

**UNIVERSITI TEKNOLOGI MARA
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**DEVELOPMENT
AND CHARACTERIZATION OF
LOW COST PLANAR
INTERDIGITAL AMMONIA SENSOR
FOR WATER QUALITY SENSING
APPLICATION**

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ABSTRACT

The existing of ammonia in the aquatic habitat was normally caused by the aquatic life itself. Previous study proves that exceeding ammonia in the water can cause the pH level to increase. In order to make sure the ammonia level was at the allowable range, the monitoring system including of ammonia sensor is needed. This thesis presents three types of planar interdigital sensors that have been fabricated and developed for the use of aquaculture monitoring process. The main objectives of this study is to develop an affordable, low – cost ammonia sensor for aquaculture industry by designing, developing, characterizing, and evaluating the proposed new sensor that is suitable for observing and detecting the contamination level caused by ammonia in water. There are several experiments conducted on these planar interdigital sensors to recognize which sensor produces a better sensitivity and performance. The sensor were tested and experimented with different type of material under test (MUT) including the different concentration of the Ammonium Chloride (NH_4Cl) ranging from 0.1mg/L to 0.5mg/L. These planar interdigital sensors were designed with the same effective area but different number of positive electrodes and of negative electrodes. The optimum number of electrode is crucial during the designing process because it will affect on the diameter, d of the sensors. The experiment was carried out by using Impedance Analyzer IM3570 to gather an appropriate data in terms of performance and NI myRIO-1900 was used to test and evaluate the sensor for the application purposed. Since the output value from the sensor is relatively small, a signal conditioning system is developed as an interfacing system between the sensor and Data Acquisition (DAQ) system. Further development in Graphical User Interface (GUI) was carried out to analyze record and display all the results obtained during the experiment or testing period. Results shows that Sensor 1 has the best sensitivity compared to other sensors and it can be conclude that Sensor 1 has the better performance of sensitivity among the sensors with the percentage of 99.8% of the imaginary part sensitivity. This planar interdigital sensor can be used as a tool for aquaculture monitoring in the pisciculture farm where the ammonia level should not exceed 0.5mg/L.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

1.1.1 Water Quality

Water quality was very important from the point of view of fisheries, economic development and others [1]. Better quality of water is vital to fisheries because water commonly related to the source of aquatic life such as fish as a source of fund for the fisheries. From the point of view of the economic development, water is so important to human. Good quality of water can be related to good health. Healthy and clean living environment is vital to food, environment, human health and human bodies. Nowadays, low quality of water can drag into a massive issue to our society. Polluted water can cause contagious diseases such as diarrhea, cholera and typhoid [2]. Contaminated water not only affects human beings, aquatic animal such as fish as a source of protein for human can be affected too. Moreover, the life of aquatic species is also count on clean water.

Aquaculture is very important to the national food security. All the productivity came from the aquaculture produces are attached to the water quality. Deficiency of the appropriate devices to measure the water quality will be an obstacle to the aquaculture industry [3]. Potential of hydrogen (pH), dissolved oxygen, nitrate, nitrite, ammonia and temperature was not the only important parameter necessitate for water quality. Salinity water which is listed in Table 1.1 is also can be dangerous [3].