SUPERVISOR DECLARATION

"I hereby declare that I have read this thesis and in my opinion this report is sufficient in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering (Plant and Maintenance)"

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OPTIMIZATION OF ORGANIC CANDLE GREEN PRODUCTION FROM WASTE COOKING OIL (EFFECT OF RATIO OF OIL CRYSTALLIZER TO WASTE COOKING OIL)

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DECLARATION

"I hereby declare that the work in this report is my own except for summaries and quotations which have been duly acknowledged."

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DEDICATION

I dedicated this report to my beloved parents

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ABSTRACT

Nowadays, the habits of dumping waste cooking oil from homes and restaurant becomes one of the most critical problem which cause blockage and pollution to the river and sewage. The problem happens when the management of this waste is inherently messy and resulting in spillage and cause impacts to drainage and water system. Thus, when the drainage is blocked, extra costs are requires for the clean-up process of sewer overflows which could result in potential environmental health hazards. Hence, to help in solving this problem, the idea of producing an organic candle from waste cooking oil was proposed. Organic candle is refer to a candle which made from natural resources comes from plants, insects and animals waxes. As the cooking oil is made from vegetable fats, the properties are suitable to become one of the raw material needed in producing the organic candles. Thus, the aim for this project is to determine the optimal production capacity from waste cooking oil by analyzing the mixture ratio of waste cooking oil and the oil crystallizer. Generally, the experiment was conducted by adding the oil crystallizer into the waste cooking oil. There is one type of oil crystallizer used in this experiment which is 12-hydroxystearic acid (12HSA). The function of oil crystallizer is to solidify the cooking oil. Moreover, the safety analysis on the impact of combustion also conducted to ensure the soot produced during the burning of the organic candle is safe and 100% organic.

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ABSTRAK

Pada masa kini, tabiat pembuangan sisa minyak masak dari rumah dan restoran menjadi salah satu masalah yang paling kritikal yang menyebabkan tersumbat dan pencemaran kepada sungai dan kumbahan. Masalah ini berlaku apabila pengurusan sisa ini pada asasnya tidak kemas dan menyebabkan tumpahan dan menyebabkan kesan kepada sistem perparitan dan air. Oleh itu, apabila saliran tersumbat, kos tambahan yang memerlukan untuk proses pembersihan dari limpahan pembetung yang boleh menyebabkan bahaya kesihatan alam sekitar yang berpotensi. oleh itu, untuk membantu dalam menyelesaikan masalah ini, idea menghasilkan lilin organik daripada sisa minyak masak telah dicadangkan. Lilin organik adalah merujuk kepada lilin yang diperbuat daripada sumber semula jadi berasal dari tumbuh-tumbuhan, serangga dan haiwan wax. Sebagai minyak masak itu dibuat daripada lemak sayuran, sifat-sifat yang sesuai untuk menjadi salah satu bahan mentah yang diperlukan dalam menghasilkan lilin organik. Oleh itu, tujuan projek ini adalah untuk menentukan kapasiti pengeluaran yang optimum daripada sisa minyak masak dengan menganalisa nisbah campuran sisa minyak masak dan penghablur minyak. Secara umumnya, eksperimen telah dijalankan dengan menambah penghablur minyak ke dalam sisa minyak masak. Terdapat satu jenis penghablur minyak yang digunakan dalam eksperimen ini iaitu 12-hydroxystearic asid (12hsa). Fungsi penghablur minyak adalah untuk mengukuhkan minyak masak. Selain itu, analisis keselamatan pada kesan pembakaran juga dijalankan untuk memastikan jelaga yang dihasilkan semasa pembakaran lilin organik adalah selamat dan 100% organik.

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CHAPTER 1

INTRODUCTION

This chapter provides the background of the research study, problem statement, objectives, scope and research outline.

1.1 BACKGROUND

Nowadays, to get an excellent presentation of food, oil frying method is used due to its contribution of good taste, attractive colour and better presentation. However, as the popularity of this method increases, the accumulation of waste generated from cooking oil also increases. It was reported that waste cooking oil is extensively produced all over the world. European Union produces around 700,000-1,000,000 tonnes waste cooking oil annually, inclusive of the oils from snack food and French fries. It was estimated that there were 40,000 tonnes per year of waste cooking oil produced in Asia countries such as China, Malaysia, Indonesia, Thailand, Hong Kong and India (Hanisah et al., 2013).

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The uses of cooking oil at home, restaurant or other related industry need proper management because fat and grease contains in waste cooking oil can cause a great problems when it is disposed of down the kitchen sinks and drain. In addition, when these elements enter rainwater pipes or gullies, it sticks to the inner lining of drainage pipes and restricts the wastewater flow causing the pipes to block. In more severe cases, the waste cooking oil flow into the river and streams and causing pollution and harm to aquatic life.

According to Kabir et al. (2014), discharge of waste cooking oil into waters change the oxygenation process and destroy the aquatic lives in the marine environment. This problem occurs when a layer of discharge oil covered the water surface and prevents oxygen dissolution. Therefore, when the by-products of oil degradation mixed with water, it increases the chemical oxygen demand (COD) and contaminates the water to be toxic. As a result, the aquatic lives absorbed poisonous compounds from the polluted water and later returned to human through food chain.

In addition, several operation and maintenance problems also occur when the waste cooking oil emptied into drainage system. The effect starts when the waste cooking oil gathers and solidifies inside the drainage system to deny the sewage from flowing freely to the wastewater treatment plant. When the sewage is blocked, extra costs are requires for the clean-up process of sewer overflows which could result in potential environmental health hazards (Kabir et al., 2014).

As a conclusion, in order to overcome the problem, the government should supports on recycling the waste cooking oil as it reduces the dependency on landfill sites and the use of fossil fuels for energy generation. In addition, by recycling the waste cooking oil, it also helps to safe environment and human health as well as reducing the major causes of costly sewer maintenance.

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1.2 PROBLEM STATEMENT

The habits of dumping waste cooking oil down the sink or drains can cause waste to congeal and block public sewers. In addition, the polluted sewage then spill into rivers and streams. Untreated sewage effluent and waste oil in the water causes dissolved oxygen level to drop drastically, thus the sewage fungus starts to cover the water like a blanket and in more severe case, the river can no longer support living organism around the water. The idea of using waste cooking oil to make an organic candle not only help to a safer environment but it also gives great benefits to human. Nowadays people tend to use organic candles compared to paraffin wax candles. Truly, the paraffin wax candle releases carcinogenic chemicals when burned and the soot or fume produced are similar to that released from a diesel engine and it can be as dangerous as a cigarette smoke. Finally, this situation can contribute to cancer and serious respiratory issues like asthma.

1.2.1 Objectives

a) To study the production process of making an organic candle from waste cooking oil and oil crystallizer.
b) To determine the optimal production capacity of organic candles from waste cooking oil by analyzing the mixture ratio of waste cooking oil and the oil crystallizer.
c) To evaluate the safety analysis on the impact of combustion and emission to human and environment by analyzing the soot and black carbon release, burning time and smell from the organic candles.

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1.2.2 Scope

The project is mainly focused on how waste cooking oil can be optimized to be recycled as an organic candle. An organic crystallizer will be used to solidify the cooking oil. Hence, the study and analysis on the crystallizer will be executed so that the ratio of the mixture is at optimum level. Next, the safety and impact of combustion of this candle will be evaluated to ensure that the organic candle is safe for human and environment.

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CHAPTER 2

LITERATURE REVIEW

This chapter described the existing case study and related information. The history of candles making production as well as candle properties such as wicks, incense, combustion product, safety and health will be discussed clearly in this section.

2.1 BACKGROUND OF CANDLE

According to Faraday (1861), in early history of candles development, besides their liturgical relevance, candles were predominantly used as a source of light for over 5,000 years. One of the first inventions in human history was candle and the first "wicks" candles were created in Ancient Rome. Candle making became a popular occupation in the Middle Ages as evidenced by the creation of many candle makers guilds throughout Europe. Basically, candle making depends on the natural resources available to that region. The art of candle making has remained amazingly similar to the original production even though the materials that encompass a candle have changed through the years.

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In the early of Roman and Egyptian times, candles originally were made up from tallow which was extracted from cattle and sheep which burned poorly and unfortunately producing quite an unpleasant smell. Upon this happen, the introduction of candles made from beeswax were greatly accepted due to structure of beeswax which burned cleanly and did not omit any odours and produce less smoke. However, because beeswax was a much scarcer resource than tallow, it became more of a candle for the opulent, and tallow was the common household candle.

Willhoft and Horn (2000) stated that in early Chinese candles were made up from an indigenous insect that was combined with seeds. The candles have been molded in paper tubes and the wick was made from rolled rice paper. In Japan, candles were made of wax extracted from tree nuts while in India fruit of the cinnamon tree was boiled to make candle wax. Nevertheless, candles starts to gained fragrance and strength in the middle of 1600s when bayberry wax was discovered by the settlers around Cape Cod Bay.

The bayberry bush grows wild in bogs and costal swamplands from New England to Louisiana. Usually, women and children gathered and dumped the grayish white berries into a boiling pot and they skimmed the aromatic greenish gray wax and added it to the tallow. Bayberry wax has a higher melting point than tallow and it makes the candles less prone to bending. However the process of making the bayberry wax was very tedious and tiresome

In the middle of 1700s, the first large scale improvement in candle making was brought via a by-product of America's fledgling whaling industry. The whale men discovered that spermaceti oil from the head cavity of a sperm whale contains a waxy component. It became the accepted standard for photometry because when it is rendered into wax, the spermaceti hardened, burned brightly and smells better than tallow and beeswax. Unfortunately, because of the prices is expensive, only the affluent could afford them (Wikipedia.com).

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