A STUDY AND ANALYSIS OF COOKING OIL QUALITY DETERMINER BASED ON PLANAR ELECTROMAGNETIC SENSOR ARRAY

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To my lovely mother, who gave me endless love, trust, constant encouragement over the years, and for her prayers .To my Family, for their patience, support, love, and for enduring the ups and downs during the completion of this project report. This project report is dedicated to them.

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ABSTRACT

Oil palm cooking oil is one of the main foods ingredients in Malaysian food. Almost all recipes are using oil palm cooking oil to cook the food. That's make the oil palm cooking oil become the main material for making a food. In this project, determining the quality of oil palm cooking oil will be the main issue. Therefore, this project ambitious to invent a low cost system for detecting the tainted cooking oil. As a result, the planar electromagnetic sensor array is proposed. Furthermore, electrochemical impedance spectroscopic (EIS) approach can describe the variation and characteristic of the oil palm cooking oil sample. EIS is about impedance level affected by the sample that being testing. This project suggests an alternative method for the detection of tainted cooking oil by developing a sensor array with the combination of planar meander and interdigital electromagnetic sensors for cooking oil quality inspection. The main objective is to fabricate the sensor array using printed circuit board (PCB). To project will study and analyze the value of the planar sensor impedance (real and imaginary part) as a function of frequency when subjected to cooking oil samples. The relationship between permittivity and conductivity will be determined after the reference measurement is obtained first. That means every result from sample is compare to the good cooking oil sample as reference. A set of experiments were conducted to determine the relationship between the sensor's output and the cooking oil parameter. To complete this project, two major parts should be carried out which are the hardware setup and result analysis. The hardware part is to get the result from the testing sample by developed a complete set of sensor and equivalent circuit. In the result analysis, the value of impedance from LCR meter will be used to estimate the type of cooking oil.

ABSTRAK

Minyak asak kelapa sawit adalah salah satu makanan yang bahan-bahan utama dalam makanan Malaysia. Hampir semua resipi yang menggunakan minyak masak kelapa sawit untuk memasak makanan. Ia membuatkan minyak masak kelapa sawit menjadi bahan utama di dalam pembuatan makanan. Dalam projek ini, menentukan kualiti minyak masak kelapa sawit akan menjadi isu utama. Oleh itu, projek ini mencipta satu sitem yang jimat dalam mengesan minyak masak yang tercemar. Hasilnya, "planar electromagnetic sensor" dicadangkan. Tambahan pula, electrochemical impedance spectroscopy (EIS) boleh mengesan variasi dan ciri-ciri sampel minyak masak kelapa sawit. EIS adalah mengenai tahap impedans terjejas oleh sampel yang menjadi ujian. Projek ini mencadangkan kaedah lain untuk mengesan minyak masak yang tercemar dengan menghasilkan pelbagai sensor dengan gabungan Meander satah dan sensor elektromagnet interdigital untuk memantau kadar kualiti sesuatu minyak masak. Objektif utama adalah untuk merekacipta pelbagai sensor yang menggunakan papan litar bercetak (PCB). Hubungan antara ketelusan dan kekonduksian akan ditentukan selepas pengukuran rujukan diperolehi pertama. Ini bermakna setiap hasil daripada sampel adalah berbanding dengan sampel minyak masak yang baik sebagai rujukan. Satu set eksperimen telah dijalankan untuk menentukan hubungan antara output sensor dan parameter minyak masak. Untuk menyiapkan projek ini, dua bahagian utama perlu dilakukan iaitu persediaan perkakasan dan analisis keputusan. Bahagian perkakasan adalah untuk mendapatkan keputusan daripada sampel ujian dengan membangunkan satu set lengkap sensor dan litar setara. Dalam analisis keputusan, nilai impedans dari LCR meter akan digunakan untuk menganggar jenis minyak masak

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LIST OF ABBREVIATIONS

EIS   -   Electrochemical impedance spectroscopy

MUT   -   Measurement under Test

NDT   -   Non-Destructive Test

HPLC   -   High Performance Liquid Chromatography

GC   -   Gas Chromatography

TPC   -   Total Polar Compound

CHAPTER 1

INTRODUCTION

1.1   Introduction of sensor

Sensor is a device that detects the parameter of show the quantity of the measured parameter. Example of sensor is such thermocouples that detect and sense the changes in the temperature. A transducer is a device that converts non electrical parameters into electrical signal such as voltage and current that are proportional to the physical value parameters that are being measured. Usually a transducer involve a sensor and signal conditioning circuit or instruments in order to translate or to read the value of the measurement. Figure 1.1 shows the block diagram of transducer used in measurement.

Physical Parameter → Transducer → Signal Conditioning → Controller → Display Instruments

Figure 1.1: transducer used in measurement block diagram

1.2   Back Ground of study

The importance of cooking oil purity is becoming high, as during the past years its use has spread across various branches of consumer activity. To determine the quality of cooking oil is important for help preserve the high-quality cooking oils which often prone to be diluted with cheaper cooking. It also Purposely over used cooking oil is dangerous to the health. It increases the risks of diseases like hypertension, damage to liver, and cancer. There should be more efforts to curb the potentially dangerous practice of reselling used cooking oil from happening using modern technology.

Chemical have been used for almost all food industries. The purpose of chemical could be good or not is depending on the way to produce the food. Not ethical part is when the chemical is used for reimaging the food looks new. In this report, the problem of reimaging palm oil cooking oil is the issue. The chemical is used to make recycle palm oil cooking oil. In that stage, the tainted palm oil cooking oil is determine.

Palm oil cooking oil is having been use in almost all food. The possibility of people to get this bad effect from tainted cooking oil is open wide. The tainted occur is increasing from day to day. Due to this matter, an improve monitoring and understanding of purity of cooking oil is important in order to ensure the recycle tainted oil can be analyze and next to eliminate it. its essentials to study a major, minor and trace element in palm oil cooking oil in order to understand the factor of, adulteration, recycle or usage and the possible effect that can be occurred to food chain and food industries system

1.3   Objective of Study

Looking at important of the palm oil cooking oil quality for society healthcare, this research aims to achieve the following objective

i.   To design and fabricate new planar sensor based on the combination of meander and interdigital sensor

ii.   To investigate the characteristic of the new planar sensor array based on meander and interdigital sensor

iii.   To conduct experimental work to determine relationship between the sensor output and cooking oil parameter.

1.4   Scope of study

In order to achieve the objective of the project, that. To investigate the tainted palm oil cooking oil level due to manufacturer. The scope of the project need to be identified implemented to make sure the aim is archived. The scope of the project as follow: The scope is involving the study of sensor sensitivity by three different placement of the sensor array where the placements are parallel configuration, delta configuration and y configuration.

i.   Developing the experiment setup consist of frequency waveform generator as the input signal, signal oscilloscope to detect the output of the sensor and to develop output components analysis software by using lab view to study on the characteristic of the sensor.

ii.   Carry out set of experiment that will be conducted to determine the relationship between the sensor output and the palm oil cooking oil parameter, the suggested experiments is on the impedance versus frequency analysis.

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