



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**FIBER OPTIC SENSOR (FOS) FOR ETHANOL DETECTION
AND OPTIMIZATION PERFORMANCE USING ANALYSIS
TECHNIQUE**

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronic Engineering Technology (Telecommunication) with Honours

by

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Engineering Technology departments of Electronic and Computer Engineering Technology.

.....

(Md Ashadi Bin Md Johari)

ABSTRACT

My project use optic fibre as main medium, however it was changed match become fibre optic sensor. Fiber optic sensor is one of the inside delivery medium telecommunication system. Nowadays, fiber optic much used in transmission system because of the time data is faster and less loss and interference. The fiber optic give many advantage although the cost is quit expensive. To prove the time increasing modem technology, fiber optic sensor be used other than usage information transmission line. As know, inside the electronic conventional component had a sensor but now create the difference used fiber optic as sensor. Therefore, ethanol had been choose as parameter experiment to detection and optimization. Ethanol is the liquid substance that not colouring, and some time is call as alcohol. Ethanol can cause the consumer lost mind control if drink it in certain rate. Sometime ethanol contents in liquor drink and the utilization in the field of medicine and usage in industry food. Apart It also much used in pharmacy medical industry and detergent ethanol give many advantage. To detect the concentration and optimization of ethanol used the DOE technique to get the result.

ABSTRAK

Projek saya menggunakan gentian optic sebagai medium utama, walaubagaimanapun ia telah diubah suai menjadi pengesan gentian optik. Gentian optic merupakan salah satu medium penghantaran didalam sistem telekomunikasi. Pada masa kini, gentian optik banyak digunakan dalam sistem penghantaran ini kerana jarak masa penghantaran data adalah lebih pantas dan kurang kehilangan serta gangguan. Ia juga mempunyai banyak kelebihan walaupun kadar kosnya agak mahal. Bagi membuktikan zaman semakin moden serta membangun pengesan gentian optic telah terbukti boleh diguna pakai selain dari penggunaan didalam talian penghantaran maklumat. Seperti yang kita tahu, didalam industri elektronik banyak menggunakan peranti pegesan sebagai satu alat, walaubagaimanapun gentian optic telah diolah menjadi alat pengesan bagi mengesan sesuatu bahan dan sebagainya. Oleh itu, saya telah memilih etanol sebagai bahan ujikaji bagi mengesan kandungan ethanol. Ethanol adalah satu bahan cecair yang tidak berwarna. Ia juga kadang kala dikenali sebagai alkohol. Ethanol boleh menyebabkan penggunaanya hilang kawalan fikiran jika meminumnya pada kadar tertentu. Ia terkandung dalam kandungan minuman keras serta penggunaan dalam bidang perubatan serta penggunaan dalam industri makanan. Selain itu juga ethanol banyak digunakan dalam penggunaan minyak wangi. Ia juga banyak digunakan dalam industri perubatan farmasi dan bahan pencuci. Dengan menggunakan teknik DOE kita akan mendapatkan peristasi etanol didalam ujikaji ini.

DEDICATION

First and foremost, I would like thank to ALLAH and my family. My father Ahmad Nizar Bin Zakaria and my mother Nor Aishah Binti Yunus for standing beside me throughout my study and writing this report. They have been my inspiration and motivation for continuing to improve my knowledge and move my study forward. To my beloved siblings always give support. I also thank my wonderful supervisor for always making me smile and for understanding and improve my project. I'd like to say thank trusting me develop the applications. I'd like to thank my friend , have always supported me throughout my study. I really appreciate that believed in me to provide the leadership and knowledge to make this report a reality

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LIST OF ABBREVIATIONS, SYMBOL AND NOMENCLATURE

LAN	Local Area Network
FOS	Fiber Optic Sensor
NRC	National Research Council
OPS	Organic Conducting Polymer
MPD	Modal Power Distribution
LED	Light Emitting Doide
ELED	Edge Emitting LED
SLED	Surface Emiting LED
LD	Laser Diode
ASE	Amplified Spontaneous Emission
OSA	Optical Spectrum Analyzer
%	Percent

CHAPTER 1

INTRODUCTION

1.0 Introduction

In this chapter, the purpose of the experiment design will be described generally. Begin with a brief explanation about the background of the experiment. Then the problem statement the lead to the idea of the experiment project and several objectives the aimed to achieve are established in order to overcome from the problem statement. This chapter also discuss about scope and objective are related with this experiment design.

1.1 Background of Project

Fiber optic is refer one of medium and the technology with the transmission as light impulses along the glass or fiber. It carries information as long or short distance and low loses. The glass fiber requires more protection within outer cable. It has a central core in which the light is guided, embedded in an outer cladding of slightly lower refractive index. Fiber optic had used different ways to travelling information it send information coded in a beam of light down a glass or plastic pipe. Fiber optic cable carry information between two place using light based technology. Fiber optic works by bouncing repeatedly off the walls. Fiber optic had difference modes travelling to carry the light signal. First mode is go straight down the middle of the fiber is call single

mode. The other type is multi-mode, it is 10 times bigger than single mode that means light beams can travel through the core by the following a different paths. This project of create difference style using fiber optic normally used in communication lines. Fiber optic sensor is system consist of a fiber optic cable connected to a remote sensor or amplifier. Fiber optic is a technology had been proven as good sensor. It can replace with the other device sensor. Compare it them is unique for type of application, mainly where device sensor are difficult to develop the same wealth of information. Fiber optic sensor can measure the difference parameter such as liquid, chemical, temperature and so on. For this section ethanol had been used as parameter. Fiber optic sensor is system consist of a fiber optic cable connected to a remote sensor or amplifier. However this project for analyze the fiber optic sensor performance in determine the detection of ethanol with difference concentration. Ethanol the type of alcohol normally used on food and drink. Ethanol is also material that alcohol nature, thus it material non-halal follow the rules by Islam religion view. To detect this liquid it need to go through various chemical test that take quit long times for make sure its validity.

Ethanol is a part of alcohol, it used for various utilities in daily life and can give goodness and harm to users. Ethanol can be identified as a material that not poisonous and not smelly also clear color. Besides that, ethanol can mix with the other material but in difference inside thickness. Therefore sometimes it can give effect intoxicate if drink to many. Based on my reading inside ethanol content liquor have difference density ratio. Ethanol had many of type, industry ethanol can be produce through two method first petrochemical industry and fermentation and for ethanol synthetic apart from fermentation process, ethanol for industry main use also be generated synthetically from petroleum refining and ethanol synthesis. Synthetic ethanol is material that very genuine, and the quality that is consistent. Furthermore, ethanol is emulsifier to simplify the mixed-oil based material into the water-based for production of flavourings. Furthermore, ethanol help in process production carbonate drink to make sure the flavour mixed together and remain soluble all time until the end of the lifespan of the product.

1.2 Objective

1. To study about fiber optic communication.
2. To analyze the result using the analysis technique.
3. To develop sensor could detect ethanol using fiber optic sensor.

1.3 Problem Statement

Malaysian Halal-food issue becomes warm topic in chest press. In Malaysia there is various types of food and drinks that are unique and attract this attention because diversity religion. Majority Malaysians that are religious Islam making legal issue is very sensitive and emphasized food and drinks. Inside foods content and drinks with often suspicious has made respective party take various steps to overcome this problem.

According to study carried out by ethanol is material that often used industry inside food. As ethanol is also commonly referred as alcohol, most people assumed that the presence of ethanol is also prohibited in halal foods. This indirectly causes the presence or addition of ethanol to be one of the most controversial issues among Muslim consumers. With sales values of halal food estimated at USD 600 billion globally, this is also an economic as well as a religious issue. Ethanol is also material that alcohol nature, thus it material non-halal follow the rules by Islam religion view. To detect this liquid it need to go through various chemical test that take quit long times for make sure its validity. Therefore a sensor will be roused to detect ethanol inside a food or drink of product.

1.4 Scope

The research will be cover about fiber optic sensor. Fiber optic sensor built by using fiber optic as is medium. Fiber optic sensor will detect the parameter had been decided. This experiment will be cover to detect the ethanol as are parameter. Ethanol is the liquid has effect the human went drink and eat it often and is the one of alcohol. Design or built the fiber optic sensor using the fiber optic single mode cable and ethanol as are parameter. To get the result performance used analysis technique.

CHAPTER 2

THEORETICAL BACKGROUND

2.0 Introduction

This chapter will cover the literature review based on the previous research is depth study about the ethanol, based on this project ethanol is material to use for the experiment. Ethanol is the part of alcohol, so what the application of ethanol to the food industry. What is the concentration of ethanol in the food. In this chapter will be summarize about the fiber optic case, fiber optic sensor case, what is ethanol and type of light on fiber optic.

2.1 Fiber Optic

Fiber optic is the medium with the transmission of information along the glass or the plastic wire, it is a natural glass of fibre that placed or is arranged in a cable, to send digital signal in light form in far or near. Fiber optic has several advantages over traditional cable communication lines. Fiber optic cable cable have a much greater bandwidth, that means can carry more data, less interference, much thinner and lighter. Ajoy Ghatak.(2008).

2.1.1 Why Glass Fibers?

Why are optical fiber made of glass, glass is the remarkable material which has been in use in pure form the least 9000 years. The composition remained relatively unchanged for millennia and its uses have been widespread. The three important of glass which makes it of unprecedented value because there is a wide range of accessible temperatures where its viscosity is variable and can be well controlled unlike most materials, likes water and materials which remain liquid until their cooled down to their freezing temperature and suddenly become solid and highly pure silica is characteristic with extremely low loss. Ajoy Ghatak.(2008).

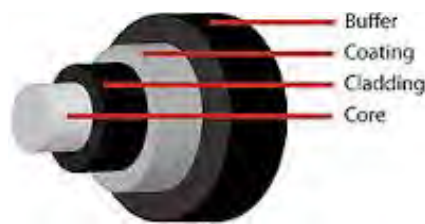


Figure 2.1: Fiber optic cable layer

2.1.2 Single-Mode and Multi-Mode Fiber

Single mode fiber is one of type fiber optic . It has very thin core 9 microns in diameter. In a single mode fiber, all signal travel straight down the middle without bouncing. The advantage used single mode fibers is only one mode with one group velocity, so it had short pulse of light arrives with delay distortion. Next the rate power attenuation is lower in single mode and higher data rates to transmitted. The are usually used on cable tv, internet and telephone signal. The information can send over 100km.Chris Woodford (2015). Application of fiber optic typically used in long

distance, higher bandwidth runs by Telecommunication, CATV companies, and Colleges and Universities.

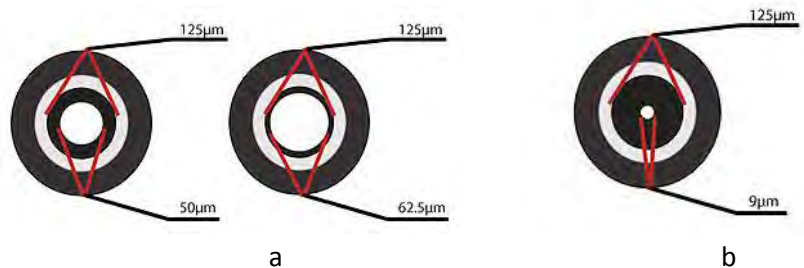


Figure 2.2: b) Diameter of single mode fiber. a) Diameter of multi-mode fiber

Another type is multi-mode, each optical fiber in a multi-mode cable is about 10 times bigger than one in a single-mode cable. This means light beam can travel through the core following a variety of different paths create to ability for more data pass through at given time. Chris Woodford (2015). The application is typically used for short distance, the example in data and audio/video applications in LANs. RF broadband signals. Multimode fiber is usually 50/125 and 62.5/125 in construction. This means that the core to cladding diameter ratio is 50 microns to 125 microns and 62.5 microns to 125 microns.

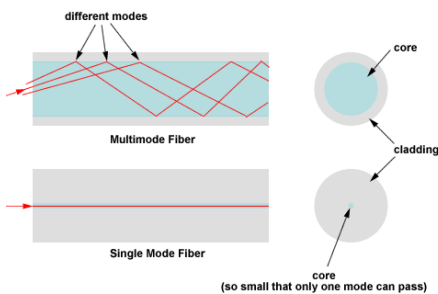


Figure 2.2.1: Single mode and multi-mode cross sectional view.

2.1.3 How the Fiber Optic Work

Optical fibers carry light signals down them in what are called modes. There just different ways of travelling a mode is simply the path that a light beam follows down the fiber. One mode is to go down the middle of the fiber. Another bounce down the fiber at a shallow angle. Other modes involve bouncing down the fiber at the other angle, more or less steep. Light travels down a fiber optic cable by bouncing repeatedly off the walls. Each tiny photon (particle of light) bounces down the pipe like a bobsleigh going down an ice run. Now you might expect a beam of light, travelling in a clear glass pipe, simply to leak out of the edges. But if light hits glass at a really shallow angle (less than 42 degrees), it reflects back in again as though the glass were really a mirror. This phenomenon is called total internal reflection. It's one of the things that keeps light inside the pipe.

The other thing that keeps light in the pipe is the structure of the cable, which is made up of two separate parts. The main part of the cable in the middle is called the core and that's the bit the light travels through. Wrapped around the outside of the core is another layer of glass called cladding. Cladding is to keep the light signals inside the core. It can do this because it is made of a different type of glass to the core. It has a lower refractive index than the core. This causes total internal reflection that stops the light escaping and keeps it bouncing down the core.

2.1.4 Advantage and Disadvantage of Fiber Optic

Fiber optic cable had a few of advantage to make the fiber optic more improve than other cable. Fiber optic cable is extremely high bandwidth the data transmission medium offers the bandwidth that fiber does. It resistance to electromagnetic interference because fiber has a very low rate bit error and noise free. More than that, fiber optic is secure transmission because fiber optic signal made from light, so very