

**MICROWAVE NON-DESTRUCTIVE
TESTING FOR PROCESSED AND
UNPROCESSED PALM OIL USING FREE
SPACE MICROWAVE MEASUREMENT
SYSTEM IN 18 – 26 GHz FREQUENCY
RANGE**

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ABSTRACT

This thesis presents the measurement and analysis at 18 – 26 GHz frequencies range for two difference sample oils, processed and unprocessed palm oil using free space microwave measurement (FSMM) system. The measurement system consist a pair of spot focusing horn lens antenna, mode transitions, coaxial cables, vector network analyzer (VNA) and computer. S-parameter measurements in free-space were measured by VNA system. Complex permittivity and loss factor of samples are calculated by Fortran PowerStation 4.0 software.

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CHAPTER 1

1. INTRODUCTION

In this chapter, the theory of the overall project is described briefly to provide an overview of the overall project. Also, the purpose of this project was included.

1.1 Background of the Project

Nondestructive testing (NDT) has a number of important roles to play in ensuring the quality and reliability of many important products. Thus, this can be defined as the testing of materials to detect internal and surfaces to discontinuities using methods which do not damage or destroy the material under test. There are five major NDT methods namely, Radiography, Ultrasonic, Magnetic Particles, Liquid Penetrant and Eddy Current [1]. Microwave nondestructive testing can be refer to electromagnetic testing conducted at frequencies in the microwave region [2]. The microwave frequencies region is between a few hundred MHz to a few hundred GHz and the corresponding wavelength in free space lie from 1 cm to 20 cm.

The processed and unprocessed palm oil was measured by using free space microwave measurement (FSMM) system in frequency range of 18 – 26 GHz. Free space microwave measurement (FSMM) system is a highly robust system for characterizing electromagnetic properties of materials. The electromagnetic properties are complex permittivity, complex permeability, reflection coefficients, transmission coefficients and other. The FSMM system consists of a pair of spot focusing horn lens antennas (transmitting and receiving), mode transitions, coaxial cables, vector network analyzer (VNA) and computer. There are main problems for determining dielectric properties of a material using free space microwave measurement (FSMM) system are due to inaccuracies in the measured S-parameters which normally are cause by diffraction effects at the ends of the sample, multiple reflection between the two antennas or objects