UNIVERSITI TEKNIKAL MALAYSIA MELAKA

IMPROVEMENT AND ANALYSIS OF COOLING SYSTEM FOR MOTORCYCLE JACKET BY USING PHASE CHANGE MATERIAL

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Automotive) with Honours.

by

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APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Automotive) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Projek ini adalah tentang peningkatan dan analisis penyejukan untuk jaket motosikal untuk mengurangkan suhu di dalam jaket motosikal dan memberikan perjalanan yang selesa untuk penunggang kerana kini pemanasan global menjadi isu serius di Malaysia. Jenis jaket motosikal yang digunakan ialah jaket kulit. Percubaan pertama akan menguji sejauh mana tinggi suhu dalam jaket motosikal sebelum dan selepas menggunakan bahan perubahan fasa. Bahan perubahan fasa jenis akan digunakan ialah lilin parafin. Dengan menggunakan lilin parafin, ia akan menurunkan suhu untuk bahagian tubuh penunggang di dalam jaket motosikal. Fabrikasi juga termasuk dalam eksperimen ini tentang bagaimana dan di mana lilin parafin akan diletakkan dan kawasan tubuh manusia yang tepat akan diuji. Hasilnya membuktikan bahawa lilin parafin adalah bahan yang dapat menurunkan suhu suhu di dalam jaket menunggang.

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ABSTRACT

This project is about improve and analysis of cooling for motorcycle jacket to decrease the temperature inside the motorcycle jacket and give comfortable ride for rider because nowadays the global warming become serious issue in Malaysia. The type of motorcycle jacket to be use is the leather jacket. First experiment will test on how high temperature inside motorcycle jacket before is and after using phase change material. The type phase change material will be used is paraffin wax. By using the paraffin wax, it will lower down the temperature for rider body parts inside the motorcycle jacket. Fabrication is also included on this experiment on how and where the paraffin wax will be put, and the exact area of human body will be testing. The results show proven that paraffin wax is a material can lower down temperature the temperature inside the riding jacket.

DEDICATION

To my beloved parents Mohd Kamal Haslin Bin Abdul Karim and Siti Rosemala Binti Yunos for giving me the support and strength of my journey at UTeM. I am eternally grateful at them and will repay them back with my success.

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LIST OF SYMBOLS

F	-	Force
g	-	Gravity = 9.81 m/s
I	-	Moment of inertia
Wt%	-	Weight percentage
^{o}C	-	Celsius
KJ/g	-	Kilojoule/gram
g/cm^3	-	Gram/centimetre
$J\ g^{-1}\ k^{-1}$	-	Joules per gram kelvin
KJ/kg*K	-	Kilo joule/kilogram*kelvin
T	-	Torque
V	-	Velocity
w	-	Angular velocity
x	-	Displacement

LIST OF ABBREVIATIONS

NMP	N-methyl-2-pyrrolidone
DMA	Dimethylacetamide
Km	Kilometre
Min	Minute
K	Kelvin
Kg	Kilogram
kJ	Kilo Joule
Cm	Centimetre
°C	Celsius
Wt	Weight percentage
G	Gram
MAIDS	The Motorcycle Accident In-Depth study

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter will discuss about the background of the product and material. This chapter is including the problem statement of the project. Then, the chapter also have objectives to solve the problem and lastly in this chapter are work scope of the project is about to design and study of the product.

1.2 Background

Paraffin wax, colourless or white, somewhat translucent, hard wax consisting of a mixture of solid straight-chain hydrocarbons ranging in melting point from about 48°C to 66°C (120° to 150°F) (Encyclopaedia Britannica Online et al., 2008). The solubility of a paraffin wax (melting point 42–43°C) in various base oils was studied at wax concentrations up to 50 wt% (Malik et al., 1993). There are two distinct regimes of the solubility behaviours which the first is relation between cloud point and wax concentration was hyperbolic and the second one is the relation was linear. Solvent extraction technique has been used to separate paraffin wax grades with different characteristics from El-Ameria light, middle and heavy slack waxes. The wax de oiling has been done by solvent extraction at different extraction temperatures and different solvent feed ratios (S/F by weight). The extraction solvents used are furfural, N-methyl-2-pyrrolidone (NMP) and N, N, dimethylacetamide (DMA) (Magdy et al., 2011). The phase change materials (PCMs) have the appropriate properties for controlling heat strain.

One of the well-known PCMs is paraffin (Saied et al., 2016). Phase change material such as paraffin wax has very low thermal conductivity which leads to many defects upon its practical utilization in thermal energy storage system (Gulfam et al., 2016). The amount of energy to change the phase of any compound is little yet effective. The paraffin wax is melting by absorbing heat from the body.

This chapter introduces the subject matter and problems being studied and indicates its importance and validity. Introduction is the first part of a thesis and allows the readers to get the general idea of what the thesis is about. It also acquaints the readers with the thesis topic, explaining the basic points of the research and pointing the direction of the research. Introduction sets out the hypotheses to be tested and research objectives to be attained. It is important to remember that the research objectives stated in the thesis should match the findings of the study. Failing to do so could result a recommendation by the examiners to conduct additional studies so that the stated objectives are met.

The purpose of motorcycle clothing is to protect the motorcyclist not only against weather conditions but also against an unforeseen contact with other objects (Magdalena 2016). Motorcyclist's body clothing is related with overheating especially in summer.

The six fundamental parameters in the classic heat balance model of human thermal comfort, metabolic rate is probably the most important and yet it is the most crudely assessed in both research and practice. Most studies in thermal comfort domain to date have relied on simple activity diaries to estimate metabolic rate (Maohui et al., 2018). In underground confined spaces with a crowded population, the thermal environment will be hot-humid and occurred with high CO_2 concentration (Maohui et al., 2018). Thermal comfort studies on relies on simple activity to estimate metabolic rate.

Climate change is the biggest threat to nature and humanity in the 21st century. Climate change means annual temperature of the earth has swung up and down by several degrees Celsius over the past million years. Temperature records in the past 30 to 50 years have shown warming trends in most places including Malaysia (Haliza, 2009).

1.3 Statement of the Purpose

Limited studies have been reported on the solubility behaviour of waxes in undefined mixtures in petroleum fractions, in crude oil and in kerosene. The maximum wax concentration in this study was limited by the solubility equilibrium temperature of the sample, which was equal to the melting point of the wax (Malik et al., 1992).

Heat is considered as one of the harmful agents in many workplaces. The heat exposure will initially create the heat strain but in long-term exposures, it will cause some problems such as muscle cramps, heat stroke, heat syncope, heat exhaustion, less productivity, more accident rate and less safety level in workplaces (Saeid et al., 2016).

Climate change is considered to be one of the biggest threats facing nature and humanity today. It is an undeniable, pervasive, and insidious planetary crisis that affects every aspect of our lives and future (Haliza, 2009).

1.4 Project Objective

The objective of this project is consisting of:

1. To fabricate leather jacket with paraffin wax built inside it.
2. To analysis the heat surrounding leather jacket while wearing it and evaluation of its effectiveness under hot weather conditions.

1.5 Scope

The scope of this project consists of:

1. Fabricate motorcycle jacket merging with phase change material.
2. Analysis the data accumulated during the field test.
3. Field test on wearing leather jacket using phase change material.