UNIVERSITI TEKNIKAL MALAYSIA MELAKA

THE IMPACT OF DIFFERENT OCTANE NUMBERS ON PERFORMANCE AND EMISSION GASSES ON THE NATURALLY ASPIRATED ENGINE

This report submitted in accordance with requirement of the UniversitiTeknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Engineering Technology (Automotive) (Hons.)

by

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APPROVAL

This report submitted to the Faculty of Engineering Technology of UTEM as a partial fulfilment of the requirement for the degree of Bachelor of Mechanical Engineering Technology (Automotive) with Honours. The member of the supervisory is as follow:

…….

(Project Supervisor)

ABSTRACT

The main goal of this research is to compare performance graph of engine and emission gas produced by the engine using two different type of RON which are RON 95 and RON 97. This research was use chassis dynamometer to get the engine performance result and use Emission Measurement System (EMS) to measure the exhaust gas produced. The result was shown in performance graph in the software that connected to the dynamometer machine. The result including rpm, torque and horsepower produced. Next, the EMS will shows the percentage of gasses produced in exhaust gas which are HC, CO2, CO, O2 but NOx displayed in part per million (ppm). The exhaust gasses result will show on the screen of the EMS. This research also targeted on developing the standard of procedure of fuel testing using chassis dynamometer. At the end of this research, the result will shows which type of RON fuel grade produced greater engine performance and less polluted emission gasses. Further experimental testing can be done for better result such as by using engine dynamometer that more accurate than chassis dynamometer because have less energy lost. Not only that, recommendation for further research on fuel properties also needed such as research on the element in the fuel that can affect engine performance.

ABSTRAK

Matlamat utama kajian ini adalah untuk membandingkan graf prestasi enjin dan pelepasan gas yang dihasilkan oleh enjin dengan menggunakan dua jenis RON yang berbeza iaitu RON 95 dan RON 97. Kajian ini adalah penggunaan chassis dinamometer untuk mendapatkan hasil prestasi enjin dan menggunakan Pelepasan Pengukuran System (EMS) untuk mengukur gas ekzos yang dihasilkan. Hasilnya telah ditunjukkan dalam graf prestasi dalam perisian yang disambungkan ke mesin dinamometer. Hasil termasuk kelajuan, daya kilas dan kuasa kuda yang dihasilkan. Seterusnya, EMS akan menunjukkan peratusan gas-gas yang dihasilkan dalam gas ekzos seperti HC, CO2, CO, O2 tetapi NOx dipaparkan dalam bahagian per juta (ppm). Gas-gas ekzos yang terhasil akan paparkan pada skrin EMS. Kajian ini juga disasarkan kepada membangunkan standard prosedur ujian bahan api menggunakan chassis dinamometer. Pada akhir kajian ini, keputusan menunjukkan jenis gred bahan api RON akan menghasilkan prestasi enjin yang lebih tinggi dan gas ekzos yang kurang tercemar. Selain itu, kajian eksperimen seterusnya boleh dilakukan untuk keputusan yang lebih baik seperti dengan menggunakan enjin dinamometer yang memberi keputusan yang lebih tepat berbanding chassis dinamometer kerana kurang tenaga yang hilang. Bukan itu sahaja, cadangan untuk penyelidikan lanjut mengenai ciri-ciri bahan api juga diperlukan seperti penyelidikan pada unsur di dalam bahan api yang boleh menjejaskan prestasi enjin.

DEDICATION

Every challenging work needs self effort as well as guidance of elders, especially those who were very close to our heart. My humble effort I dedicate to my sweet and loving Father & Mother, whose affection, love, encouragement and prayer of day and night make me able to get such success and honour. As my promise to them to complete all requirements need by UTeM and with all hard working and respected lecturers.

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LIST OF SYMBOLS AND ABBREVIATIONS

RON	Research Octane Number
rpm	Revolution per minute
ppm	Part per million
EMS	Emission measurement system
ECU	Electronic Control Unit
IC	Internal combustion
SI	Spark ignition
TDC	Top death centre
BDC	Bottom death centre
Dyno	Dynamometer
ULP	unleaded petrol
PULP	Premium unleaded petrol
UPULP	Ultimate Premium unleaded petrol
CO2	Carbon dioxide
CO	Carbon monoxide
HC	Hydrocarbon
O2	Oxygen gas
NOx	Nitrogen oxide
H2O	Water
SOP	Standard operation procedure
Hp	Horsepower
Nm	Newton metre

CHAPTER 1
INTRODUCTION

1.1. Project Background

This research study on natural aspirated engine, the main goal of this research is to improve the properties of the fuel, to reduced fuel consumption and reduce the poisonous emission gas produced in exhaust. Research Octane Number (RON) has close relationship with performance of the engine and gas emission produced from the exhaust pipe.

RON are importance parameter that measured the fuel quality and will effect of engine performance and emission gasses. Theoretically, RON 95 and RON 97 are a mixture of 95% and 97% iso-octane with 5% and 3% of n-heptane by volume respectively. User was attracted to use high RON because they believe that higher number of RON will produced better performance of the engine. For the information when engine was filled with high octane number from required it will delay the ignition because the ECU mapping based on manufactured.

This research was study the effect of RON on engine performance. This research will investigate the RON 95 and RON 97 in V6 engine (6A12). Two different brands of fuel were chosen to compare the performance of engine using these two different types of octane rating gasoline. The emission gas produced from the exhaust pipe also will be observed in this research during the experiment.

1.2. Problem Statement

People mind has nowadays been thinking that RON 97 was better than RON 95 fuel. They claim that RON 97 will better deliver engine performance and also fuel consumption. They thought that it will help clean engine component better. Generally, people still do not fully understand about fuel choices that present in all petrol stations for their vehicles. People thought that emission gas that came out of their vehicle have no relation to the fuel grade used. Some said when uses high fuel grade it will result high carbon produced. Therefore, the problem statements for this project are:

I. People still do not understand the different effect of different RON fuel grades used in their vehicles.
II. Different gas emission produced from different fuel grade used.
III. Different brand fuels give different result for engine performance.
IV. They do not fully understand that the engine performance (power, torque and brake specific fuel consumption) has a relationship with the fuel grade used.

1.3. Objective

Below are the objectives for this research:

I. To extinguish the performance of 6A12 engine with different type of Research Octane Number (RON).
II. To compare the amount of emission gas produced from exhaust pipe by using different Research Octane Number (RON).
III. To compare an expected result with an actual result get from the experimental result.

1.4. Project scope and limitations

The scopes of this project are:

I. Using an engine dynamometer to get the graph of performance of the engine including the torque and horsepower.

II. To measure the emission gas produced by using the gas analyzer that provided.

III. Research will use two type of RON which are RON 95 and RON 97 from Petron and Shell.

CHAPTER 2
LITERATURE REVIEW

2.1. Introduction

Fuel is one of the sources of car to move and get the better performance. In this chapter will be discussed the history of fuel, engine and emission gas that will be use and have a relation in this research. All information provided was generally about fuel, engine or emission gas. The method or material used will be discussed in next chapter.

2.2. Engine

An engine is the machines that convert heat into mechanical energy. The heat from burning a fuel produced power which moved the vehicles. Automotive engines are internal combustion (IC) engine because fuels that run in the engine burned inside the combustion chamber. IC operation in two difference type which are by Compression Ignition (CI) or Spark Ignition (SI).

SI engine consist two types of engine strokes which are 2 stroke and 4 strokes.

2.2.1. 2 stroke engine

This engine had two cycles that complete the power stroke with two movement of the piston (up and down). This engine is internal combustion engine.

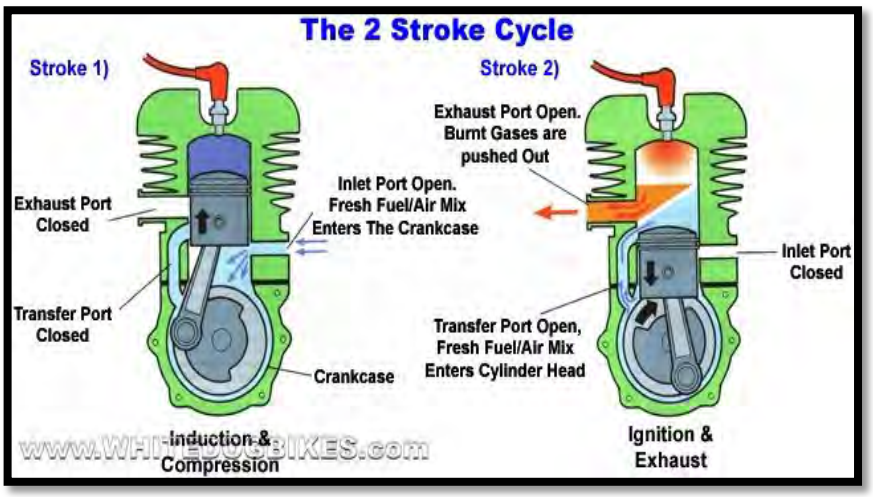

Figure 2.1: two stroke engine

First Stroke: also known as upward stroke, in this stroke fresh air will enter the cylinder from the port open that shows by the light blue colour on the figure above, and at the same time the piston from bottom will compress the air that shown by the dark blue in the figure above.

Second Stroke: also known as downward stroke, once the piston moving downward that affect by the power cycle, it will close the inlet pipe and open the other pipe that known as exhaust port. The exhaust gas will flow and exit through this pipe.

2.2.2. 4 stroke engine

This type of engine has done internal combustion that convert chemical reaction or combustion reaction into mechanical reaction that can make the car moved. The pressure inside the cylinder add with spark ignition and presented of oxygen gas will form a combustion inside the combustion chamber that give power to the piston that transmitted the energy to the crankshaft and fly wheel will rotate.

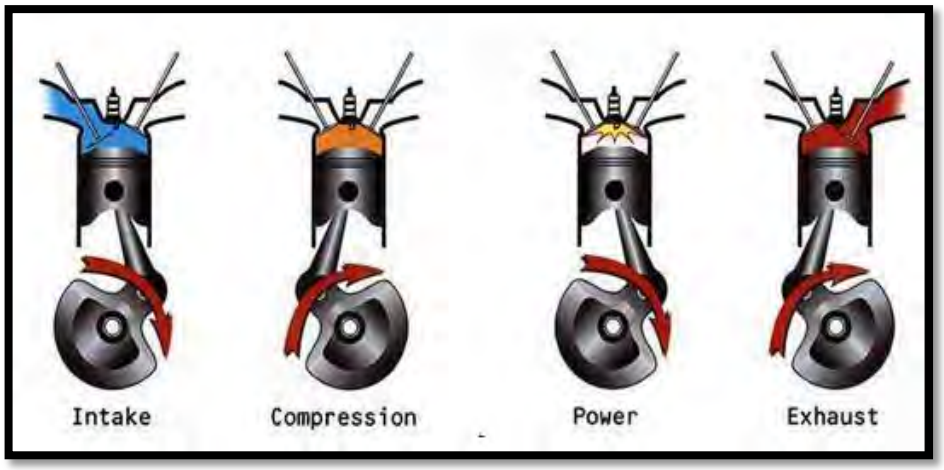

Figure 2.2: Four stroke engine cycle

Table 2.1: Working principle

Process name	Inlet valve	Exhaust valve	Piston moves	What happen
Intake	Open	Closed	Downward (TDC to BDC)	Air fuel mixture will enter the combustion chamber.
Compression	Closed	Closed	Upward (BDC to TDC)	Air fuel mixture was compressed and spark ignites.
Power	Closed	Closed	Downward (TDC to BDC)	The air fuel mixture burn and undergoes combustion reaction.

Exhaust	Closed	Open	Upward (BDC to TDC)	Burnt gas was pushed out from the cylinder.

In this research, I will use SI engine with 4 stroke that used by the proton cars. This is because, majority of vehicle now days were provide with 4 stroke engine that use gasoline as the source of combustion.

2.2.3. Engine Parameter

Parameters of engine used to produce a performance of the engine after run the experiment. It as an evaluation that provide a result to show how the performance of the engine.

Table 2.2: Parameters that measured

Parameters	**Explanation**
Torque	The torque was measured as work done per rotations (radian) of the crank. Torque shows the ability of the engine to do works. It read in unit Nm or lbs. High torque was needed by heavy vehicle to give the engine high performance to start move when it at rest.
Horsepower	It is rate of work of the engine. beside that its known as an output work for the engine to make the car move forward or reverse. The relationship of horsepower and rpm is directly proportional so it can be increase or decrease when rpm increase or decrease while the relationship between horsepower and torque is inversely proportional.
Temperature	Temperature is one of parameter that ensure by the coolant. So function of the coolant is to maintain the

	temperature of engine and prevent the overheating. The temperature of engine can be measured by the thermocouple to make sure the engine run in suitable temperature. Beside coolant, air flow and lubricant oil also can reduce the temperature of engine.
Lubricant oil	Lubricant oil is important to prevent the weariness of components inside the engine. It also to prevent the temperature increase on the wall of the cylinder when the piston moves upward and downward. The viscosity of this parameter must be controlled.

2.3. Dynamometer

Dynamometer was used to get the performance of the car by absorb the power that engine produced. Dynamometer will apply a resistance to the engine rotation. The resistance means here is dynamometer will apply break in their system during engine run to interrupt the power produced and shows the value of power output after braking applied. Besides that, the dynamometer used to across the range of engine speed provided by the manufacturer this to get the accurate torque and power output of the engine. There have two types of dynamometer which are Chassis dynamometer and engine dynamometer.

2.3.1. Chassis Dynamometer(dyno)

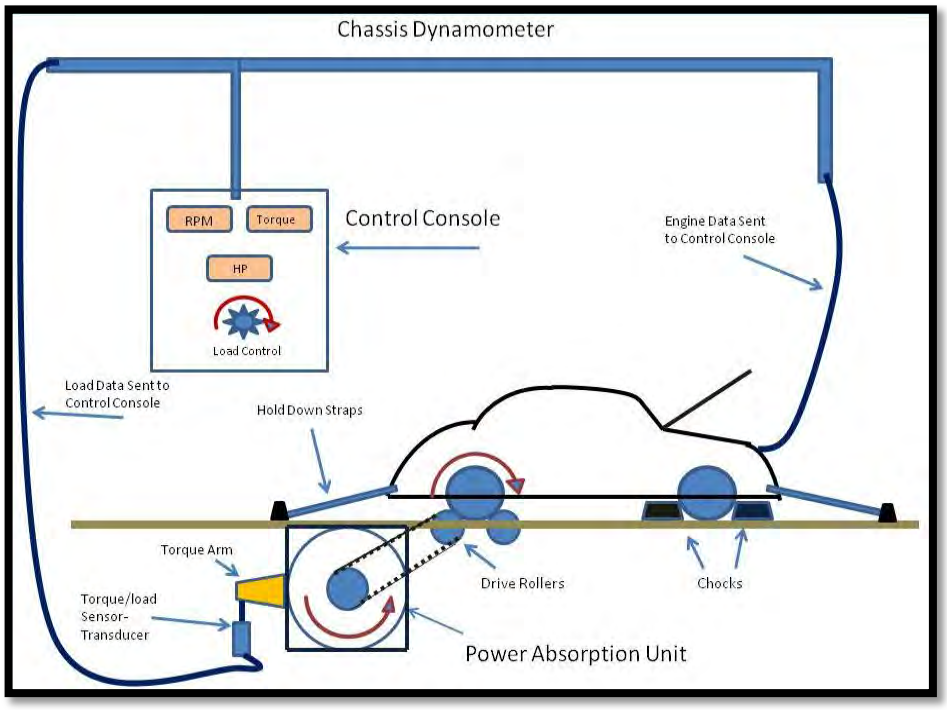

Figure 2.3: chassis dynamometer test

This dynamometer was used by the car is park above the machine. Both of front tires placed on the roller. The machine size was provided for different type of vehicles. If truck test, they need the large set of dynamometer with large roller. The roller is the main component in this machine. Figure above shows the dynamometer machine do the test. The rear tyre was on the roller because this is front engine rear wheel drive car type. The machine also provided for front engine with front wheel drive car. The roller set can be adjusted follow the diameter of the tyres. The roller will rotate during tires rotate, the power output from tires will transmitted to the dyno machine and become the result of performance for the car.