STUDY ON THE PERFORMANCE OF CARBON ADSORBENT IN LPG TANK FOR SMALL ENGINE FUELLED BY LPG.

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This report is written as a partial fulfillment of terms in achieving the award for Bachelor of Mechanical Engineering (Thermal-Fluid)

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‘I/We approve that we have read this thesis thoroughly and in my/ our opinion, this thesis is has fulfilled the criteria covering all the aspects of scope and quality and satisfied to be awarded for Bachelor of Mechanical Engineering (Thermal-Fluid).’

Signature :……
Supervisor I :……
Date :.....

Signature :……
Supervisor II :……
Date :.....

"I admit that this report is all written by myself except for the summary and the article which I have stated the source for each of them."

Signature :……
Writter :……
Date :.....

TO MY BELOVED MOM AND DAD...

TO ALL MY BEST FRIENDS...

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ABSTRAK

Cecair petroleum gas (LPG) digunakan untuk peralatan pemanasan dan juga untuk kenderaan. Pada masa kini, penggunaan LPG sebagai bahan api alternatif untuk kenderaan adalah meluas. Akan tetapi, terdapat beberapa masalah yang timbul apabila menggunakan LPG pada kenderaan. Oleh itu, penyerap carbon digunakan di dalam tangki LPG untuk menambah muatannya. Di dalam projek ini, laporan memfokuskan tentang pembangunan dan persediaan penyerap carbon dengan menggunakan kaedah yang baru dan dibandingkan dengan kaedah yang sebelumnya. Kaedah yang baru tidak menggunakan sebarang gas dalam pembakaran kerana kosnya yang mahal. Oleh itu hasil keputusan daripada kaedah yang baru akan menentukan samada prestasi penyerap carbon adalah lebih efisien atau tidak serta menjimatkan apabila diaplikasikan dalam tangki LPG. Malangnya, keputusan yang diperolehi menunjukan kaedah yang lama lebih baik dalam penghasilan penyerap karbon berbanding kaedah yang baru. Oleh yang demikian, kaedah yang lebih baik perlu digunakan untuk menghasilkan penyerap karbon yang baik dan cara penyediaanya ringkas lagi menjimatkan.

ABSTRACT

Liquefied Petroleum Gas (LPG) is used as a fuel in heating appliances and vehicles as well. Nowadays, the use of LPG as an alternative fuels for vehicles are widely. But somehow, there are several problems arised when applying the LPG for vehicles. So, in order to overcome such problems, the carbon adsorbent is being used in LPG tank for increasing the storage capacity. In this project, the report is more focuses on development and preparation of carbon adsorbent by using the new method compare to the current method by the current research. The result will determine the performance of carbon adsorbent in LPG tank of which method is more efficient and more saving when applied to LPG tank. The new method is not using any gas in the process as it is costly. Therefore, the performance of carbon adsorbent can be obtained after the results. Unfortunately, results had shown that the current method performed better in producing carbon adsorbent compared to the new one. For the recommendation, it is suggested that a better, simple and more saving method have to be applied.

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CHAPTER 1

INTRODUCTION

Carbon adsorbent is also known as activated carbon. The active carbon is a material with an exceptionally high surface area. One gram of activated carbon has a surface area of approximately 500 m^2, typically determined by nitrogen gas adsorption, and includes a large amount of microporosity.

The active carbon can be produced in different process from a variety of carbonaceous source materials such as coconut shells, coal, walnut shell, palm date pits, nutshell and oil palm shell. The two different processes include physical reactivation and chemical activation.

Normally, the activated carbon is used in gas purification, metal extraction, water purification, medicine, sewage treatment, air filters in gas masks and filter masks, filters in compressed air and many other applications.

1.1 Background research

In order to reduce air pollution, many countries had used LPG as an alternative way replacing natural gas and petrol as a fuel in their vehicles. The use of LPG is more economic because it is simply to prepare and easy to use as the LPG is not using the high pressure tank compared to natural gas.

Many researches are being done to improve the use of LPG in the automotive industry. One of the current researches is to develop LPG and methane gas storage as the alternative fuels for vehicles based upon the carbon adsorbent. Carbon adsorbent or active carbon is used as a gas storage media for LPG is an alternative way to overcome the disadvantages of pressurized vessel such as high pressure flammable gas content, dimension of gas tank and other dangerous aspects.

The current research of using the carbon adsorbent in LPG is successfully worked as the carbon adsorbent has a potential to adsorb the gas based on its characteristics. For this project, the objective is to develop and prepare a carbon adsorbent that can be used in LPG tank for increasing the storage capacity. In terms of that, different techniques and preparation procedures are being used to investigate the effects on the pore structures development on carbon because it is important in gas adsorption and desorption processes.

1.2 PSM flow chart

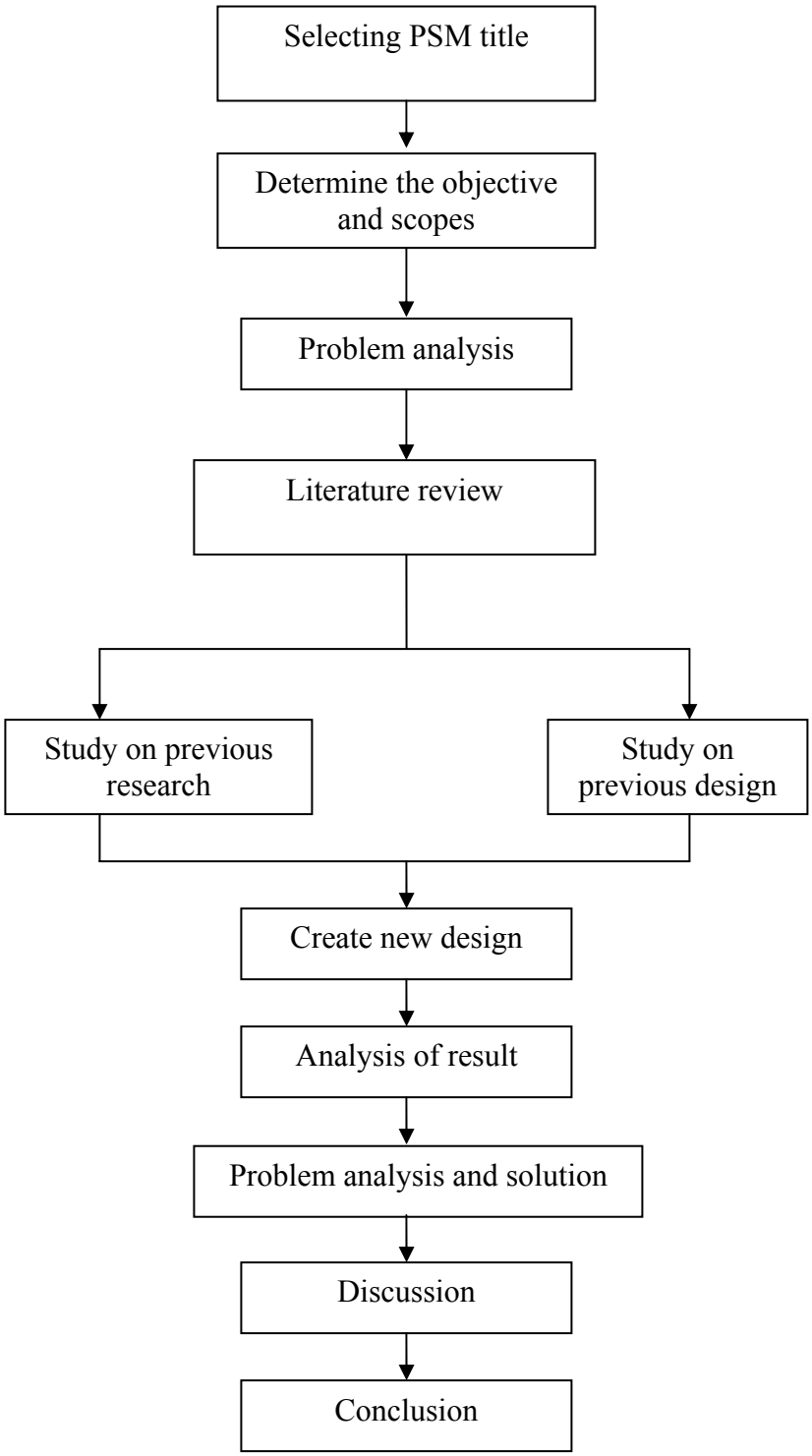

Figure 1.1 PSM flow chart

1.3 Problem Analysis

Liquefied petroleum gas (LPG) is used to replace the petrol because of the fuel cost is rapidly increase nowadays. Using LPG as a fuel for vehicles give more advantages than the others fuel. This is because the LPG is more economic and is not using high pressure tank.

In application for the vehicles, a small tank for LPG storage with high capacity is needed. In order to increase the storage capacity in small LPG tank, carbon adsorbent is used. Carbon adsorbent has a potential to adsorb LPG due to its characteristics. Carbon adsorbent was prepared by the process of carbonization and activation on previous research.

Even the process is capable to produce carbon adsorbent in high adsorption capacity; the process is occurs in high temperature and using N_2 and CO_2 gas. Heating at high temperature take a long time to get the product and the use of N_2 and CO_2 gas have to be control to obtain the specific flow rate and CO_2 is costly.

1.4 Scope

Objective

- To develop and prepare a carbon adsorbent that can be used in LPG tank for increasing the storage capacity.

Scopes

- Design and develop an experimental rig for preparing carbon adsorbent
- Design and develop an experimental rig for testing carbon adsorbent in LPG tank
- Determine the performance of a carbon adsorbent in LPG tank

CHAPTER 2

LITERATURE REVIEW

2.1 Activated carbon

Carbon adsorbent is also known as activated carbon. The activated carbon is a material with an exceptionally high surface area. One gram of activated carbon has a surface area of approximately 500 m^2, typically determined by nitrogen gas adsorption, and includes a large amount of microporosity.

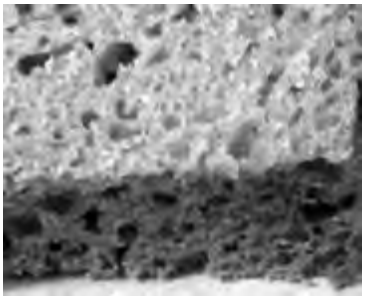

Figure 2.1 Activated carbon

Figure 2.2 Close up of sample activated carbon

(Source: www.wikipedia.com)

2.2 Source material

The activated carbon can be produced in different process from a variety of carbonaceous source materials. The potential natural precursors for carbon adsorbents include coconut shells, coal, walnut shell, palm date pits, nutshell and oil palm shell.

2.3 Production

There are two different processes in producing the activated carbon. It can be produced using one of the two following processes:

1. **Physical reactivation**: The precursor is developed into activated carbons using gases. This is generally done by using one or combining the following processes:
    - Carbonization: material with carbon content is pyrolysed at temperatures in the range 600-900°C, in absence of air (usually in inert atmosphere with gases like nitrogen)
    - Activation/oxidation: raw material or carbonized material is exposed to oxidizing atmospheres (carbon dioxide, oxygen, or steam) at temperature above 250°C, usually in the temperature range 600-1200°C.
2. **Chemical activation**: Impregnation with chemicals such as acids like phosphoric acid or bases like potassium hydroxide, sodium hydroxide or salts like zinc chloride, followed by carbonization at temperatures in the range 450-900°C. It is believed that the carbonization / activation step proceeds simultaneously with the chemical activation. This technique can be problematic in some cases because, for example, zinc trace residues may remain in the end product. However, chemical activation is preferred over physical activation owing to the lower temperatures and shorter time needed for activating material.