DEVELOPMENT OF MAGNETO ELECTROLYSIS FOR HYDROGEN GENERATOR SYSTEM

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"I admit that this report is done all by myself except statement that I have already stated on each one of them"

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ABSTRACT

This Final Year Project is about the development of magneto electrolysis for hydrogen generator system. Magneto electrolysis for hydrogen generator system is an enlargement of hydro-fuel technology which is as an alternative way of cost saving for petrol used. It consist the design of hydrogen generator system built by water electrolysis. The objective of this project is to find the optimum parameters in magneto electrolysis process and to study the rate of hydrogen gas generated using the proposed system. Today, the energy source for nearly all daily applications is fossil fuel, principally petrol. The supply of petrol is limited and its price is increasing. Greenhouse gas and air pollutants are emitted when petrol is used. Hydrogen generator which is built by water electrolysis that produces the hydrogen gas could solve this problem by hybridization with petrol. A proposed system consist of tank-type water electrolysis apparatus with series electrodes arrangement and wherein imposed magnetic fields enhance electrolyte solution circulation further enhanced in apparatus operation by use of immersed electrets providing partitioning structure between separated hydrogen bubbles-producing and oxygen bubbles-producing regions in the solution. Various design parameters and the fabrication of the reactor is discussed briefly in the thesis. Experimental results of hydrogen production rate and the comparison are also discussed.

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ABSTRAK

Projek akhir tahun ini adalah berkaitan dengan pembangunan sistem elektrolisis berasaskan magnet untuk generator hidrogen. Sistem elektrolisis berasaskan magnet untuk generator hidrogen adalah perkembangan dari teknologi bahan api menggunakan air yang mana ia merupakan salah satu cara altenatif untuk menjimatkan kos penggunaan petrol. Ia terdiri daripada reka bentuk hidrogen generator yang menggunakan sistem elektrolisis menggunakan air. Objektif projek adalah untuk mencari parameter yang optimum dalam proses elektrolisis berasaskan magnet ini dan untuk mempelajari kadar penghasilan hidrogen daripada sistem yang dicadangkan. Hari ini, hampir semua sumber kuasa bagi pengunaan harian datangnya dari penggunaan minyak mentah terutamanya petrol. Namun pembekalan petrol adalah terhad dan harganya semakin meningkat. Gas rumah hijau dan pencemaran udara terjadi apabila petrol digunakan. Generator hidrogen yang terdiri daripada elektrolisis berasaskan air yang menghasilkan gas hidrogen mampu menyelesaikan masalah ini dengan mencampurkannya dengan petrol. Sistem yang dicadangkan terdiri daripada peralatan sistem tangki elektrolisis air dengan susunan elektrod yang sesiri dan dimana medan magnet didedahkan untuk meningkatkan kadar peredaran ion-ion dalam larutan elektrolit. Ia seterusnya dapat meningkatkan operasi elektrod yang ditenggelamkan didalam larutan yang terdapat dinding pemisah ditengah-tengahnya bagi mengasingkan buih-buih gas hidrogen dan oksigen yang terhasil. Pelbagai bentuk parameter dan fabrikasi untuk reaktor terlibat dibincangkan didalam tesis ini. Keputusan experiment untuk kadar penghasilan gas hidrogen dan perbandingannya turut dibincangkan.

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LIST OF SYMBOLS

Δ	The change in
$\geq$	Less than or equal to
$\leq$	Greater than or equal to
~	Roughly similar
$\approx$	Approximately equal to

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LIST OF FORMULA

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LIST OF ABBRIVIATION

H_2O	Water
H_2	Hydrogen
O_2	Oxygen
KOH	Potassium Hydroxide
ICE	Internal Combustion Engine
CO	Carbon Oxides
HC	Hydro Carbon
SI	Spark Ignition
CI	Compression Ignition
NOx	Nitrogen Oxides
mJ	Mili-Joules
K	Kelvin
DC	Direct Current
HG	Hydrogen Generator

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CHAPTER 1

INTRODUCTION TO THE STUDY

The purpose of this chapter is to provide the reader with an introduction to the research conducted in this thesis. First, the fundamental of hydrogen generator will be discussed. The results of literature search conducted in the areas related to this research will then be discussed. The chapter ends with the objectives for the research conducted, followed by an outline of subsequent chapters in this thesis.

1.1 Introduction

Basically, a hydrogen generator is a device that separates hydrogen from oxygen in water, H_2O so that the hydrogen gas can be used in various applications. For commercial use, hydrogen is most commonly released by a petroleum cracking process from natural gas, as generating large amounts of hydrogen from water is more expensive than generating it from carbon. However, for domestic use, the small hydrogen generator is the easiest and most effective means of separation.

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The separation process is accomplished by charging distilled water by means of an electrode, and then harvesting the hydrogen as it rises above the oxygen in the hydrogen generator. Hydrogen is the lightest element known, atomic weight 1.00794; much lighter than oxygen, atomic weight 15.9994, and it is the most abundant element on earth. It is also highly combustible and great care must be taken when generating and using hydrogen.

Hydrogen, when mixed with fuel vapor, creates a combustible material that can efficiently power gasoline and diesel engines. The hydrogen, when separated by the hydrogen generator, mixes with or replaces the oxygen needed for combustion in combustible engines. Once the hydrogen has replaced the oxygen in high enough quantities, fuel mileage will usually increase, and the engine will run cleaner and more smoothly.

The basic requirements for a hydrogen generator are: a bottle of distilled water, a long vacuum hose, a quart size canning jar with a solid lid, an electrode made of a stainless steel in a row, and two long electrical wires. The two electrode terminals, positive and negative, are simple bolts with the stainless steel wire wound around them at the top end of the electrode and fixed through holes in the jar lid. Once a positive direct current (DC) is tapped from the auto electrical system, a wire connects to the positive post of the electrode. The other electrode is the ground and should be attached to the frame of the automobile.

When DC electricity from the auto electrical system is introduced to the electrode inside the jar three fourths full of water, the newly created hydrogen generator begins the separation of hydrogen from oxygen.

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The hydrogen, being a much lighter gas than oxygen, rises to the top of the jar where it is siphoned off through a vacuum hose connected to the fuel intake of the automobile engine. Hydrogen then replaces oxygen in the intake and mixes with fuel to become the combustible agent.

Due to the more complex computerized oxygen/fuel mixing computer on most late model cars, this means of replacing oxygen with hydrogen from the hydrogen generator is most effective on vehicles manufactured before 1995.

1.2 Project Background

Hydrogen generators for the vehicle use electricity provided by the car to electrolyze a small amount of water and inject the resulting hydrogen and oxygen gases into the vehicle's intake system. The hydrogen and oxygen displace some of the fossil fuels in the cylinders, help the fuel to burn more efficiently, increase power and decrease pollutants coming out the tailpipe. The hydrogen generator tank consists of water electrolysis using aluminum electrodes and potassium hydroxide, KOH as solvent to increase the rate of hydrogen producing. The experiment will be conducted on the motorcycle to record the result of petrol saver by using hydrogen injection. The target for petrol saving by using hydrogen gas is about 40% to 50%. The fuel mixture of petrol or diesel, hydrogen and oxygen is then injected into the engine where combustion takes place.

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1.3 Objectives

The objective of this project is to find the optimum parameters in magneto electrolysis process such as shape of electrode, type of electrode, the type of solvent used, the size of hydrogen generator tank, and to study the rate of hydrogen gas generated using the proposed system.

1.4 Scope of Work

The study of magneto electrolysis based hydrogen generation system including the optimization of magneto electrolysis system parameters and performance evaluation on the rate of hydrogen gas using the proposed magneto electrolysis system. In this study, ways to optimize the energy efficiency of the hybrid cycle are explored by varying the electrolyte concentration, internal heat recuperation, based on currently available experimental data for the electrode potential.

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1.5 Problem Statement

Today, the energy source for nearly all daily applications is fossil fuel, principally petrol. The supply of petrol is limited and its price is increasing. Greenhouse gas and air pollutants are emitted when petrol is used. In order to overcome the energy crisis because of the current rising of petrol price in Malaysia, the new solution needs to be highlighted to reduce the burden of the higher living cost. One of the new solutions is to use the hydrogen generator by magneto electrolysis process.

1.6 Report Outline

In Chapter 2 of this report, previous electrolysis research in similar application is reviewed. Chapter 3 addresses the methodology for preparing the hydrogen generator based on hydrolysis system. Chapter 4 will stated all the experimental results that have been done during the project. The preliminary calculation on ions and analysis of parameter in electrolysis such as type of electrode, shape of electrode and the number of electrode will be discussed in Chapter 5. Chapter 6 discussed the conclusions and recommendations for the future work.

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CHAPTER 2

LITERATURE REVIEW

The purpose of this chapter is to give the research background of the magneto hydrolysis for hydrogen generator system. In addition, the research aspects of hydrogen generator will also be discussed. Furthermore, the expansion on the Lorentz Theory for the magnetic field will be added.

2.1 Introduction

For more than a century, hydrocarbon fuels have played a leading role in propulsion and power generation. Recent years, declining oil reserves and increased fuel prices have, together with increased awareness of the environmental impacts of burning hydrocarbon fuels, led to an interest in alternatives to fossil fuel based propulsion and power generation. One such alternative is to use hydrogen as an energy carrier and to extract energy using a hydrogen generator or a modified internal combustion engine (ICE).

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