CHAPTER 1

INTRODUCTION

1.1 RESEARCH INTRODUCTION

This chapter basically discuss on the hydrogen as fuel used on a diesel engine. It is well known that fossil fuels are widely used in the whole world and because of that the source of it become lesser by each year. Combustion from fossil fuel also produces poisonous gas that is harmful for the planet. The main pollutants cause from fossil fuel burn are unburned or partially burned hydrocarbon (UBHC), carbon monoxide (CO), oxides of nitrogen (NOx), smoke and particulate matter. Hence an alternative fuel with clean burning and renewable has to be develop and compatible with the engine design used nowadays. A lot of research is being carried out throughout the world to evaluate the performance, exhaust emission and combustion characteristic of the existing engines using several alternative fuels such as hydrogen, compressed natural gas (CNG), alcohols (methanol and ethanol),

Liquefied petroleum gas (LPG), biogas, producer gas, bio-diesels develop from vegetable oils, and other alternative fuel. For this study, the effect of hydrogen use as a dual fuel in diesel engine is observed. In real life, hydrogen cannot be use directly in compression ignition engine (CI) due to its higher self-ignition temperature. The self-ignition temperature of hydrogen is 858 K, so hydrogen cannot be used directly in a CI engine without a spark plug or glow plug. This makes hydrogen unsuitable as a main fuel for diesel engines. An alternative way to overcome this problem is to use hydrogen as an enrichment or induction where diesel is used as a pilot fuel for ignition. Hydrogen is mixed with air or injected in the intake manifold before entering combustion chamber. Small amount of diesel fuel as the pilot fuel is injected to promote ignition.
1.2 PROBLEM STATEMENT

The urge to find an alternative fuel has taken a major interest on researchers throughout the whole world. It is not only to reduce the rate of pollution but also a fuel that can replace the conventional fuel nowadays which is fossil fuel. The question of how long will the fossil fuel will last is a big question mark. No one knows how much oil is left that can be feasibly extracted in the whole world. Organization of the Petroleum Exporting Countries (OPEC) producers keeps it a big secret, as they don’t want to disclose how much oil they have found or think they will find. Many think that the world is rapidly reaching the point where the growth in new supplies of oil cannot keep up with the pace of oil depletion. Estimate from international organisation suggest that if the world’s demand continues at the present rate that oil and gas reserves may run out within some of our lifetimes. Coal is expected to last longer.

<table>
<thead>
<tr>
<th>Fossil fuel</th>
<th>Time left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil</td>
<td>50 years</td>
</tr>
<tr>
<td>Natural gas</td>
<td>70 years</td>
</tr>
<tr>
<td>Coal</td>
<td>250 years</td>
</tr>
</tbody>
</table>

Table 1.1 Estimated length of time left for fossil fuels

A preparation is need to overcome the situation on fossil fuel depletion. More or less reserve fossil fuel, still one day the reserve will be dry out. Hydrogen which is known nowadays to all researchers as one of the alternative fuel that one day will replace the conventional fuel. Researchers have carried a lot of experiment on hydrogen to become fuel in a conventional engine. Not only to observed hydrogen as fuel but also the effect of using hydrogen on the environment. Conventional fuel use nowadays produce a lot of dangerous gases after combustion and harmful to the environment. Hence, a new and clean source of fuel has to replace fossil fuel.
1.3 OBJECTIVES

The studies objective is:
   i. To investigate the effect of hydrogen in diesel engine.
   ii. Performance of engine with and without hydrogen.

1.4 SCOPES

The main scopes of this study are:
   i. Study is done base on single cylinder diesel engine.
   ii. Various engine speeds is tested when hydrogen is applied.
   iii. Three mass fraction of hydrogen is studied in simulation.
   v. To compare previous research done on hydrogen.

1.5 PROJECT METHODOLOGY

The project methodology is briefly described in the flow chart in Figure 1.1, project methodology can be simple describe as follow:
   i. Setting up the one dimensional simulation in GT Power software
   ii. Analyze the scopes by establishing minimum and maximum range of indicated variable.
   iii. Compared result with different experiment.

1.6 HYPHOTESIS

Hydrogen addition in combustion will increase the engine performance and reducing the emission.