قال تعالى:

{ قالوا سبحانك لا علم لنا إلا ما علمتنا
انك انت العليم الحكيم}

،،،،،،، صدق الله العظيم ،،،،،،،

سورة البقرة :(32)

Dedication:-

To our mothers and fathers, beloved family for always supporting, helping, and standing by us

To our brothers and sisters who stand with us, allow us to use their purpose when we need it to complete this research

To our dear friends who supported us throughout the process

Acknowledgment:-

Thank to Allah before and after everything.

We would like to thank our parents for their everlasting encouragement; this could not have been done without your support.

We wish to humbly acknowledge with sincere gratitude, our supervisor **A. ABUBAKR YUOSEF** for his advice and guidance during the writing of this report. It is his persistent criticism that brought hope and confidence in us, even at the most depressing moments. He was truly a source of inspiration.

Thanks to all our friends for encouragement in many moments.

Thanks to **College of Engineering**

ABSTRACT

Laboratory experiments are done at Karari University for single cylinder two stroke engine used an oil benzene mixture as fuel. Analyze the exhaust gas components is done by using a gas analyzer device to determine the amount of exhaust emission, and dynamometer is used to read the engine speed (rpm) at different engine speeds and different mixing fuel ratios. The gasses that are analyzed are: Nitric Oxides (NOx), Carbon Monoxide (CO), Carbon Dioxide (CO2) and Hydrocarbons (HC).Over at speed between (1500-2500 rpm), it found that there this a decrease in the quantity of each of Nitrogen Oxide (NOx) and Carbon Dioxide (CO2) emitted from the exhaust gasses and when the increase in engine speed. In the cause of Carbon Monoxide (CO) and Hydrocarbons (HC) it found that it increase when the increase in engine speed. But when the increase in oil fuel mixing ratios, it found that there is an increase in the quantity of each of Nitrogen Oxides (NOx), Carbon Dioxide (CO2), Hydrocarbons (HC) and Carbon Monoxide (CO) , According to this study we found the optimum oil/fuel mixing ratio is (1:25) (5ooml of fuel per 20ml of oil) depended on law exhaust emission and it equivalent (for every gallon (4000ml) need (20ml) of oil) in the labor market of the users of two- stroke engine.

المستخلص

تم اجراء تجارب معملية في جامعة كرري العسكرية لمحرك احادي الاسطوانة ثنائي الاشواط يستخدم خليط من (البنزين والزيت) كوقود وذلك لتقليل نسبة انبعاثات العادم عن طريق تحديد نسبة الخلط الامثل باستخدام جهاز لتحليل الغازات المنبعثة وجهاز لقياس سرعة دوران المحرك واخذت القراءات في التجارب عند سرعات دوران مختلفة ونسب خلط مختلفة للوقود والزيت . والغازات التي تم تحليلها هي : اكاسيد النيتروجين (NO_x) و اول اكسيد الكربون (CO) و ثاني اكسيد الكربون (CO_2) والهايدروكربونات (HC).عند مدى سرعات (1500-2500 RPM) وجد ان هنالك نقصان في كمية كل من اكاسيد النيتروجين (NO_x) وثاني اكسيد الكربون (CO_2) المنبعثة من غازات العادم وذلك عند الزيادة في السرعة الدورانية . اما في حالة اول اكسيد الكربون (CO) والهايدروكربونات (HC) وجد انها تزيد بزيادة السرعة الدورانية.اما عند الزيادة في نسب خلط الزيت الى البنزين وجد ان هنالك زيادة في كمية كل من اكاسيد النيتروجين (NO_x) وثاني اكسيد الكربون (CO_2) والهايدروكربونات (HC) واول اكسيد الكربون (CO).وبناء على هذه الدراسة تم تحديد نسبة الخلط الامثل اعتمادا على اقل كمية من الغازات المنبعثة ووجد انها (1:25) (500مل من الوقود مع 20مل من الزيت) وهي تعادل في سوق العمل لمستخدمي محركات الدورة الثنائية (ان لكل جالون (4000مل) من البنزين يحتاج الى (160مل من الزيت))

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LIST OF ABBREVIATIONS AND SYMBOLS

NOx	Nitric Oxides
ICE	Internal Combustion Engine
Sox	Sulfur Oxides
RPM	Revaluation Per Minute
PPM	Part Per Million
% VOL	Percentage Volume
CO	Carbon Monoxide
CO2	Carbon Dioxide
HC	Hydrocarbons
IC	Internal Combustion
TDC	Top Dead Center
BDC	Bottom Dead Center
SAE20-40	Society Automotive engineering, (20-40) refer to number of viscosity
H2SO4	Sulfuric Acid
HNO3	Nitric Acid

CHAPTER ONE

INTRODUCTION

1.1 Introduction:

The air pollution carries significant risks for human health and the environment, cars and trucks produce air pollution through their life, including pollution emitted during vehicle operation, refueling, manufacturing, and disposal. Additional emission is associated with the refining and distribution of vehicle fuel, Air pollution from cars and trucks are split into primary and secondary pollution, primary pollution is emitted directly into the atmosphere, secondary results from chemical reactions between pollutants in the atmosphere. [1]

Hydrocarbon fuels leave a natural deposit of carbon residue that clogs carburetor. Fuel injector, leading to reduced efficiency and wasted fuel Pinging, Stalling, loss of horsepower and greatly decreased mileage on cars are very noticeable. Most fuels for internal combustion engine are liquid, fuels do not combust until they are vaporized and mixed with air. Most emission motor vehicle consists of unburned hydrocarbons, carbon monoxide and oxides of nitrogen. Unburned hydrocarbon and oxides of nitrogen react in the atmosphere and create smog. Generally a fuel for internal combustion engine is compound of molecules each molecule consists of a number of atoms made up of number of nucleus and electrons which orbit their nucleus. [2]

Emissions from the large and rapidly growing number of two- and three-wheel vehicles are a major source of air pollution in Sudan. Because they are less expensive than other vehicles, two- and three-wheelers play an important role in the transport market in Sudan. Three-wheel vehicles, which include s taxis such as auto rickshaws and larger vehicles use as public transport commercially. Until this year, nearly all three-wheelers and the majority of the two-wheelers had two-stroke

engines. Apart from emissions considerations, these two-stroke engine vehicles are much noisier than their four-stroke equivalents, an issue that draws much.

1.2 Problem statement:

The two stroke engine are the most inefficient vehicles in complete burning of fuel and thus contribute most to emission of air pollutants in the environment, The major pollutants from two-stroke engines are Carbon Monoxide (CO), Nitrogen Oxides (Nox), Hydrocarbons (HC) and Particulate Matter (PM) and Carbon Dioxide (CO2).Their presence in the environment causes a number of respiratory diseases and other illnesses.

1.3 Objective:

The objective of this research is summarized in:

- Know the effect of oil/fuel mixture ratio and the engine speed in the amount of exhaust components.
- Reduce the exhaust emission by using the optimum mixing ratio.

1.4 Scope:

The scope of this research will cover the investigation of two stroke engine exhaust emissions. The blends ratios will be investigated are (1:15) (1:20) (1:25). The concentration of exhaust gas emissions such as carbon dioxide, oxides of nitrogen and unburned hydrocarbon will be measured by gas analyzer.

CHAPTER TWO

LITERATURE REVIEW

2.1 Background

2.1.1 Internal Combustion Engine:

An internal combustion engine (ICE) is a heat engine where the combustion of a fuel occurs with an oxidizer (usually air) in a combustion chamber that is an integral part of the working fluid flow circuit. In an internal combustion engine, the expansion of the high-temperature and high-pressure gases produced by combustion applies direct force to some component of the engine. The force is applied typically to pistons, turbine blades, rotor or a nozzle. This force moves the component over a distance, transforming chemical energy into useful mechanical energy. [3]

2.1.2 Classification of internal combustion engine:

There are several possible ways to classify internal combustion engines and it can be classify by number of strokes to: [4]

1- Two - stroke engine.

2- Four – stroke engine.

- Two stroke engine: two-stroke (or two-cycle) engine is a type of internal combustion engine which completes a power cycle with two strokes (up and down movements) of the piston during only one crankshaft revolution. This is in contrast to a "four-stroke engine", which requires four strokes of the piston to complete a power cycle during two crankshaft revolutions. In a two-stroke engine, the end of the combustion stroke and the beginning of the compression stroke happen simultaneously,

with the intake and exhaust (or scavenging) functions occurring at the same time.

Two-stroke engines often have a high power-to-weight ratio, power being available in a narrow range of rotational speeds called the "power band". Compared to four-stroke engines, two-stroke engines have a greatly reduced number of moving parts, and so can be more compact and significantly lighter.

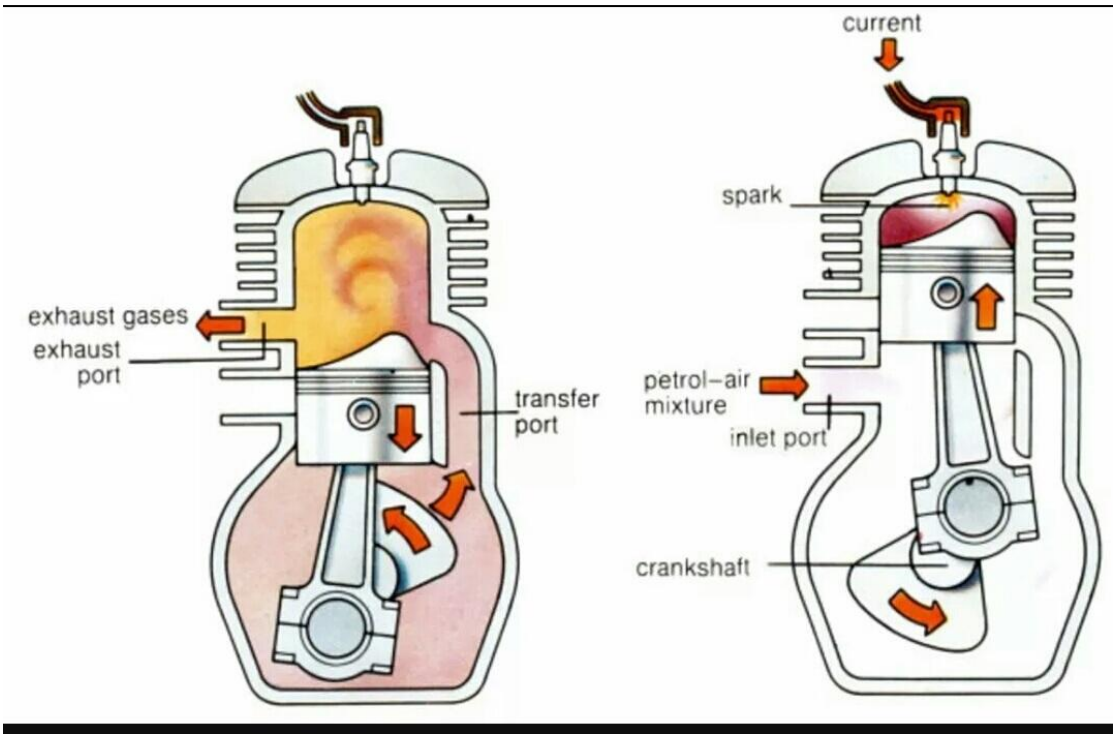


Figure (2.1) show the two stroke engine [5]

- Four – stroke engine: A four-stroke (also four-cycle) engine is an internal combustion (IC) engine in which the piston completes four separate strokes while turning the crankshaft. A stroke refers to the full travel of the piston along the cylinder, in either direction. The four separate strokes are termed:

Intake: also known as induction or suction this stroke of the piston begins at top dead center (T.D.C.) and ends at bottom dead center (B.D.C.). In this stroke the intake valve must be in the open position while the piston pulls an air-fuel mixture into the cylinder by producing vacuum pressure into the cylinder through its downward motion.

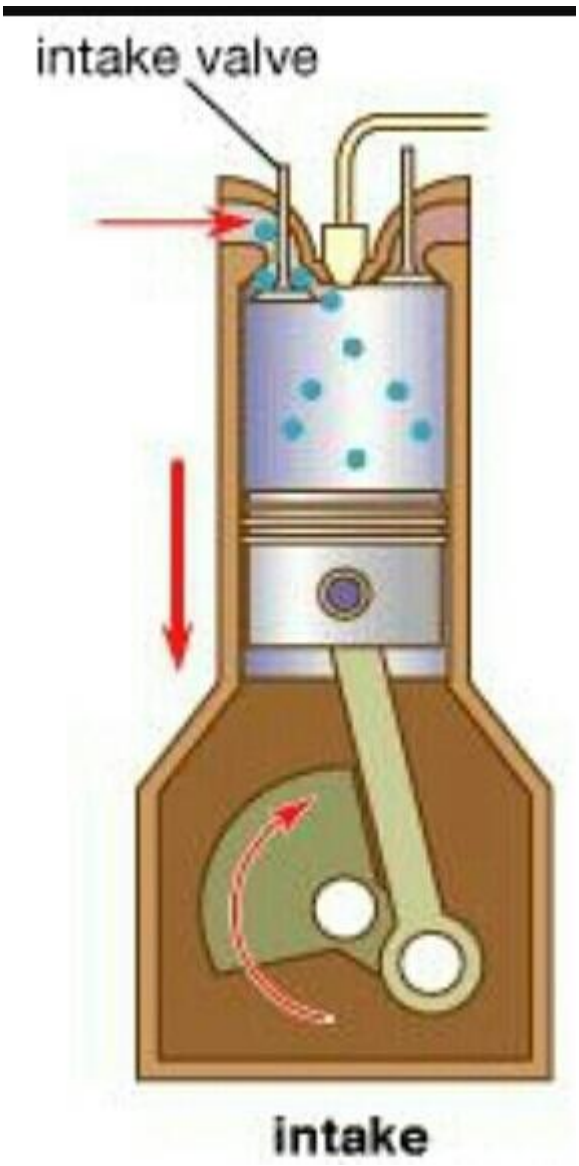


Figure (2.2) Show the intake stroke [5]

Compression: This stroke begins at B.D.C, or just at the end of the suction stroke, and ends at T.D.C. In this stroke the piston compresses the

air-fuel mixture in preparation for ignition during the power stroke (below). Both the intake and exhaust valves are closed during this stage.

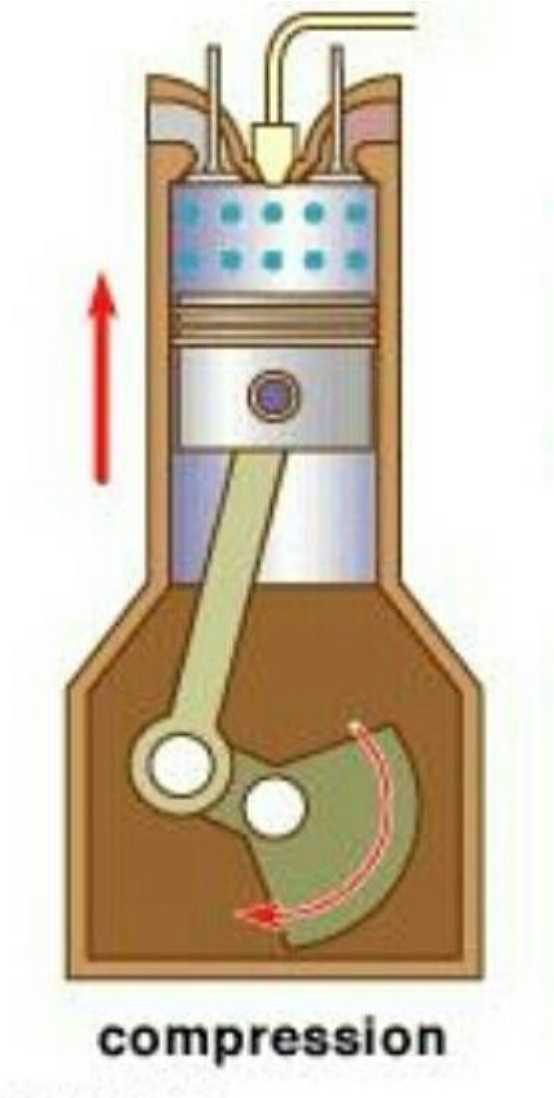


Figure (2.3) Show compression stroke [5]

Combustion: also known as power or ignition this is the start of the second revolution of the four stroke cycle. At this point the crankshaft has completed a full 360 degree revolution. While the piston is at T.D.C. (the end of the compression stroke) the compressed air-fuel mixture is ignited by a spark plug (in a gasoline engine) or by heat generated by high compression (diesel engines), forcefully returning the piston to

B.D.C. This stroke produces mechanical work from the engine to turn the crankshaft.

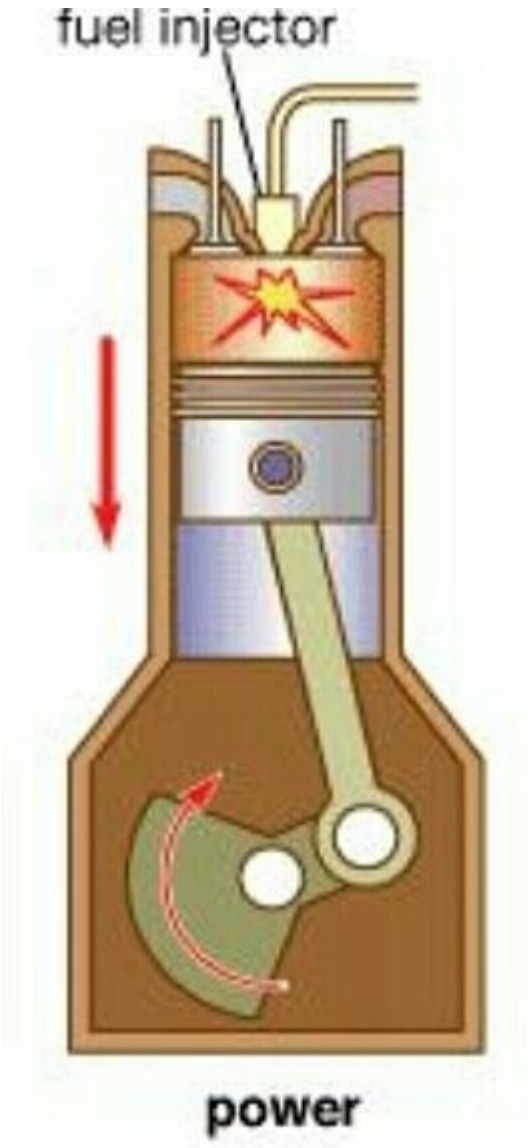


Figure (2.4) Show combustion stroke [5]

Exhaust: also known as outlet. During the exhaust stroke, the piston once again returns from B.D.C. to T.D.C. while the exhaust valve is open. This action expels the spent air-fuel mixture through the exhaust valve.

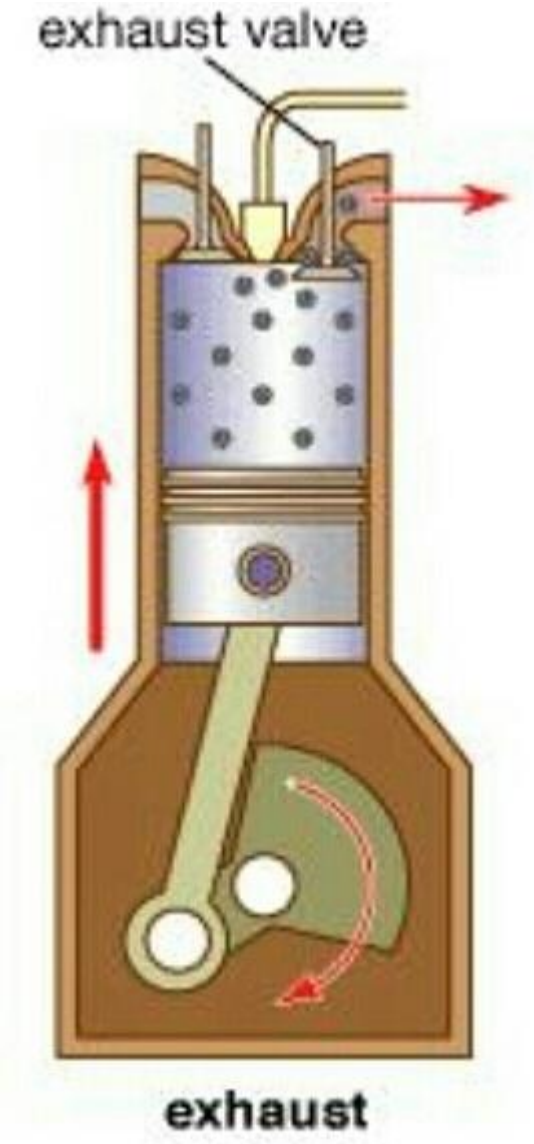


Figure (2.5) Show exhaust stroke [5]

- Comparing between four stroke engine and two stroke engine:

Table (2.1) comparing between two and four stroke engine [6]

Four stroke engine :	**Two stroke engine:**
It has one power stroke for every two revolutions of the crankshaft.	It has one power stroke for each revolution of the crankshaft.
Heavy flywheel is required and engine runs unbalanced because turning moment on the crankshaft is not even due to one power stroke for every two revolutions of the crankshaft.	Lighter flywheel is required and engine runs balanced because turning moment is more even due to one power stroke for each revolution of the crankshaft.
Engine is heavy	Engine is light
Engine design is complicated due to valve mechanism.	Engine design is simple due to absence of valve mechanism.
More cost.	Less cost than 4 strokes.
Less mechanical efficiency due to more friction on many parts.	More mechanical efficiency due to less friction on a few parts.
More output due to full fresh charge intake and full burnt gases exhaust.	Less output due to mixing of fresh charge with the hot burnt gases.
Engine runs cooler.	Engine runs hotter.
Engine is water cooled.	Engine is air cooled.
Less fuel consumption and complete burning of fuel.	More fuel consumption and fresh charge is mixed with exhaust gases.
Engine requires more space.	Engine requires less space.
Complicated lubricating system.	Simple lubricating system.

Less noise is created by engine.	More noise is created by engine.
Engine consists of inlet and exhaust valve.	Engine consists of inlet and exhaust ports.
More thermal efficiency.	Less thermal efficiency.
It consumes less lubricating oil.	It consumes more lubricating oil.
Less wear and tear of moving parts.	More wear and tear of moving parts.
Used in cars, buses, trucks etc.	Used in mopeds, scooters, motorcycles etc.

2.2 Fuel:

Is any material that can be made to react with other substances so that it releases chemical or nuclear energy as heat or to be used for work, The concept was originally applied solely to those materials capable of releasing chemical energy but has since also been applied to other sources of heat energy such as nuclear energy (via nuclear fission and nuclear fusion). [7]

The heat energy released by reactions of fuels is converted into mechanical energy via a heat engine. Other times the heat itself is valued for warmth, cooking, or industrial processes, as well as the illumination that comes with combustion. Fuels are also used in the cells of organisms in a process known as cellular respiration, where organic molecules are oxidized to release usable energy. Hydrocarbons and related oxygen-containing molecules are by far the most common source of fuel used by humans, but other substances, including radioactive metals, are also utilized. [7]

Fuels are contrasted with other substances or devices storing potential energy, such as those that directly release electrical energy (such as batteries and capacitors) or mechanical energy (such as flywheels, springs, compressed air, or water in a reservoir).

- Fuel consumption increase reasons:

1- Mechanism state.

2- Periodic maintenance.

4- Not change oil in time.

5- Machine misuse.

6- Overloads

8-Engine management, and running the air conditions for long time when no need to

9-fuel grade and characteristics

2.2.1 Main resources of fuel burning:

The mean resources are:

l- Electrical powers stations

It Produce big amount of polluters, and unburned hydrocarbons, carbon oxide because of incomplete burning

2- Different industrial operations:

Include mineral melt centers, paper and sugar, and glass factories, scoop, yarn and spun cotton centers, plastic factories.

3-Internal combustion engine:

Cars are the main resource for air pollution, two thirds of carbon oxide, and a half of hydrocarbons and nitro oxides which pollute the air come from cars.

2.3 Pollution:

The environmental pollution is an important problem facing human recently, it comes in the top of environmental problem because there is no potentiality to control the air and determine the way of circulation The internal combustion engine which used in means of transportation, shipment, planes, industrial and agriculture machines, water pumps, and electrical generators.... etc; in spite of strict and enforcement rules, its responsible of over than 70% of pollution in industrial countries: this pollution come because of machines cheapness, and continuously maintenance absences. [1]

Scientists divide the pollution to many kinds:

- Pollution from industrial resources, it happens because of human as nuclear energy stations, atomic piles.

- Air pollution from fuel burning, no doubt the fuel burning specially the petroleum and coal create a great amount of different sizes of particles

- Micro particles what create the smoke, like carbon particles, metal dust, solid oxides, sulfate, and nitrate, usually, the big particles accumulate near burning resources because of the gravity, but the smoke stays a lot of time in the air. The accumulated soil make the color of the area black, beside the damages can cause to the plants, and difficulty in breathing for human and animal, also smoke is inhaled and inter to the respiratory system and cause serious diseases.

- Other toxic pneumatic compounds: Nitrogen compounds oxygen compounds, halogens, radioactive materials

.

2.3.1 Air pollution:

Air pollution considers as a big environmental problems on danger side. The talk about air pollution is difficult, because its multi sides environmental problems and the dimensions are undetected.

Air pollution forms:

A huge mass of atmosphere (5 million billion ton) surround the earth which is necessary to live.

Pure air consists of many gasses:

Nitrogen, oxygen, Argon, Carbon dioxide, Helium, Hydrogen, Methane, and 1-3% Steam. Air pollution happens from human entrance when he changes the ration of air components by garbage, smoke from factories. The environment law defined the air pollution as: any change in specifications or characteristics on natural air, put the environment or human health endanger, Even if this pollution came from natural factors or any human activity including noises.

2.3.1.1 Air pollution from burning inside the engine:

The resultant of complete burning are carbon dioxide and water, and it don't have color or smell but burning often produce many other materials l called polluters. These polluters could be carbon oxide sulfur oxides, nitrogen oxides, volatile ash, hydrocarbons, and acids. In internal engines, burning happens and it's hard to get complete burning, so we found the resultants contain pollutes. To understand why the reaction isn't complete we need to know the circumstances of steady of the reactions which depend on mixing ratio.

Mixing ratio =percentage of air to fuel (air mass / gas mass) [8]

The burning inside the engine is controlled by air and fuel ratio, and the perfect burning ratio is (1-15) this is the full burning the inside the

engine, but it is not steady, so subsequently happens incomplete burning operation

Full chemical formulation for fuel burning:

Standard form for internal burning formulation:

Simple formulation:

C_nH_m+ (n +m/4) (O_2) → nCO_2 + (m/2) H_2O [3]

Full standard formulation:

C_nH_m + (n+m/4)(O_2+3.79N_2) → nCO_2 + (m/2)H_2O + 3.79N_2 [3]

2.3.1.2 Air pollution control:

The natural processes to filter the air still long centuries enough to control air pollution, the rain and snow remove polluters from the air also big part of solid polluters falls down to the earth to be absorb, but with increasing in polluters' r natural processes are no longer enough to filter the air, and harm polluters should be controlled. There are many ways to control the air pollution. [9]

1- Separate and accumulate the polluters:

This way separate and accumulate the polluters before it go to climate and the best ways to get rid of polluters in change the production way and move to tight ways, but the difficulty of this technology lead to use different ways to separate the particles by using different devices like filters, electrostatic precipitators, and other mechanical ways like towers and special burning tools, to fit with polluters nature that need to controlled. Solid be particulates can be separated before it go to the air using filter the gas by allowing it to pass through and prevent the solid particulates, also there are more complicated ways such as: the air with solid particulates touch microscopically chips with hot and cold laminas which put side by side, the microscopically chip installed in the cold lamina: when the air pass through laminas, the heat came from the hot lamina push the polluted air to the cold one then the polluted materials

stick on the microscopically chip. The Unite States of America applied this way and decreased the polluted solid particulates by 87%.

But the polluted gasses can't be collected by this mechanical way a solid particulates because they're not heavier than the air, but it can dissolve in liquids; when the air pass through the particular liquids, particular gasses dissolve in these liquids. It's known that there are liquids remove sulfur dioxide, other remove hydrogen sulfide, and so on.

2- Convert the polluters into nontoxic compounds:

The most important way is by oxidize it. The oxidation used to get rid of some gasses, and rarely used to get rid of solid particulates, when the

Materials contain carbon, hydrogen and oxygen it can be oxidized mechanically. But that will cost a lot; because it will need an extra energy to complete the oxidation: for example, convert the polluted gas exhauster into nontoxic gasses, to complete the conversion process there are two basic ways:

A - Inject the air in the exhaust valve in high heat to oxidize the non oxidized or partial oxidized materials.

B - Design the cylinders and adjust the air, fuel ratio, timing the sparks. And any other variables to reduce hydrocarbon and carbon monoxide in exhauster, and this are the common way these days.

3- Prevention Procedures To Preserve The Air

To avoid pollution dangers, must work in early phase by scientific planning because we don't need the industrial development and modern technology to make deficiency in the environmental health requirements, and the most helpful procedures to reduce the pollution are:

a) Scientific planning must be used when we need to create any industry work, considering the weather and geotectonic, prevent constructing industrial, or chemical buildings near population cities; specially

cement industries and electrical power stations because of cities expansion in the future, and environment ability to accommodate the industrial dumps.

b) The burning machines in laboratories and electrical power station should always be observe to reduce the polluters, also monitoring cars and transportation and check their engine periodically.

c) Exchange the old warming means by others with high electrical quality, or high technology.

d) Put laws, rules, and measurements specialized in maximum concentration for air polluters. Especially in civilian and industrial areas; also build an observation stations to monitor the pollution.

e) Solicitude to plant trees and greeneries, because it play an important rule on air purity by reducing the polluters' effect, and improve the environment circumstances around human and animal

2.4 Gasses generated from burning inside the engine:

1- Carbon mono oxide (CO):

Generated from incomplete burning inside the car engines, whereas over than 75% come from cars and it is colorless and odorless has serious damages for human most toxic air polluters, because it unite with and it's the hemoglobin in blood instead of oxygen, by that prevent the body tissue from the oxygen which leads to physiology changes in the body of human and animal can lead to death. What can make that gas more danger is it's uniting with hemoglobin by 200 300 times speed up than oxygen with hemoglobin union. It causes death if its concentration increased than 700 parts in million especially in closed areas. [4]

2- Sulfur oxides include: sulfur dioxide (so2) sulfur trioxide dioxide:

The emission amount depends on sulfur ration in used fuel. Sulfur effects is dangerous air polluter, its inflammable and its colorless gas on the taste sense if its ratio reached 0.3 part in million. We can feel the

autarchic smelling if the concentration reached 3 parts in million and it can oxidizes in the air and produces sulfur trioxide (SO2) which react with the steam in the air and create sulfuric acid (H2SO4). Also sulfur dioxide and the acids generated the because of it and effect on it because it scratch mucosa causing dry cough, tracheotomy inflammation and chest pain. Dispend; also cause vocal lead to sudden spasm and cords spasm which strangulation. [4]

3-Hydrocarbons HC:

Hydrocarbons come from cars engines, petroleum refineries, and solid garbage burners It's materials contain carbon and hydrogen and it have the ability of hydrocarbon different effects on the and the increase, depend a danger will compound. Whenever it was effective and active the danger will increase, olefins group so active while benzene compound interact weakly. Also ole fins group so it benzene interact annular active while they are multi kernel there are other kinds of hydrocarbons: compounds which can cause cancer.[4]

4-Particals:

, It's the particulates emits from two stroke engine exhauster because of fuel added there are many particles which have bad healthy trails like lead which the two benzene to help in burning operation, when these material become on air will cause some healthy issues like corpuscle decrease in the body. The lead accumulation in the body leads to confuse the nervous system.[4]

5- Carbon dioxide (CO2):

Increasing it leads to difficulty in breathing and feeling congested with irritation of the mucous membranes, bronchitis and irritation of the throat. Carbon dioxide is composed of combustible organic materials such as paper, wood, coal and oil. The carbon dioxide produced from fuel is one

of the most important contaminants that humans have put into the air. The process of environmental equilibrium that dissolve excess carbon dioxide in the sea and ocean water is a week acid component known as carbonic acid and reacts with some sediments consisting of bicarbonate and calcium carbonate . Plants also contribute a large part of process to photosynthesis. Excessive use of fuel, cutting down forests or reducing green spaces have contributed to the rise in the amount of carbon dioxide in the atmosphere that could lead to global warming, known as global warming.[4]

6- Nitrogen oxide:

Is the nitrogen oxide present in the exhaust gasses of the engines and is considered the first nitrogen oxide (NO) less toxic than the nitrogen dioxide (NO2) , but it is not in the air freely because it reacts with oxegen to form (NO2) , but the nitrogen dioxide is poisonous gas , especially if it exceeds (1 - 10) ppm , while its percentage in the ambient air is usually less than 1 ppm . In high temperature conditions, NO2 is rapidly combined with water to form the poison known as (HNO3).

NO&NO2 at high temperature (1800c – 2800c) with free oxygen concentration increasing in gas engine gasses (99%) while in diesel (90%), NO is converted to NO2 as soon as it exits into the outer environment. [4]

Polluters which emit from the engines depend on many factors:

1- Shape and size of engine.

2- Used fuel combination.

3- The way of running the engine (quickness, slowness, continuous travelling situation)

4- Different environmental geotectonic.

2.5 Ways of gas Pollution treatment in exhauster:

There is main ways to reduce the emission of polluters from internal combustion engine:

Improve the burning operation.-

Reestablish burning the steams which come from the exhauster.-

- Develop the operation system by develop the operation of internal burning for the engine or it can be develop the mixing ratio by between air, and fuel and the time of ignition.

- Develop the design of shape and size of the engine.

- Treat the exhauster gas by using ways to reduce polluters it to unharmed material .

2.6 Previous studies:

In the last decades the scientists worked on improving the internal combustion processes and the factors which effect on it, such as mixing ratio and the amount of fuel consumption and exhausted emission.

1- Magnetic field enact on fuel consumption and combustion emission in engine

Students at university of science and technology in lraq made a research on benzene machine, they used permanent magnet with different intensity they tied it on fuel line and they studied the fuel consumption and combustion emission in engine.

RESULT:

The results showed saving in consumption (9- 14%). decrease in emission (40%), and change in chemical and physical combination of fuel by infrared and ultraviolet rays.[10]

2- The effect of magnetic flux on the ionization and fuel burning

Experimental study has been done by Deshmukh, Shaweta in 2012 investigating the economical using of fuel and get a clean environment the used material was, engine with one cylinder, gases analyzer, cable, and 12 volt battery; the cable wrapped around the fuel tube and connected with battery to produce the magnetite field. The engine let working for an hour without magnetic field and for an hour with it: the emission measured in both cases.

RESULT:

The emissions decrease (60%) for hydrocarbons, (35%) for carbon monoxide. The study recommended by making tubes from magnetic materials, The ionization process reduce the maintenance and increasing the engine life time (10-30%).[11]

3- Device for reducing the consumption and decreasing the emissions in taxis in Lisbon city:

Researchers from high institute in Lisbon made an experiment to reducing the consumption and decreasing the emissions by installing a device on taxis, which became consuming 1 liter to cross 100 Km Portuguese Company "Ultimate power", produced it and called it "Ultimate Cell" ,The technique of this device produces the hydrogen by electrical analyzing and separation between hydrogen and oxygen molecules which are existed in the water then feeds the hydrogen to car

engine by tubes the hydrogen arrives to the burning room with the fuel and air mixture and improves the burning then decrease the emission and fuel consumption.

RESULT:

Reduced the fuel by (30%) and decreased the emission by (65%).

The device has been installed on fishing boats, noticed a clearly decreasing on fuel consumption (l40 liter/ hour).

4- **Comprehensive experimental study on the effect of electromagnetic field ion ionization and combustion of fuel in an internal combustion engine**

Okoronkwo, in 2010 achieved an economical using and environment friendly in internal combustion engine

RESULT:

The introduction of an electromagnetic field within the fuel line of an I,C engine enhances the combustion process by economizing fuel consumption and reduce gas emission.

CHAPTER THREE

METHODOLOGY

3.1 Experiments:

These experiments were done in Karari University lab in two stroke engine to measure the ratio of gases which emit from the mixture between the fuel (Benzene) and oil with different.

3.2 Experimental steps:

1- Select good location for ventilation.

2- Preparation the mixtures in packaging with different percentages (3 blends):

- Mix at 1:25 (500ml of fuel per 20ml of oil).
- Mix at 1:20 (500ml of fuel per 25ml of oil).
- Mix at 1:15 (500ml of fuel per 33.3ml of oil).

3- Use Two stroke engine.

4- Switch on the engine after feed it with one of the mixtures.

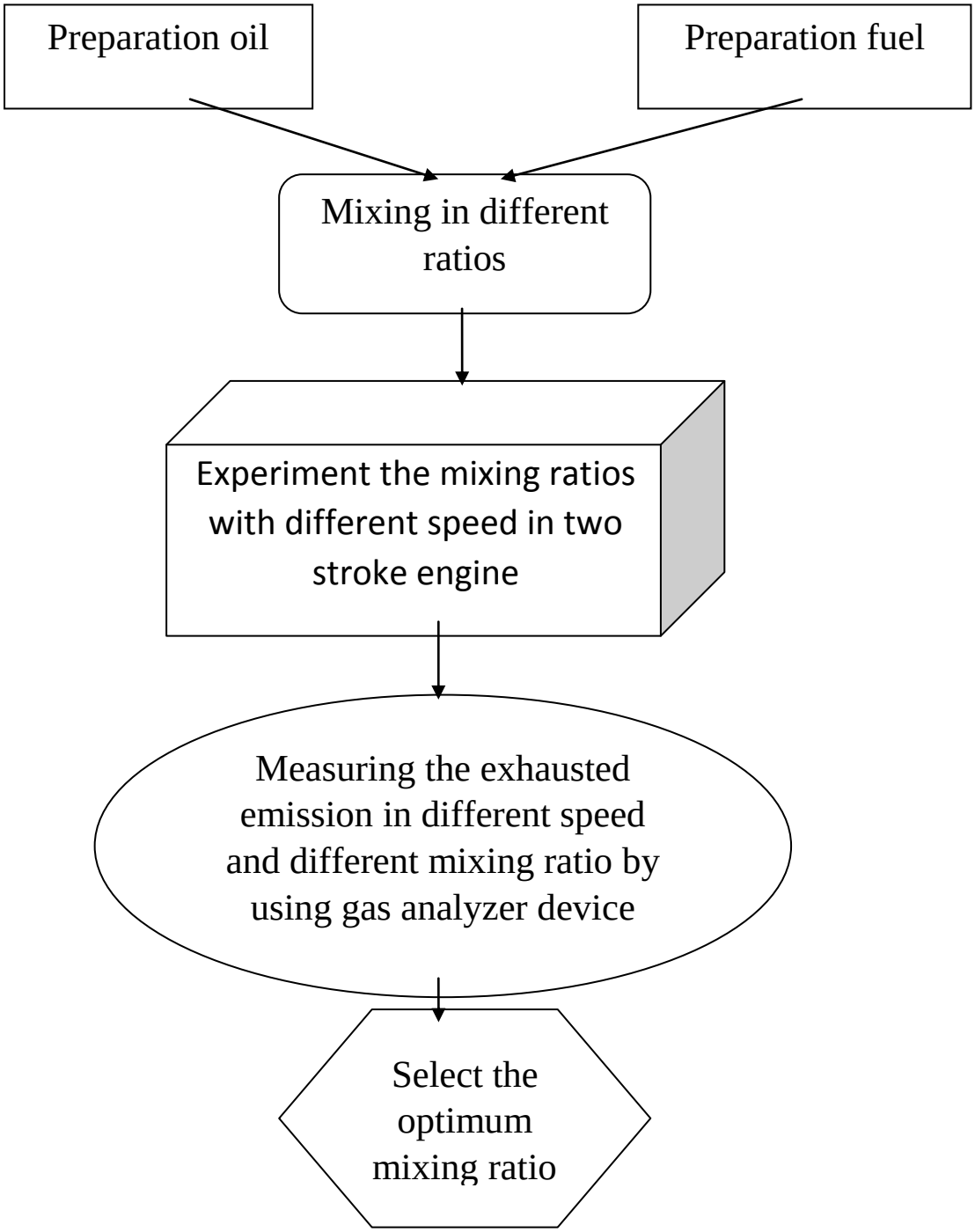
5- Take the result of the exhaust gasses using gas analyzer to determine the amount of gasses emitted.

6- After take results of the first experiment, disposed of the mixture in (carparator) and feed the engine with new mixture and let it for a few minute to dispose the residual of the first experiment.

7- Take the results in five speeds (r.p.m) for one mixture because the engine speed effect on the emission of the exhaust gasses.

8- Repeat these same steps to all experiments.

Flow chart:



Flow chart 3.1(steps of select the optimum ratio)

3.3 Equipment Required:

1- Measuring cylinder, 50ml vastness.

2- Decanter, 1000 ml.

3- Burette 50 ml vastness.

3.4 Devices Required:

3.4.1 Base engine frame:

Base frame is made up of medium carbon steel channel and powder coated for durability. The engines are mounted on separate frame provided with caster wheels to allow shifting of engines, while the generator is mounted on stationary frame provided with anti-engine power to dynamometer, the engine can be coupled to the shaft of the magnetic coupling by mean of removable Teflon coupling. The engine to be tested is brought near the dynamometer frame and bolted on the frame using high tension bolts

3.4.2 DC-generator:

A DC generator (capacity 8 k w) which can be also used as Motor acts as dynamometer to measure power of the engine, it can be run as motor to conduct motoring test and start the engines.

3.4.3 Dynamiter with the following accessories and instruments:

Figure (3.2) shows water dynameters

3.4.3.1 Inductive RPM Sensor: The engine speed is measured by means of an inductive RPM sensor. The sensor sends a pulse when a metallic part passes in front of it. These pulses are sent to indicator, which in turns display the engine speed.

3.4.3.2 RPM Indicator*:* The RPM indicator display engine speed in RPM measured by inductive sensor

3.4.3.3 Mode selector switch: Mode selector switch is used to select mode of operation in motor mode or Generator mode.

3.4.4 Tow Stroke Petrol Engine (145ec):

Single cylinder two stroke petrol engines mounted on separate moving frame is provided with test bed. It has variable speed.

Table (3.1) Show engine technical specification

Maximum Power , kw @ rpm	4.63 k w
Maximum Torque , NM@ rpm	9 N – m
Displacement	145cc
Bore	57mm
Stroke	57mm
Make	Bajaj auto
Number of cylinder	One

Figure (3.3) shows the two stroke engine used in the experiment

3.4.5 gas analyzer:

It is device use to measure chemical contains of exhaust gasses.

Figure (3.4) shows gas analyzer

1- *Component of the device:*

i. Knurl with sensor put in the end edge of the exhaust.
ii. Connecting tube to transmit to the gasses from the sensor to device pump.
iii. Pump to pull gasses through connecting tube.
iv. Electrical adapter.

2- *How the device work:*

We connect the device with electrical current, and connect the sensor in the exhaust and we take the readings after one minute from put the sensor in the exhaust, pull the knurl of sensor from exhaust, and update the device for 75sec to sincerely pervious experiment gasses and preparation to next experiment. Repeat these same steps to all experiment.

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CHAPTER FOUR

RESULT AND ANALYSIES

Based on the methodology used to analyze exhaust gases and using five speeds and three mixtures for study, we found the following:

4.1 Nitric Oxides (NOx):

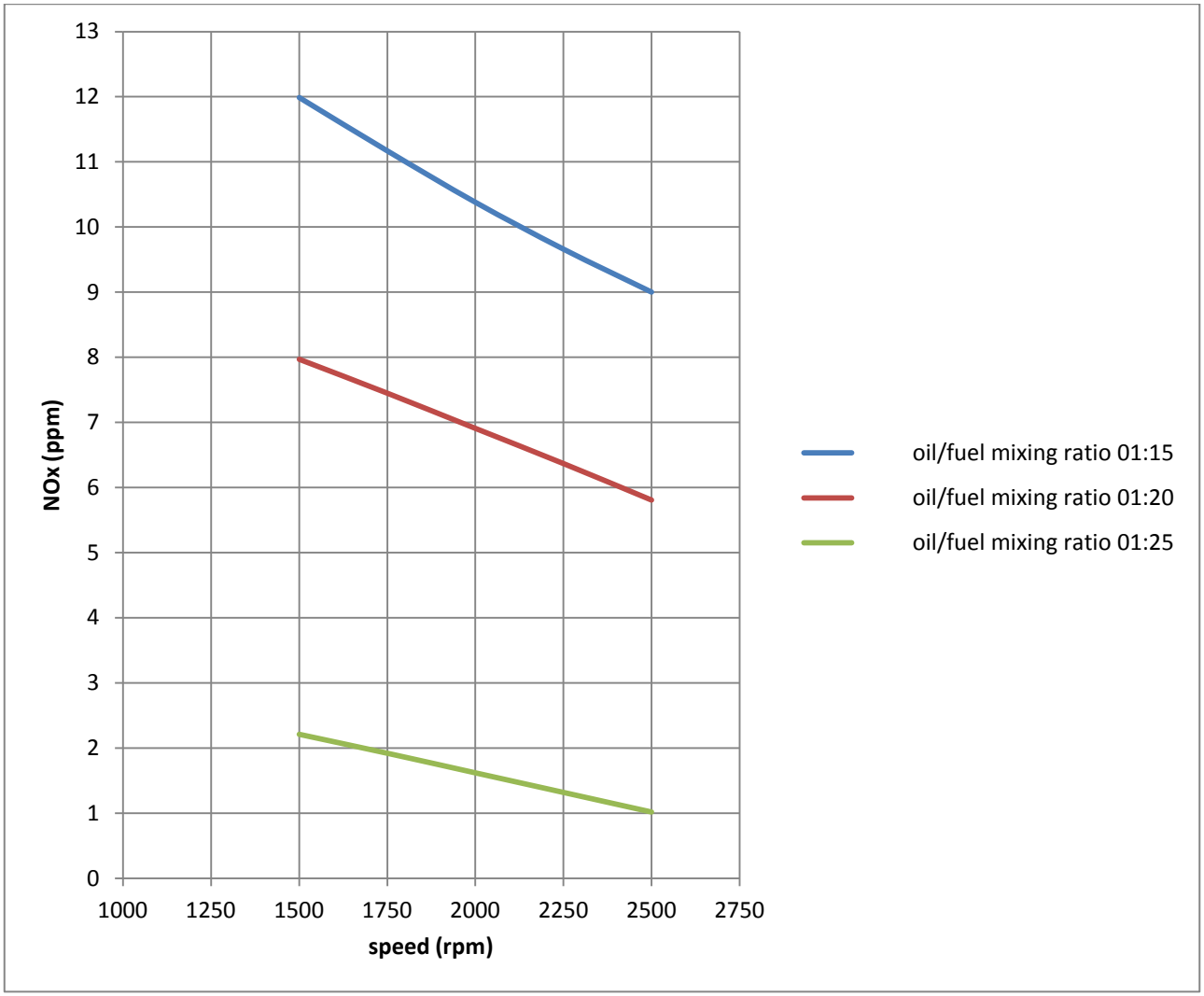

Figure (4.1): shows variation between NOx (ppm) and speed (rpm)

From nitric oxides (NOx) curve shown in figure 4.1 it is noted that the amount of (NO) decrease while increasing in engine speed and decreasing in oil/fuel mixture in range of (1500 – 2500) rpm of engine speed because the engine use premixed flame that reduced peak flame temperature

which decrease NOx formation in emissions. At the (2000 rpm) of engine speed it could found that :

- The Nitric Oxides (NOx) is (10.38 ppm) if oil/fuel mixture is (1:15).
- The Nitric Oxides (NOx) is (6.91 ppm) if oil/fuel mixture is (1:20).
- The Nitric Oxides (NOx) is (1.62 ppm) if oil/fuel mixture is (1:25).

Also when the oil/fuel mixture ratio (1:20) we found that:

- The Nitric Oxides (NOx) is (7.97 ppm) when the engine revolution speed is (1500 rpm).
- The Nitric Oxides (NOx) is (6.91 ppm) when the engine revolution speed is (2000 rpm).
- The Nitric Oxides (NOx) is (5.81 ppm) when the engine revolution speed is (2500 rpm).

According to the data collected by using experimental setup it noticed that the maximum NOx emission is (11.99 ppm) at (1500 rpm) of engine speed and (1:15) of oil/fuel mixing ratio, and the minimum NOx emission is (1.02 ppm) at (2500 rpm) of engine speed and (1:25) of oil/fuel mixing ratio.

At (1:25) oil/fuel mixing ratio the amount of NOx emission lower than the other oil/fuel ratio in all engine speeds, but at (1:15) oil/fuel ratio the amount of NOx emissions higher than the other oil/fuel mixing ratio for all engine speeds. Therefore the amount of NOx emissions decreases by decreasing in oil/fuel mixing ratio.

However at (2500 rpm) engine speed the amount of NOx emissions lower than the other engine speed for all oil/fuel mixing ratio,

but at (1500 rpm) engine speed the amount of NOx emissions higher than the other engine speed for oil/fuel mixing ratio. Therefore the NOx emissions decrease by the increasing in engine speed.

4.2 Carbon Monoxide (CO):

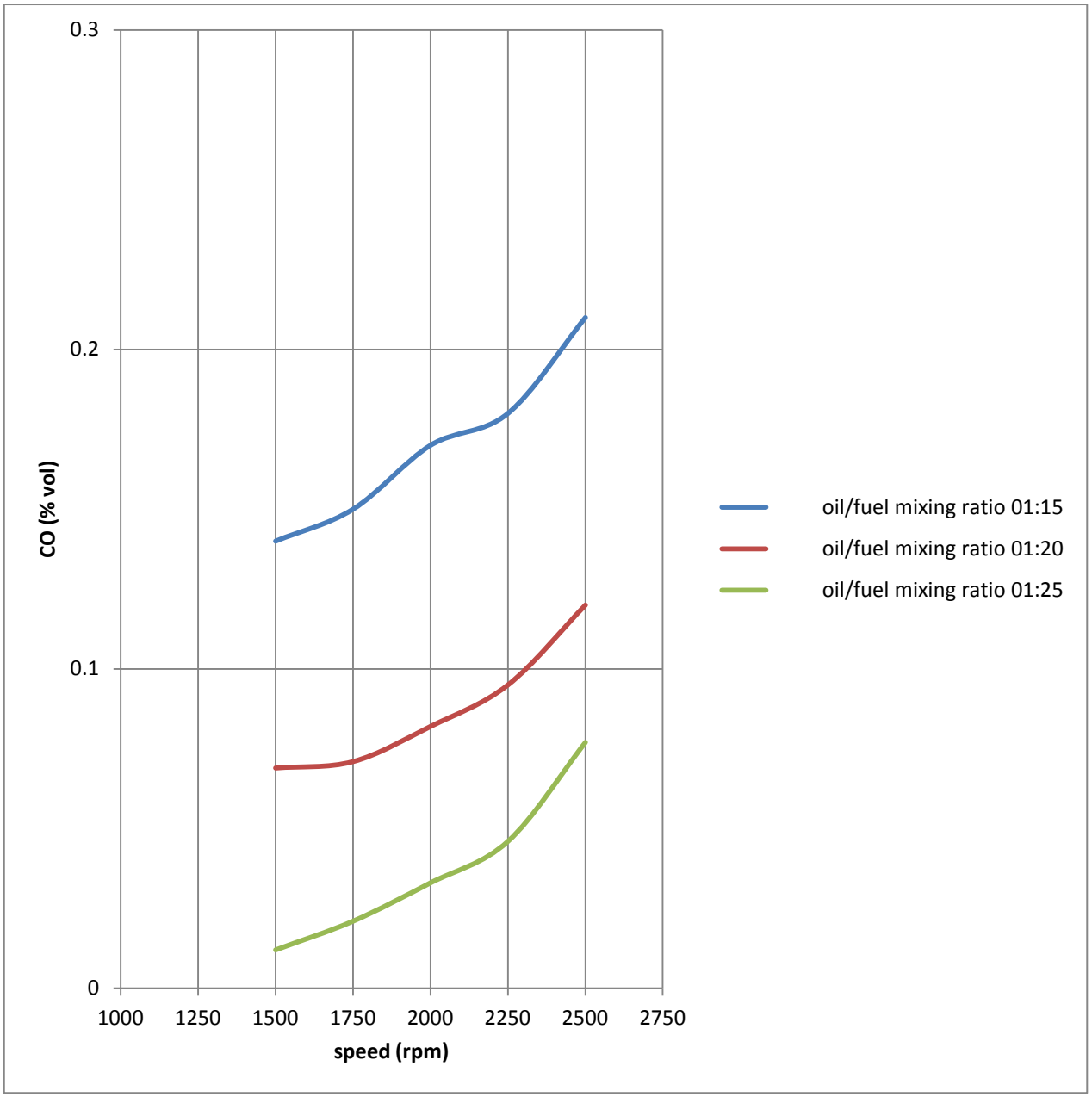

Figure (4.2): shows variation between CO (% vol) and speed (rpm).

From Carbon Monoxide (CO) curve shown in figure 4.2 it is noted that the amount of (CO) increases while increasing in engine speed and increasing in oil/fuel mixture in range of (1500 – 2500 rpm) of engine speed. At the (2000 rpm) of engine speed it could found that:

- The Carbon Monoxide (CO) is (0.17 %vol) when oil/fuel mixture is (1:15)
- The Carbon Monoxide (CO) is (0.082 %vol) when oil/fuel mixture is (1:20)
- The Carbon Monoxide (CO) is (0.033 %vol) when oil/fuel mixture is (1:25)

Also when the oil/fuel mixture ratio (1:20) we found that:

- The Carbon Monoxide (CO) is (0.069 %vol) when the engine revolution speed is (1500 rpm).
- The Carbon Monoxide (CO) is (0.082 %vol) when the engine revolution speed is (2000 rpm).
- The Carbon Monoxide (CO) is (0.120 %vol) when the engine revolution speed is (2500 rpm).

According to the data collected by using experimental setup it noticed that the maximum (CO) emission is (0.077 %vol) at (2500 rpm) of engine speed and (1:25) of oil/fuel mixing ratio, and the minimum (CO) emission is (0.012 %vol) at (1500 rpm) of engine speed and (1:25) of oil/fuel mixing ratio.

At (1:25) oil/fuel mixing ratio the amount of (CO) emission lower than the other oil/fuel ratio in all engine speeds, but at (1:15) oil/fuel ratio the amount of (CO) emissions higher than the other oil/fuel mixing ratio for all engine speeds. Therefore the amount of (CO) emissions decreases by the decreasing in oil/fuel mixing ratio.

However at (1500 rpm) engine speed the amount of (CO) emissions lower than the other engine speed for all oil/fuel mixing ratio,

but at (2500 rpm) engine speed the amount of (CO) emissions higher than the other engine speed for oil/fuel mixing ratio. Therefore the (CO) emissions decrease by the decreasing in engine speed.

Poisonous gases are result from incomplete partial combustion. Excessive Carbon Monoxide (CO) exhaust emissions are usually created by rich air-fuel mixture.

4.3 Carbon Dioxide (CO2):

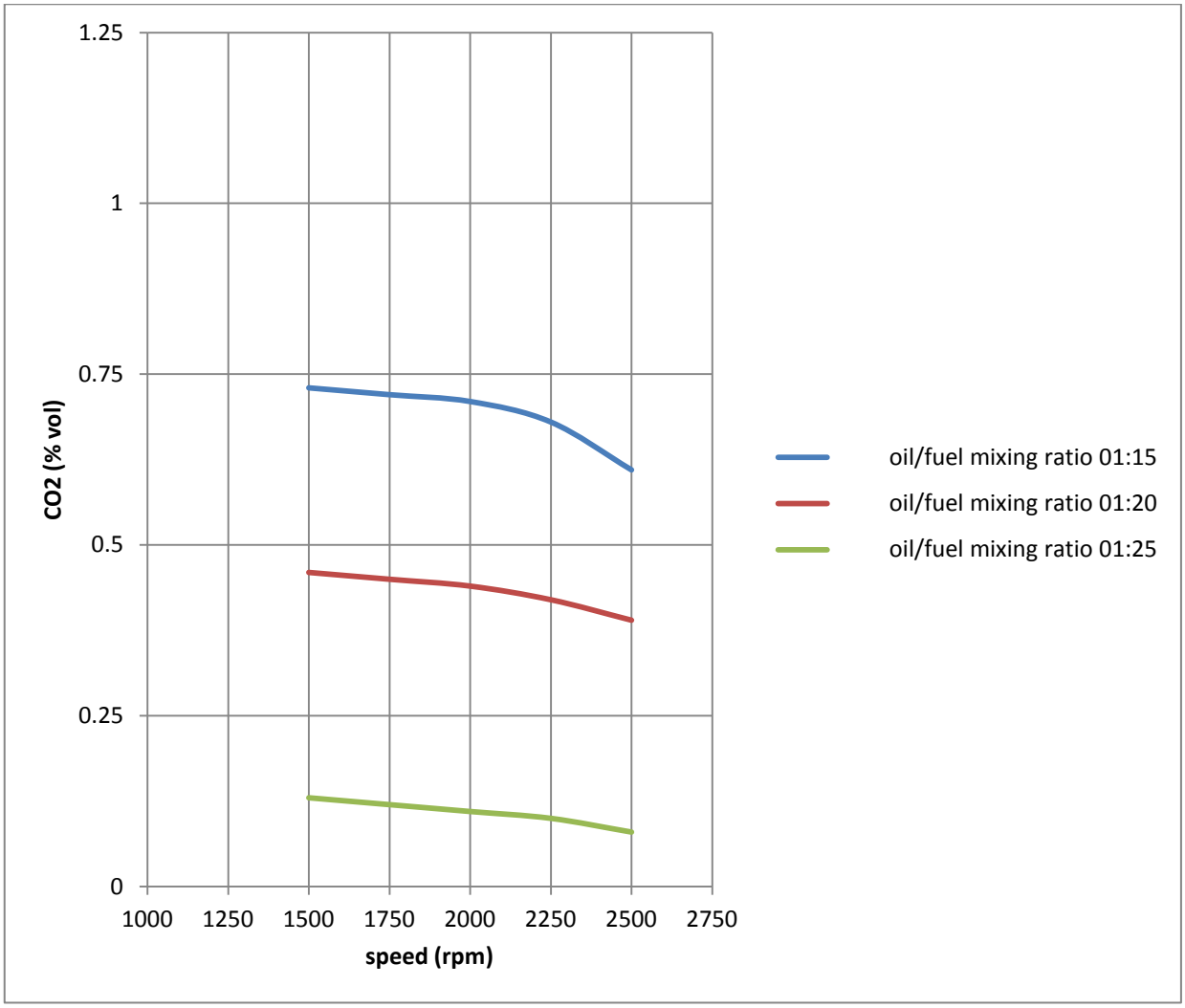

Figure (4.3): shows variation between CO2 (% vol) and speed (rpm).

Carbon Dioxide (CO2) is a desirable by product that is produced when the carbon from the fuel is fully oxidized during the combustion process. As a general rule, the higher the Carbon Dioxide reading, the more efficient the engine is operating. Therefore, air/fuel imbalances, misfires, or engine mechanical problems will cause (CO2) to decrease.

From Carbon Dioxide (CO2) curve shown in figure 4.3 it is noted that the amount of (CO2) decreases while increasing in engine speed and decreasing in oil/fuel mixture in range of (1500 – 2500 rpm) of engine speed. At the (2000 rpm) of engine speed it could found that:

- The Carbon Dioxide (CO2) is (0.71 %vol) when oil/fuel mixture is (1:15).
- The Carbon Dioxide (CO2) is (0.46 %vol) when oil/fuel mixture is (1:20).
- The Carbon Dioxide (CO2) is (0.13 %vol) when oil/fuel mixture is (1:25).

Also when the oil/fuel mixture ratio (1:20) we found that:

- The Carbon Dioxide (CO2) is (0.45 %vol) when the engine revolution speed is (1500 rpm).
- The Carbon Dioxide (CO2) is (0.44 %vol) when the engine revolution speed is (2000 rpm).
- The Carbon Dioxide (CO2) is (0.41 %vol) when the engine revolution speed is (2500 rpm).

According to the data collected by using experimental setup it noticed that the maximum (CO2) emission is (0.72 %vol) at (1500 rpm) of engine speed and (1:15) of oil/fuel mixing ratio, and the minimum (CO2)

emission is (0.08 %vol) at (2500 rpm) of engine speed and (1:25) of oil/fuel mixing ratio.

At (1:25) oil/fuel mixing ratio the amount of (CO2) emission lower than the other oil/fuel ratio in all engine speeds, but at (1:15) oil/fuel ratio the amount of (CO2) emissions higher than the other oil/fuel mixing ratio for all engine speeds. Therefore the amount of (CO2) emissions decreases by the decreasing in oil/fuel mixing ratio.

However at (2500 rpm) engine speed the amount of (CO2) emissions lower than the other engine speed for all oil/fuel mixing ratio, but at (1500 rpm) engine speed the amount of (CO2) emissions higher than the other engine speed for oil/fuel mixing ratio. Therefore the (CO2) emissions decrease by the increasing in engine speed.

4.4 Hydrocarbons (HC):

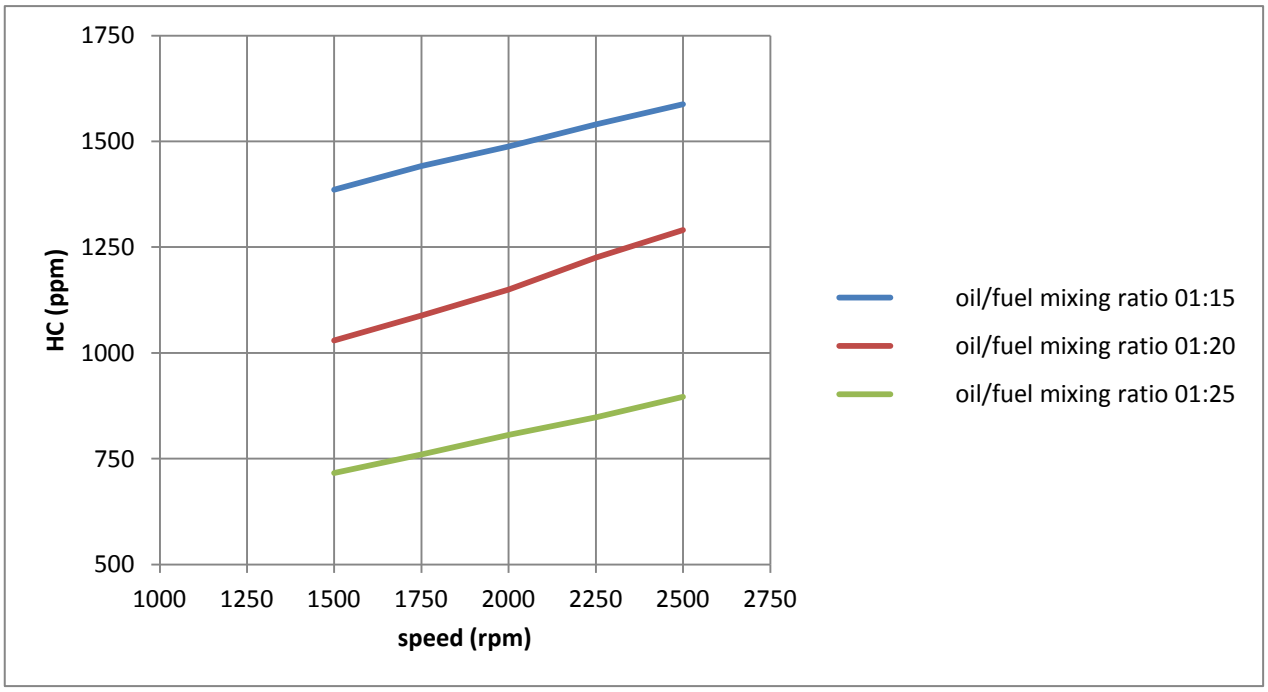

Figure (4.4): shows variation between HC (ppm) and speed (rpm).

Hydrocarbons are measured by an exhaust analyzer in parts per million (ppm). As you know, (HC) is unburned fuel that remains as a result of misfire. When combustion doesn't take place or when only part of the air/fuel charge burns, (HC) levels goes up.

From Hydrocarbons (HC) curve shown in figure 4.4 it is noted that the amount of (HC) increases while increasing in engine speed and increasing in oil/fuel mixture in range of (1500 – 2500 rpm) of engine speed. At the (2000 rpm) of engine speed it could found that:

The Hydrocarbons (HC) is (1488 ppm) when oil/fuel mixture is (1:15).

The Hydrocarbons (HC) is (1150 ppm) when oil/fuel mixture is (1:20).

The Hydrocarbons (HC) is (806 ppm) when oil/fuel mixture is (1:25).

Also when the oil/fuel mixture ratio (1:20) we found that:

The Hydrocarbons (HC) is (1059 ppm) when the engine revolution speed is (1500 rpm).

The Hydrocarbons (HC) is (1150 ppm) when the engine revolution speed is (2000 rpm).

The Hydrocarbons (HC) is (1290 ppm) when the engine revolution speed is (2500 rpm).

According to the data collected by using experimental setup it noticed that the maximum (HC) emission is (1588 ppm) at (2500 rpm) of engine speed and (1:15) of oil/fuel mixing ratio, and the minimum (HC) emission is (716 ppm) at (1500 rpm) of engine speed and (1:25) of oil/fuel mixing ratio.

At (1:25) oil/fuel mixing ratio the amount of (HC) emission lower than the other oil/fuel ratio in all engine speeds, but at (1:15) oil/fuel ratio the

amount of (HC) emissions higher than the other oil/fuel mixing ratio for all engine speeds. Therefore the amount of (HC) emissions decreases by the decreasing in oil/fuel mixing ratio.

However at (1500 rpm) engine speed the amount of (HC) emissions lower than the other engine speed for all oil/fuel mixing ratio, but at (2500 rpm) engine speed the amount of (HC) emissions higher than the other engine speed for oil/fuel mixing ratio. Therefore the (HC) emissions decrease by the decreasing in engine speed.

CHAPTER FIVE

CONCLUSION & RECOMMENDATIONS

5.1 Conclusion:

From the study we found the relation of oil/fuel mixture ratio and engine speed are effected clearly in the exhaust gas components.

In Nitric Oxides (NOx) are decreases while increasing in engine speed in the range of (1500-2500 rpm). And when the increasing in oil/fuel mixing ratio, it found that the there is a increasing in the quantity of each of Nitrogen Oxides (NOx).

Carbon Monoxide (CO) is increases while increasing in engine speed in the range of (1500-2500 rpm). And when the increase in oil/fuel mixing ratio, it found that there is increase in quantity of each Carbon Monoxide (CO).

Carbon Dioxide (CO2) is decrease while increasing in engine speed in the range of (1500-2500 rpm). And when the increasing in oil/fuel mixing ratio, it found that there is an increase in the quantity of each Carbon Dioxide (CO2).

Hydrocarbons (HC) are increasing while increasing in engine speed in the range (1500-2500 rpm). And when the increasing in oil/fuel mixing ratio, it found that there is an increase in quantity of each of Hydrocarbons (HC).

We found that the optimum mixing ratio is (1:25) that mean (500ml of fuel per 20ml of oil), because it has low amount of emissions coming from it, and it based on the study of the rate of exhaust emissions, and this ratio is very close to the ratio in the labor market by the users of two stroke engine.

5.2 Recommendation:

- It is best to conduct experiments in well-ventilated laboratories and have mechanisms for drawing and renewing the air to prevent accumulation of exhaust gasses in the laboratory.
- A two-stroke engine for laboratory experiments should be used.
- It is prefect to use oils made specifically for two-stroke engine such as fuchs oils (SAE20-40), with features:

1. Protects engine in extreme operating condition.
2. Improve machine performance and provides maximum protection.
3. Reduce noise and combustion waste.
4. Reduce fuel and oil consumption.

- The performance of engine must be taken in to account to determine the optimum mixing ratio.

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