in fuel efficiency which makes the fuel last longer.

If the ring is incorporated in vehicles, it can prove to be beneficial for consumers on a daily basis. With the results obtained, a person saves fuel worth of 7 minutes travelling time on 1 litre of fuel with the help of the ring. From this calculation, if a person uses 1 litre of petrol per day, he or she can save fuel worth of 1 hour of travelling time, which means 1 litre of petrol is saved if a person travels 10 Km on road in vehicles incorporated with the ring. And, on an even larger scale 55 litres of the fuel can be saved in a year.

The ring can reduce around 15% of pollutants from the diesel engine, and also leads to remarkable reduction in the emissions produced by petrol engine.

Hence, it can be concluded that the Power Ring is the much needed means to get the rising levels of pollution in control and further also proves to be economical.

Chapter 6
Future scope

Innumerous methods to control pollution have been employed since the awareness of pollution rise has been spread. For example, a muffler is installed in the engine to control the noise and vibrations due to knocking. Earlier, a positive Crankcase Ventilation (PCV) system was used in the automobiles. In this system, the exhaust gasses were sent back into the crankcase so that complete combustion of the un-burnt particles could be carried out. But, this did not prove to be an effective method since the efficiency was not as desired. Also, the exhaust gasses caused harm to the crankcase. These days, a new technology has been developed. IC engines employ catalytic convertor at their exhaust valves to reduce the smoke emissions. Inside the catalytic convertor, the smoke emissions are adsorbed on the catalyst which makes them unstable, thereby atomizing them. The atomized exhaust gets converted into non-toxic molecules which enter the atmosphere. It proves to be very efficient in reducing the smoke emissions from the engine exhaust valves. The idea of the Power Ring is to atomize the fuel at the very inlet of the engine. This gives two positive results, firstly, burning the fuel much more efficiently and secondly, minimizing the emission of the un-burnt carbon particles. This not only helps in reducing the pollution at the exhaust valve, but also increases the efficiency of the fuel by about 5-30%, making it last longer. The Power Ring can be installed in petrol engines, diesel engines and generators. The installation process being simple, it can be attached on the fuel pipe by any individual. Since, automobiles contribute to 80-90% of the air pollution; there is tremendous scope of this Power Ring in the present as well as in the future as it is high time for mankind to act on the rising levels of air pollution especially in megacities.

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