PERFORMANCE OF TURMERIC AS WCO GREEN PRINTING PRODUCT

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BACHELOR OF MANUFACTURING ENGINEERING TECHNOLOGY (PROCESS AND TECHNOLOGY) WITH HONOURS

2022

Faculty of Mechanical and Manufacturing Engineering Technology

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A thesis submitted
in fulfillment of the requirements for the degree of
Bachelor Manufacturing Engineering Technology (Process and Technology) with Honours

Faculty of Mechanical and Manufacturing Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2022

DECLARATION

I declare that this project entitled "Performance of Turmeric as WCO Green Printing Product" is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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APPROVAL

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor of Manufacturing Engineering Technology (Process and Technology) with Honours.

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Date : 14/1/2022

DEDICATION

First and foremost, I want to thank God for the opportunity to complete this endeavour. Next, I'd like to thank my beloved parents and family. They have been incredibly compassionate and supportive of me since the day I started attending this university until today.

ABSTRACT

This study focuses on the substitution of digital printing ink components. Because of the current state of the environment, minor advancements such as green printer ink development have been a focus of this investigation. The release of VOCs from oil-based ink is one of the strongest motivators for developing a green printing ink that contributes little or nil to environmental contamination. Wasted cooking oil (WCO) was used as a cover to remove the VOCs, and natural sources, for example, went about as shade colourants, were investigated to demonstrate the qualities and reasonableness. WCO was chosen because it also promotes a decrease in WCO removal. The methodology used in this study began with WCO filtration and purification via transesterification. The proportion was chosen to ensure the quality of the methyl ester supplied. The normal source chosen for this study was reduced to one containing natural colourant. The turmeric extract is converted into the colourant component for this ink detailing during the extraction process. BHT with a new proportion of use was added as a new substance in this ink scheme. Everything being equal, the ink detailing was made and delivered as GPi near the end. A few tests have been conducted in order to validate the plan's outcome. Viscotester, FTIR, and Visual Observation are the testing methods. Waste Cooking Oil (WCO) is used to replace petroleum-based binders in the production of printing ink. Turmeric is used as a yellow colourant in the printing ink, which is derived from natural sources. Vehicles or binders, natural colourants, solvents, and additives are among the components required to create green printing ink. The materials' composition will be done to demonstrate the properties of both natural sources, and a few tests will be performed to observe and analyse the findings.

ABSTRAK

Kajian ini memberi tumpuan kepada penggantian komponen dakwat percetakan digital. Kerana keadaan persekitaran semasa, kemajuan kecil seperti pengembangan dakwat pencetak hijau menjadi tumpuan penyelidikan ini. Pelepasan VOC dari dakwat berasaskan minyak adalah salah satu pendorong kuat untuk mengembangkan dakwat percetakan hijau yang menyumbang sedikit atau nol kepada pencemaran alam sekitar. Minyak masak terbuang (WCO) digunakan sebagai penutup untuk menghilangkan VOC, dan sumber semula jadi, misalnya, digunakan sebagai warna pewarna, disiasat untuk menunjukkan kualiti dan kewajaran. WCO dipilih kerana ia juga mendorong penurunan penyingkiran WCO. Metodologi yang digunakan dalam kajian ini bermula dengan penyaringan dan pemurnian WCO melalui transesterifikasi. Bahagian tersebut dipilih untuk memastikan kualiti metil ester yang dibekalkan. Sumber normal yang dipilih untuk kajian ini dikurangkan menjadi sumber yang mengandungi pewarna semula jadi. Ekstrak kunyit ditukar menjadi komponen pewarna untuk dakwat ini secara terperinci semasa proses pengekstrakan. BHT dengan perkadaran penggunaan baru ditambahkan sebagai bahan baru dalam skema dakwat ini. Semuanya sama, perincian dakwat dibuat dan dihantar sebagai GPi hampir ke penghujungnya. Beberapa ujian telah dilakukan untuk mengesahkan hasil rancangan tersebut. Viscotester, FTIR, dan Visual Observation adalah kaedah pengujian. Waste Cooking Oil (WCO) digunakan untuk menggantikan pengikat berasaskan petroleum dalam penghasilan dakwat percetakan. Kunyit digunakan sebagai pewarna kuning dalam dakwat percetakan, yang berasal dari sumber semula jadi. Kenderaan atau pengikat, pewarna semula jadi, pelarut, dan bahan tambahan adalah antara komponen yang diperlukan untuk membuat dakwat percetakan hijau. Komposisi bahan akan dilakukan untuk menunjukkan sifat kedua sumber semula jadi, dan beberapa ujian akan dilakukan untuk memerhatikan dan menganalisis penemuan tersebut.

ACKNOWLEDGEMENTS

First and foremost, I thank God for making my thesis journey simpler. I am grateful to and would like to express my heartfelt appreciation to my supervisor, Assoc. Prof. Ts. Dr. Zulkifli Bin Mohd Rosli, for his initial ideas, invaluable guidance, continuous encouragement, and unwavering support in making this research possible. He has always impressed me with his professionalism. His time and efforts were invaluable during the thesis preparation process, and they will not be forgotten. I'd also like to thank everyone who contributed with the project's execution at Universiti Teknologi Malaysia Melaka (UTeM).

I would like to thank my family members for always offering words of support when I was feeling bad. Without them, I am nothing and have no meaning. I would also like to thank my group members for their friendship and assistance in problem solving, as well as for sharing their knowledge of experimental apparatus and machine systems. Finally, I want to thank my supervisor and my family for their unwavering support and believe in my efforts. Thank you to everyone who helped me finish my thesis who went unmentioned. Your assistance will be remembered forever and god bless you.

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LIST OF SYMBOLS AND ABBREVIATIONS

FTIR	-	Fourier transform infrared spectroscopy
WCO	-	Waste cooking oil
BHT	-	Butylated Hydroxytoluene
ASTM	-	American Society for Testing and Material
CH_3OH	-	Methanol
VOC	-	Volatile organic compound
EU	-	European Union
ml	-	Millilitre
°C	-	Degree Celcius
%	-	Percent

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CHAPTER 1

INTRODUCTION

1.1 Background Study

In this era of globalization, atmospheric pollution has been identified as the most important pollution in the world, as it contributes to the thinning of the ozone layer, which then contributes to global warming. Volatile Organic Compound (VOC) contamination is the most dangerous form of pollution. Solids and liquids release volatile organic compounds (VOC) as gases. Many production firms are currently using huge quantities of chemical-contained VOC which can have both short- and long-term negative health effects.

The ink printing industry is one of the most famous producers of VOC-containing products. Linseed oil, soybean oil and a strong petroleum distillate as a solvent (called the vehicle) along with organic pigments are most common ingredients in printing inks. The heavy petroleum oil in printing ink has the potential to damage the environment.

When ink is disposed of volatile organic compounds (VOCs) and heavy metals in it can pollute the soil even water. The pigments are made up salts of multiring nitrogen-containing compounds (dyes) like a yellow lake, peacock blue, phthalocyanine green and diarylide orange according to Steve Ritter (1998). To a lesser degree inorganic pigments are still used in printing inks. Chrome green (Cr2O3), Prussian blue (Fe4[Fe (CN)6]3), cadmium yellow (CdS), and molybdate orange are few examples (a mix of lead chromate, molybdate, and sulfate).

This ink is made for several purposes, including documentation, packaging, and improving the appearance of a product. Printing inks have now become an essential item for teachers, workplaces and schools in their everyday lives. As a result, it plays an important role in our daily lives. Many researchers have discovered alternative ways to protect the environment by making green printing. The issue focuses on the VOC content of ink processing, eco-friendly disposal ink that is100 % yellow and the reuse of waste cooking oil. Waste cooking oil can be used as an alternative to petroleum as a bender.

Oil-based ink has been shown to decrease VOC emissions during the printing process. As a result, the focus of this research will be on the characterization of the natural source properties for digital printing ink produced from waste cooking, oil-based yellow pigment in able to produce green printing. The yellowish colour comes from organic turmeric.

1.2 Problem Statement

Printing ink can release fugitive volatile organic compounds (VOCs). Furthermore, many individual components of VOCs have been classified as hazardous air contaminants (HAPs) under the 1990 Clean Air Act Amendments and thus require regulation. Linseed oil, soybean oil and a strong petroleum distillate as solvent (called the vehicle) along by organic pigments are most common ingredients in printing inks. The heavy petroleum oil in printing ink can be harmful for the environment. When volatile organic compounds (VOCs) as well as heavy metals in ink are released it can pollute the soil even the water.

Many researchers have discovered alternative ways to protect the environment by making green printing. The issue highlighted in this study is the VOC content in ink processing, eco-friendly disposal ink that is 100% yellow and the reuse of waste cooking oil. The ink-based has been researched and checked so it can be replaced with waste cooking oil through a chemical reaction known as transesterification. Thus, the research will aim to characterize the natural source properties for digital printing ink made from waste cooking oil-based yellow colourant to produce green printing.

1.3 Objective

The objectives for this study are:

i. To investigate the performance of turmeric properties as natural ink as a green printing product.

ii. To analyze the ability of waste cooking oil as binders to substitute the petroleum-based.

1.4 Scope

The research aims are to characterize the natural source properties for digital printing ink made from waste cooking oil-based yellow colourant to produce green printing. Filtration and oil purification are conducted on used cooking oil. The natural colour extract would go through a phase with treated waste cooking oil. To achieve the perfect colour of digital printing ink, the colourant will be observed and characterize by various tests such as viscosity, concentration and so on.

1.5 Summary

In summary, this chapter discusses the overall processes and objectives of this report. It began with the study's scope which discussed the significance of green printing ink, followed by problem statements, objectives, and the scope of the study. The research will aim to characterize the natural source properties for digital printing ink made from waste cooking oil-based yellow colourant to produce green printing. This research would also re-formulate the previous green printing ink without the addition of any chemicals, result in 100% green printing, digital ink that is also eco-friendly.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In new global economy, green printing product analysis will go into greater detail about research done in this chapter. The analysis will go into greater detail about the research done in this chapter. The review consists of studies on the principle as well as the requirements of the materials used in the manufacturing process of this green printing ink. Waste cooking oil (WCO) is the most generally used vehicle in manufacture of green printing ink. Since heavy vehicles such as petroleum-based ink are still used in this period waste cooking oil (WCO) is used in this research to reduce Volatile Organic Components (VOCs) which have negative environmental effects. To determine the composition of green printing ink, raw materials, substances, methods and manufacturing will be examined. To produce ink able to understand and analyses processes as well as describe the properties of the formulation. The extraction of yellow colour from natural sources was also reviewed with waste cooking oil (WCO) to produce ink.

2.2 Digital Printing Ink

Studies have found that digital printing ink play an important in any daily lifestyle, such as magazines, books, and newspaper. Printing ink is a liquid and paste that includes pigments as well as dyes used in the printing process. Ink is a type of pigment that dissolves in a solvent. Author researched that about 4500 years ago, the first man made ink appeared in Egypt and it be made from animal or vegetables charcoal (lampblack) combined with glue. Inks were made from fruit and vegetable juices, defensive secretions along with cephalopods such as cuttlefish, octopus' blood from certain shellfish or tannin from tree galls, nuts and bark (Steve Ritter, 1998).

Many printing ink firms have switched their focus toward eco-friendly inks in recent years. Aside from resource scarcity or a higher legislative burden, drivers for this growth include increased environmental consciousness among population and as a result rising demand for inks with low environmental footmark. As a result, UV-curing and water-based processes have begun to replace the solvent-based inks resulting in a reduction for volatile organic compounds (VOC) produced during the printing process. Furthermore, products extracted from renewable resources is increasingly being polymeric binders, solvents, and other additives are used to replace petrochemical ink constituents such as polymeric binders, solvents, and other additives.

The above advancements also coincide with an economic advantage as the inks allow reduced drying times or lower equipment costs the name a few. Despite this many inks are still primarily made from petrochemical feedstock. This analysis provides an overview recent development in the field of printing inks derived along as renewable materials, examines the benefits with disadvantages of the systems mentioned and addresses outstanding issues. Unlike paint films inks is very thin ranging from 2 to 30μm turn on the print process.

If an ink's primary functions are transmitting a message to decorate it is worthless if it would not move to substrate or stick satisfactorily after printing. In addition to its visual features, an ink is made to print in a certain way, dry under specific conditions, adhere to a given substrate, and have specific resistance properties dictated by intermediate processing and final end usage of the printed content.

2.2.1 The Adhesive Nature of Printing Inks

Among the most basic functions of an ink is to adhere and tie the colourant the substrate on which it is printed and hold it there over the lifetime of the printed product. Colourants have little to no effect on the adhesive quality of inks, however if are not adequately bonded by the vehicle, potentially due to inadequate dispersion, the ink will not adhere strongly. The type of resin used in ink can to a large extent decide its adhesive properties on absorbent substrates. The degree of ink penetration affects adhesion.

Pigments does not absorb well and it too much resin is drawn into the substrate the pigment can become under bound. On these conditions pigment will powder off. Adhesion on non-absorbent surfaces is largely governed by the resin's ability to form films as well as its molecular affinity for the substrate. The choice of resin for specific substrate is thus crucial, even though its output can be altered using other approaches. The right solvent mixture will improve adhesion by improving substrate wetting and flow-out.

Surface, active and chemical additives may also have an effect on adhesive properties. These materials alter the surface of the substrate as a result of a chemical reaction or physical interaction.

2.2.2 Printing Ink Resistance Properties

Throughout their 'lifespan,' every ink must withstand various types of chemical and physical attack. To begin with, the raw ingredients must be able to resist the manufacturing process use to make the ink. After being prepared, the ink must be able to withstand the rigours of the printing process. In lithographic printing, for example, it may have to work in the presence of corrosive solutions and under high shear conditions.

In order to print, the ink may have to survive abrasion further processing such as cutting, creasing, gluing, shaping until the printed article is finished and ready for use. After that, the ink film can be exposed to new factors such as abrasive filling and heat sealing with heated jaws in direct contact with the ink film. The ink may also be required to withstand the chemical nature of packaged product as well as the environmental circumstances under which its placed. In order to survive in nature inks must have unique chemical and physical resistance properties.

i. Heat Resistance

Printed packages must often withstand high temperatures during processing and application, as well as the selection of resin pigment is vital to the ink's heat resistance properties. The heat resistance of pigments varies. Heat will make a colour dirty, strength loss and change the colour. Pigments should be examined and chosen to resist the temperatures encountered throughout the manufacturing process as well as the final use of the printed object.

ii. Abrasion Resistance

During their life cycle, majority not all printed papers is subjected to various types of rub or abrasion. Both printing inks designed with this in idea. The degree to which a dried ink sheet can endure abrasive pressures is significantly controlled by the level of pigment attachment. More resin present, the greater ink's abrasion resistance, the hardness or flexibility of ink film can affect its ability to withstand abrasion or mechanical wear. To improve the scuff resistance of waxes, for example, are ink additives that facilitate surface slip are widely used. Wax is present in the majority of printing inks.