Development of Formalin Tester Device for Food using Microcontroller AT89S51

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***Abstract*—This article discusses the manufacture of formaldehyde content test kit device. The device made can find out whether formalin or samples that are dropped are reagents, its characteristics can be processed electronically to determine the levels of formalin detected in the reagent/test kit. The design is made using AT89S51 microcontroller. Detection of formaldehyde levels using a color measurement method for reagent fluids consisting of R, G, and B values. Measurement of these color parameters using the TCS230 sensor. With this device, it is expected to facilitate health workers, especially health analysts, to automatically test the level of formaldehyde in food with a display on the LCD. The result of device test, this device is feasible to use by the percent error value of less than 10%.**

***Keywords*—reagent, formalin, color sensor, microcontroller**

I. Introduction

It is our common understanding that meeting health needs is an absolute must for every human being. For that, the development of technology must continue to develop. In answering the guidelines for fulfilling health, one of them is with medical services. As support for the diagnosis of laboratory test results, it means that the practice is a practice. Some of these things take food objects, urine, feces, and others.

Formalin is a colorless metal-smelling solution that usually contains about 37% formaldehyde. Formalin is a trade name for formaldehyde solution in water with levels up to 40%. Formalin also usually also contains as much as 15% alcohol (methanol) which functions as a stabilizer so that there is no polymerization [1], [2].

This compound includes a strong disinfectant, can eradicate various types of bacterial disease and fungal rot. Formalin can harden body tissues, therefore it is often used to preserve corpses, biological material and other pathologies [3], [4].

Based on WHO research, dangerous formalin content of 6 grams. Even though the average formalin content found in wet noodles is 20 mg / kg of noodles. In addition, formalin that enters the human body will be broken down within 1.5 minutes to CO2. WHO research says new formaldehyde levels will cause toxification or negative effects if it reaches 6 grams.

To keep every food that enters the body must be considered, especially if the food contains formalin. The use of formalin as a preservative in food is very dangerous for human health. Therefore, people are asked not to consume products with formalin. Food products that contain formaldehyde are not only sold in traditional markets, but the all-round market also does not guarantee that formalin-free foods are similar.

Based on the results of investigations and laboratory tests carried out at the Central Bureau of Drug and Food Control (BPOM) in Jakarta, found several food products such as salted fish, wet noodles, and tofu that use formalin as preservatives while according to the Minister of Health Regulation No. 1168 / Menkes / PER / X / 1999 prohibits the use of formalin chemicals for food. In the International Program on Chemical Safety (IPCS) it is stated that the tolerance limit for formaldehyde that can be accepted by the body in the form of drinking water is 0.1 mg per liter or in one day the allowable intake is 0.2 mg. While formaldehyde that may enter the body in the form of food for adults is 1.5 mg to 14 mg per day.

II. Method

A. System Design

In writing and making this module by using a pure experimental method that is making an electrolyzer to test the purity of the water looking for information in an existing hospital laboratory. Which of these devices will be operated according to procedures that have been prepared.

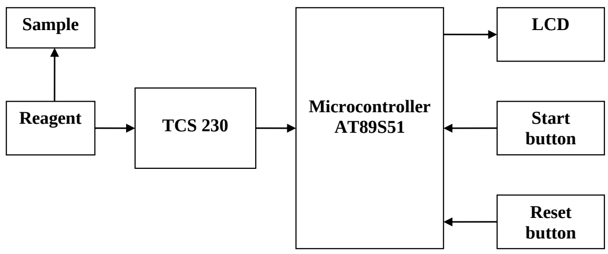

Fig. 1. System block diagram.

Press the start button then the device is ready to operate. Dip the kit kit / stick Quantofix Formaldehyde for ± 1 second on the sample (liquid) that has been prepared. Flick the liquid over the stick, within 60 seconds there will be a color change whose color scale will be detected by TCS 230 in the form of a frequency to be processed by the AT89S51 Microcontroller IC to display on the LCD.

This device uses a microcontroller IC that has been filled in with the program as a working device processor. IC Microcontroller used in this device is made by Atmel [5]–[11].

In this device uses a type of AT89s51 Microcontroller IC because it has a 128 Ram data memory capacity [12], [13]. This capacity is used to store software that is used to control the working of devices. In addition, the type AT89s51

Microcontroller IC has a 2 byte timer, so it can be used for internal timer selection.

Where IC Microcontroller IC AT89s51 Microcontroller is a component of Atmel's production oriented control with CMOS logic level. This component is still in the MCS'51 family. The integration circuit has basic features as a single chip microcomputer. The equipment in question is the CPU (Central Prossesing Unit) consisting of components that are related to each other, namely the register, ALU (Atrithmatic Logic Unit), the control unit [14], [15], [24]–[33], [16], [34], [17]–[23].

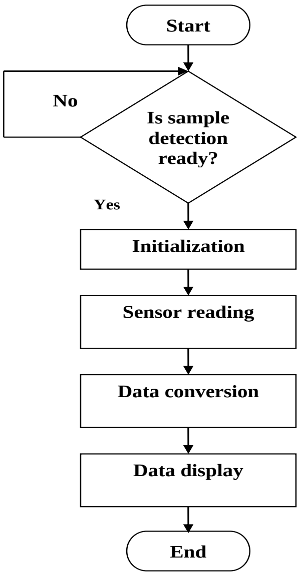

Fig. 2. System work flow diagram.

At the start of the device work starts from BEGIN. Then the LCD is initialized, after the initialization the sample will be detected if it is ready, then the reagent is inserted / dipped in the sample, and the reagent will be read by the TCS230 color sensor and forward the data to the IC Microcontroller to be processed and then the results of the reading will be displayed on the display LCD Charakter 2 x 16 and the process is finished ending with End.

B. *Independent Variable*

As an independent variable is the AT89s51 Microcontroller, because this microcontroller is not controlled by another circuit. This microcontroller only gets input Vcc + 5 V.

C. *Dependent Variable*

The dependent variable is TCS230 which is used as a color sensor, where this sensor will read the color changes in the teskit (Dry Reagent).

D. *Controllable Variable*

The controlled variable consists of an LCD that is controlled AT89s51 to display formaldehyde content in the Test kit.

III. IMPLEMENTATION

Preparing a material is one of the things that is very important in supporting the success of making an electronic circuit, which needs to be considered in this activity include the technician data and the characteristics of electronic components, price and whether the component is present or not on the market. Because it is necessary to do careful calculations, field surveys and study the data in the Data Sheet Book the components that we will need in making the module.

A. *Minimum System Electrical Design*

Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

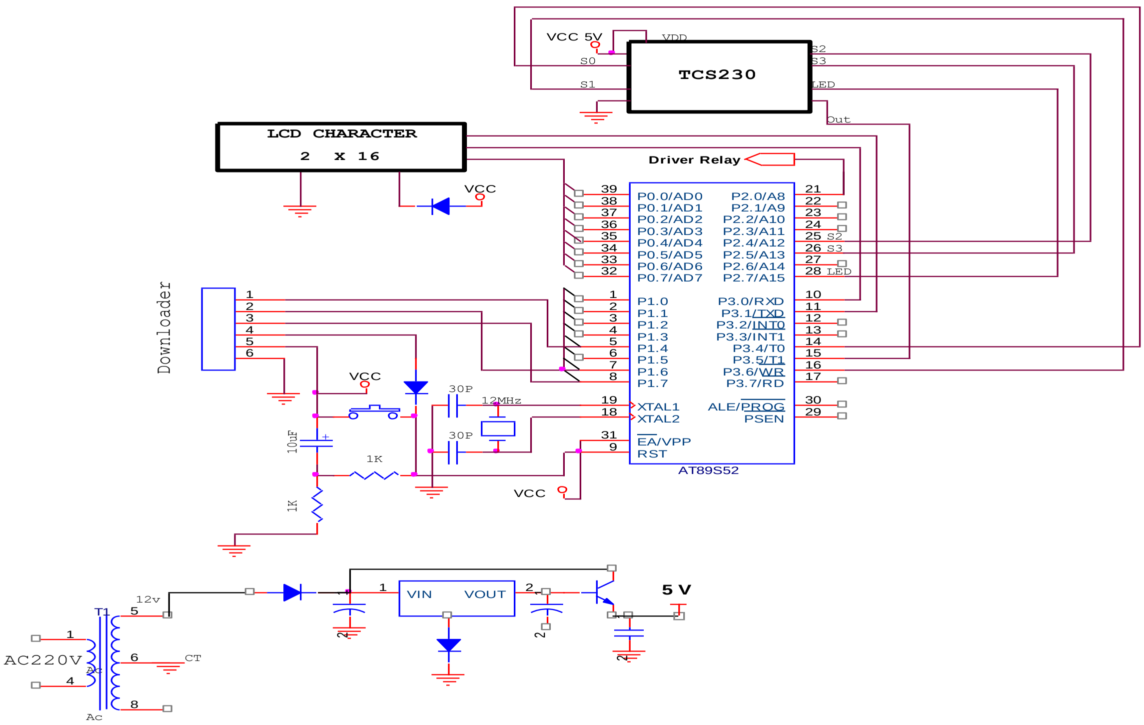

Fig. 3. Overall system schematic diagram.

First the grid netting is entered and then the voltage is directed to supply the device. After that the LCD start button is initialized, so the AT89s51 Microcontroller IC activates the TCS230 color sensor. Then the color reading process is detected by TCS230, output from TCS230 on port 3.5, which is then processed by the AT89s51 Microcontroller IC and the results will be displayed on the LCD.

B. TCS 230 DB Sensor Test

TCS 230 used is TCS 230 DB where there are 12 pins, but only 9 pins are used: VDD, + 5V, GND, OUT, S0, S1, S2, S3. the function of each pin is the VDD pin and pin + 5V combined, is the supply voltage on TCS230. GND pin as Ground, LED pin (P2.7) as a light / light in the process of reading the color, pin OUT (P3.5) is output after completion of color reading, Pin S0 (P3.4) and S1 (P3.6) as the pin is the ratio between the reading of the sample color and the RGB test value. Pins S2 (P1.4) and S3 (P2.5) function as pins for reading RGB values.

C. Detection Process

TCS230 scanning process, which is used in taking the RGB value is only pin S2 and pin S3 which are RGB color reading pins (Red, Green, Blue). In the scanning process, for reading red (pin) pin S2 (P2.4) is given logic 0 (low) while pin S3 (P2.5) is also given a logic of 0 (low). Then call the counter frequency procedure. For green readings, pins S2 (P2.4) and S3 (P2.5) are given logic 1 (high), then call read_frek. And for the reading of blue (Blue) pin S2 (P2.4) is given logic 0 (low) while S3 (P2.5) is given logic 1 (high) and call read_frek.

IV. Result and Discussion

After making the module it is necessary to test and measure it. For this reason, the authors conduct data collection through measurement and testing processes. The purpose of measurement and testing is to find out the accuracy of making the module that the author is doing or to ascertain whether each part (component) of the series of modules in question has worked in accordance with its function as we have planned.

As a result of research in the manufacture of formaldehyde content testing devices based on AT89s51 microcontroller, the authors tested the measurements of RGB (Red, Green, Blue) on each sample to be read on the LCD Character.

TABLE I. FORMALIN TEST RESULT

Content (mg/l)	Average	Deviation	Error %	StDev	Ua	U95
0	39.6	-39.6	0	-2.14	-0.95	-2.45
20	43.6	-23.6	1.18	1.19	0.53	1.36
60	48.6	11.4	0. 19	333.67	149.22	383.49

Table 1 shows the result of measurement and calculation, the percentage error for 0 formaldehyde is 0%; with the uncertainty of -0.95, the percentage error for formaldehyde levels 20 is 1.18%; with uncertainty 0.53, the percentage error for formaldehyde 60 is 0.09%; with uncertainty 149.22. From these results this device can be said to be feasible to use because it has a percent error value of less than 10%.

V. Conclusion

After carrying out the process of making and studying the literature planning, experiments, testing devices and data collection, the author can conclude as follows; By the measurement and calculation, the percentage error for 0 formaldehyde is 0%; with the uncertainty of -0, 95, the percentage error for formaldehyde levels 20 is 1, 18%; with uncertainty 0, 53, the percentage of errors for formalin 60 is 0, 09%; with uncertainty 149, 22. From these results this device can be said to be feasible to use because it has a percent error value of less than 10%. After carrying out the process of making and studying the planning literature, experiments, testing devices and data collection, the author can conclude that can be made a series of Formalin Level Test Device.

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