1 INTRODUCTION

1.1 Motivation and statement of problem
The most effective source of power nowadays is oil fuel power which extracted from petroleum or also known as fossil fuel. This source of power is proven efficient, easy to find and use also comes in affordable price. It is also an important source of power because almost all technologies either old or recently created are using this type of energy to be functioning. As it is our strength, it is also our weaknesses as we highly depend on the fossil fuel. Fossil fuel is not a source that can be generated by technologies, it can only produced by nature. However, nature requires million of years to produce fossil fuel. As the time goes by, it will be completely depleted. To overcome this dire situation, researchers all over the world are focusing on finding new type of energy that is efficient and feasible, which still in questions, except for nuclear power. Still, nuclear power technology is not accessible to many countries and it also comes with great risk. This is the reason this study was conducted, to prolong the fossil fuel era to give more time for the world to find an efficient source of energy that can be used like oil fuel energy. The aim of this study is to develop a new type of fuel, emulsion fuel. Emulsion fuel is a combination of conventional fuel with water. This kind of fuel will reduce the consumption of oil and at the same time will give more energy. Emulsion fuel is also giving a cleaner combustion than the conventional fuel. Emulsion fuel needs an element to mix and stabilize the water and oil together, that element is emulsifier. Emulsifier will act like an adhesive to combine the water and oil. The emulsifiers we use in this are SPAN-80 and LSWR.

1.2 Objectives
The following are the objectives of this research:

i) To find the most stable emulsifier, water in oil (w/o) ratio and emulsifier percentage.

ii) Analyzing characterization of the emulsion fuel.

iii) To analyze the difference of the combustion between emulsion fuel and conventional oil.
1.3 Scope of this research

The following are the scope of this research:

i) To find either SPAN-80 or LSWR is the most stable emulsifier by conducting stability test with different water in oil ratio and emulsifier percentage.

ii) To find the emulsion fuel characterization by using viscometer to find the shear stress, shear rate, viscosity, tensiometer to analyze the surface tension and interfacial tension, and by using microscope with 10x lens to check the water droplets size.

iii) Using gas burner to analyze the difference between conventional fuel and emulsion fuel created.

1.4 Main contribution of this work

The following are the contributions of this research:

i) Produce a better combustion type of fuel, emulsion fuel provide better combustion hence more power than conventional fuel.

ii) Roughly can save a lot of oil fuel and extend the source life.

iii) Environmental friendly, as better combustion provide cleaner combustion. Thus, reduce the NO and CO produce.
2 LITERATURE REVIEW

2.1 Low Sulphur Wax Residue (LSWR)

LSWR is a side product produced in the crude oil refinery. The crude oil come with an amount of water in it and been removes for corrosion protection in the pipeline. This LSWR, asphaltene and resin in crude oil are believed as the stabilizer for the water in the crude oil. From M. A. Manan, A. R. A. Razak and A.T. Sulai, LSWR is the lowest and the last fraction of refinery products of crude oil. This residual material produced at a temperature of about 3600°C and filtering on. In both room temperature and operating temperature, it is a solid because its pour point is in between 48 to 51°C.

Studies of chemical composition and physical properties of the material balance show that the LSWR suitable and safe for use as a fuel source because it complies with the permitted range of specifications. However, the problems are the pour point and high wax content requires a suitable method for handling LSWR as a fuel.

![Figure 2-1.1: kinematic viscosity, cSt VS temperature. (Source: LSWR Minyak Tapis Blend di Loji Penapisan Kerteh)](image-url)