

## **Development of a Detector to Determine Presence of Formalin in Fish**

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### **Introduction**

Formalin is an aqueous solution of the chemical compound formaldehyde. Formalin is used as a disinfectant solution. Formalin is commonly used in aquariums to prevent the growth of parasites. In some cases formaldehyde is produced naturally by certain types of fish.

Overuse of formalin causes many health risks for human. Many of these health issues may occur due to illegal use of the formalin. Recently some cases of illegal use of formalin were reported in many coastal areas in Sri Lanka. However, there is no rapid and economical method for formalin detection. Most of the detection methods require expensive and high technology apparatus, a large amount of samples, long sample preparation and detection time. Therefore, it is necessary to develop a simple, rapid and a convenient method avoiding the above mentioned disadvantages. The instrument designed is a convenient, rapid and a simplified method of detecting formalin in fish and can be handled easily. It works at a high accuracy in a range between 100 ppm to 1000 ppm. The design is portable. Samples can be tested within a short period of time. The design is also cost effective and simple.

### **Methodology**

Used a chemical method. The chemical which reacts with formalin was Purpald (4-amino-3-hydrazino-5-mercapto-1,2,4-triazole) and it is used to specify the formalin. Purpald reacts with formalin and forms a Tetrazine which is in purple colour in the presence of oxygen. Purpald reacts with different formalin concentrations and the color development of the reaction was proportional to the formalin concentration.

The colour development of the reaction was detected by a Light Dependent Resistor (LDR). Variation of resistance in LDR converted into a voltage variation, which is proportional to the color development of the reaction. Voltage variances of different formalin concentrations were recorded and plotted with respect to the time.

The voltage difference at the seventh minute was distinguishable from each other (Figure 1). There was a linear positive strong correlation between the formalin concentration and the voltage. Pearson correlation of Formalin concentration and Voltage in the seventh minute was 0.986. So the regression analysis was carried out. This regression model was used to program the microcontroller.

Detected voltage difference, which is an analog voltage variation, was fed in to the microcontroller. Using a microcontroller program, analog signal was converted into digital form and formalin concentration was calculated as parts per million (ppm) value. Detected formalin contamination was displayed on Liquid Cristal Display (LCD).

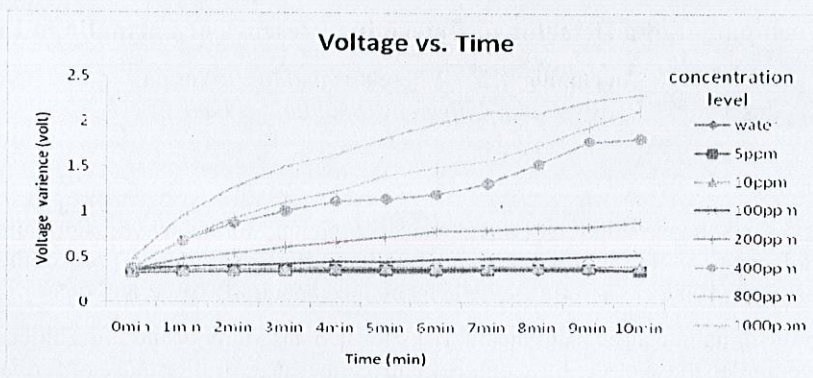


Figure 01: Voltage at different formalin concentrations with respect to the time

### Results

Samples were taken from two locations, one from a fish market and another from International fish Export Company. Tuna (*Thunnus* sp.) was taken as the fish variety. These samples were taken by washing the skin (outer most layer) and gills of the fish. Three standard formalin concentration series were tested with the chemical to check the repeatability and accuracy.

The reproducibility of the results was high and the precision is very high in the instrument. The accuracy of the instrument was 70.9%.

### Discussion

A rapid and simple method was developed to determine the formalin content in fish. Designed instrument is user friendly and less time consuming instrument with low energy consumption. Another advantage of this machine is that it is portable and can be operated with a battery DC current.

Only one chemical is used and no other chemicals are needed to prepare the sample. Another advantage is that there are no any specific conditions for sample preparations and by pressing just one switch the user can get the accurate reading within seven minutes. User interface displays the result as a numerical value and the led series also indicate the result. Another crucial advantage of this model is that the users do not need technical skills to operate the instrument.

### Conclusions

The accuracy of the machine can be increased. High sensitive RGB sensors and image processing techniques can be used. The accuracy of the machine will be increased through image processing technology. Another advantage of image processing is that it can store relevant data which are taken from the machine using a microprocessor.

This model can be developed as automated design. A machine consists of stock tanks with an automatic system can be introduced to measure the quantities of solutions used in the machine.

## **References**

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