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THE SAVING OF FUEL USAGE IN GENERATOR BY USING THE HHO GAS FROM ELECTROLYSIS OF WATER (HYDRO FUEL)

MOHD KHALIL BIN MOHD ZAKI

This report was adduced in partial fulfillment for award condition of Bachelor of Mechanical Engineering (Thermal-Fluids)

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MAY 2009

"I hereby, declare this thesis is the result of my own research except as cited in the references"

Signature :……..

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Date : 10 APRIL 2009

To beloved mom and dad,

Mohd Zaki B Salim

Samsiah Bt Ali

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ABSTRAK

Di dalam kertas kajian ini, pembangunan sistem ‘Hydro Fuel’ menggunakan elektrolisis air untuk digunakan dalam enjin petrol sebagai bahan bakar telah disiasat dan dirancang. Gas HHO yang terhasil daripada proses elektrolisis air tersebut kemudiannya disalurkan ke dalam sistem enjin untuk enjin tersebut melakukan proses pembakaran dan seterusnya menjana enjin. Penyelidikan ini dilakukan bagi mencari penyelesaian untuk meminimumkan menggunakan minyak petrol yang menjadi semakin mahal dan bagi meningkatkan kecekapan enjin serta mencari jalan terbaik bagi mendapatkan hasil pengeluaran gas HHO yang maksimum daripada proses hidrolisis tersebut. Perkara paling penting yang mempengaruhi kadar pengeluaran gas HHO adalah jenis dan bentuk elektrod, jenis air dan sumber arus digunakan. Daripada maklumat yang diperolehi dan hasil-hasil ujian yang dijalankan, elektrod terbaik untuk digunakan adalah tiub keluli tahan karat (hollow stainless steel) kerana keluli jenis ini mempunyai luas kawasan permukaan yang besar yang menyumbang kepada penghasilan kuantiti gas HHO yang lebih banyak. Selain itu, keluli tahan karat ini adalah tahan lama dan mempunyai sifat anti kakisan. Air suling adalah elektrolit yang terbaik yang boleh digunakan disebabkan ia tidak mempunyai bendasing larut seperti klorin yang terdapat dalam air paip dan sumber arus yang sesuai untuk proses elektrolisis ini adalah bateri 12 V yang kebiasaannya terdapat pada kereta. Setelah kadar maksimum pengeluaran gas HHO diperolehi, sistem itu akan dipasangkan pada sistem kereta dan ujian dilakukan bagi menentukan kecekapan sistem ini. Sistem Hydro Fuel ini tidak akan mendatangkan kerosakan pada enjin atau sistem komputer kereta tetapi ia telah menolong melancarkan proses pembakaran dalam sistem enjin dan menyumbang kepada sistem enjin yang lebih efisien. Jadi, penggunaan system Hyfro Fuel ini dapat menjimatkan penggunaan minyak.

ABSTRACT

In this paper, the development of Hydro Fuel system by using water electrolysis for petrol engine as a fuel have been investigated and studied. The HHO gas produced from the electrolysis process and it was supplied into the petrol engine. This research was done to find the solution for minimize the using of petrol that was become more expensive nowadays and to increase the efficiency of the engine. Research was proceeded to find the best way for get maximum HHO gas production from hydrolysis of water. The most important thing that was influenced HHO gas productions are type and shape of electrode, type of water and current source used. From the information and testing results, the best electrode can be used is stainless steel hollow because this type has large surface area and the HHO gas can be produce more. Besides, this stainless steel is durable and anti-corrosion. Distilled water is the best electrolyte can be used because it doesn't have soluble impurity such as chlorine as in tap water and the current source that suitable for this electrolysis process is 12 V battery that usually car having it. After get the maximum HHO gas production, the system will be installed and testing was done to determine the efficiency of this system. This Hydro Fuel system does not interfere or damage the car's engine or computer but it was helped the combustion process in the engine system and making it run more efficiently. So, the usage of petrol can be saving by using this system.

TABLE OF CONTENT

CHAPTER II LITERATURE REVIEW

CHAPTER IV RESULT

LIST OF TABLE

LIST OF FIGURE

LIST OF SYMBOL

E	=	Standard potential of cell
e^-	=	Electron
H^+	=	Cations
OH^-	=	Anions
aq	=	aqueous solution
$\dot{m}$	=	mass flow rate
ρ	=	density of fuel
Q	=	volumetric flow rate
m	=	mass

LIST OF APPENDIX

CHAPTER I

INTRODUCTION

1.1 Introduction

'Projek Sarjana Muda (PSM)' is one of subject that was offer by Faculty of Mechanical Engineering (FKM) for student in the final year who is taking the degree. It is one of the rules for student must be fulfill that was stipulate by Universiti Teknikal Malaysia Melaka (UTeM) before the student graduate. This final year project is an academic activity which it must be done as individual and supervises by FKM's lecturer.

The objective of this project implementation is to increased the student's capability and skill especially in the aspect of research, analysis and solving the problem with regard to project title where was choose due to academic or scientific research. This is to produce the professional person that was able to solving the engineering problem encountered by did research and development by knowledge applications related to study fields.

Based on the information above, the project title The Saving of Fuel Usage in Generator by Using the HHO Gas from Electrolysis of Water (Hydro Fuel) have been agreed and approved for my project. Operation and implementation of this project encircles the activities start from project title approved until submission the full report of the project.

1.2 Background of study

Nowadays, majority of vehicles and machine that based upon the fuel usage are widespread around this entire world. The internal combustion engines have already become an indispensable and integral part of our present day life style, particularly in the transportation and agricultural sectors. Unfortunately the survival of these engines has been threatened due to the problems of fuel crisis and environmental pollution.

The price of the fuel was abruptly increased with rapidly due to this crisis. Also the adverse effect of the petrol and diesel consumption where it was contributes to the environmental pollution such where it can cause the long term effect especially to the human.

Therefore, to sustain the present growth rate of civilization, a non-depletable, clean fuel must be expeditiously sought. Hydrogen exactly caters to the specified needs. Hydrogen, even though ‘‘renewable’’ and ‘‘clean burning’’, does give rise to some undesirable combustion problems in an engine operation, such as backfire, pre-ignition, knocking and rapid rate of pressure rise.

The modern petrol and diesel engines has an average efficiency about 25% to 30%. In other words, 70% to 75% of the energy stored in that expensive fuel wastes as heat, pollution (unburned fuel) and vibration. That’s only 25% of energy moves the vehicle (*internet source*, 23/07/2008). Due to this problem, hydrogen production using hydrolysis of water is the best choice. The gas is supplied to the engine to help the petrol or diesel burn more efficiently, while producing its own combustion. That added combustion of the hydrogen gas gives more power and ultimately requires less petrol and diesel to run engine that resulting in better efficiency.

1.3 Problem statement

The project research is conducted to find the best method and solution for development the new option to minimize the using of petrol and liquid petroleum gas (LPG) due to saving the usage of this fuel. The development of the Hydro Fuel System needs to have deep understanding with regard to theory of HHO gas production, the system that compatibility with the generator and the risks can occurs. Besides, the problems about temperature, pressure and efficiency of the system must be take note to get the productive result in this research.

1.4 Objectives

This final year project for The Saving of Fuel Usage in Generator by Using the HHO Gas from Electrolysis of Water (Hydro Fuel) title has been encircles as:

a) Analyses and design the Hydro Fuel System.
b) Develop this system by done the experiment, testing and research.
c) Understanding and determine how the HHO gas producing in the system and their properties.
d) Analyses the method for optimize the HHO gas to the engine system.
e) Determine the best method to get the maximum HHO gas production from this Hydro Fuel System.

1.5 Scope

Scope of the research was encircles:

a) Make research and development for the Hydro Fuel System.
b) Make the experiment to test the system.
c) Determine the performance of the system.
d) Make comparison about the process data of the system for before and after improvement to approve the best method to get the best result.

1.6 Problem analysis

In the problem analysis, several methods have been discovered and considered to overcome the problem statement that was explained before. The methods are:

a) Discovered overall related problems and find the best solution.
b) Make a research to understand the properties of HHO gas.
c) Make a research about the risks of HHO gas usage.
d) Familiarize with equation, concept and hypothesis regards to research problem.
e) Make a research about type of equipment and instrumentation that can be used in this project.
f) Using the systems that have in the market by make comparison and development from the system.
g) Carry out the experiment and analyses the method and parameter that can be used.
h) Selection the best method for doing the experiment and overcome the problems appear during experiment.
i) Predict the risks and make the precaution of it.

1.7 PSM's flow chart

Figure below shows that the flow chart for overall PSM I and II implementation. As the preliminaries, the flow starts with selecting the title and determination of the objective and scope. After that, the problem analysis must be done for arose problem. Then, when finish done the literature review it was studied on previous research and previous design to make research. A new design was create after that based on the research which is have done before. The acquired result after testing the new design has been analyzed and the problem arose has been settled by make problem analysis and solution. The last result was discussed and the conclusion was made lastly.