



DEVELOPMENT OF A DEVICE TO DETECT SACCHARIN CONTENT IN FOODS

Safreena kabeer* Ashwina. S¹, Julaiha. M. Y², Annapoorani. P³, Harshavardhini. T⁴

*Assistant professor, ^{1 2 3 4}Research Scholars,

*Department Food Processing and Preservation Technology
School of engineering,

*Avinashilingam Institute for Home Science and Higher Education for Women
Coimbatore -641043.

Abstract: In recent times the consumption of sweetened foods have increased as a result the adulterants have also increased in both processing and serving. Saccharin has turned out to be a major adulterant, which is also a non-nutritive artificial sweetener. Hence, we focus on developing a user-friendly device to detect saccharin content in foods. People now-a-days are looking forward to have new technologies which consumes less time and human work. As excess consumption of saccharin present in sweetened foods might cause headache, type 2 diabetes, breathing problem, diarrhea, skin problems and so on. Therefore, this device detect the presence of saccharin in foods

Index Terms - saccharin, adulterant, artificial sweetener, user friendly device

I. INTRODUCTION

Sugar has been part of our lives for centuries and we need to understand how we enjoy it in a healthy balanced lifestyle. As sugar is processed and used for years the addition of additives also added in following years. The major additive which is used as an artificial sweetener is saccharin. Saccharin is currently used in beverages like fruit juices, mixes, and bases a sugar substitute in cooking and serving. Many people have concern about the amount of sugar they consume and often look for low sugar or healthy alternatives in food products, reducing or removing sugar from a product often require replacing it with a number of substitute ingredients to N the same quality, taste and texture profile. In order to attain these profiles, the manufacturer use additive or an artificial sweetener, so development of a device to detect saccharin in food. Saccharin (1,2-benzisothiazol-3(2H)-one-1,1-dioxide) is the oldest artificial. Saccharine is [prepared through methyl anthranile reaction with nitrous and other oxides, since they are sweetening, they taste more sweetened nearly 300 to 400 times sweeter than sucrose [1] Saccharin, is commonly used in soft drinks, baked foods, jams, canned fruit, candy, dessert toppings, and chewing gum. The Food and Drug Administration (FDA) has established an acceptable daily intake (ADI) for each artificial sweetener. ADI for saccharin is 5mg/kg body weight. The major drawback of saccharin is its bitter metallic aftertaste, which is particularly evident at higher concentration. A few epidemiological studies also found relationships between saccharin and bladder cancer risk in humans and also other adverse health effects in humans. The objective of our project is to develop a user-friendly device for the measurement of saccharin in foods, to determine the amount of saccharin, to check the accuracy and efficiency of the device by comparing with analytic method [2]

Saccharin, being 300 times sweeter than sugar, is used in many foods and drinks, and compared with carbohydrate-rich, high-calorie sweetened foods, it ensures sustained organoleptic taste with minimal calories. Saccharin experimentally found as carcinogenic in animals, but the fact remains that many other carcinogenic animals still they cause some reactions in animal on the other hand they are added in foods and drinks. Trichloroethylene solvent (found in instant decaffeinated coffee), diethylstilbestrol [DES (in beef liver)], secondary amines—nitrosamines—and benzopyrenes (in barbecued meats), aflatoxin (in agricultural products), tannins (in beverages, tea, and wine), thiourea (in cabbage), zearalenone (in corn), ethyl carbamate (in most fermented products including bread, wine, and beer), patulin (in flour, oranges, and apple sauce), and nitrates and nitrites (in vegetables, meats, fish, milk, and eggs) are the selected putative example. [3]

If manufacturers use saccharin in beverages, the FDA limits the acceptable amount to less than 12 milligrams (mg) per fluid ounce. In processed foods, saccharin cannot exceed 30 mg per serving size (zia sherrell, 2021). The FDA has said the acceptable daily intake of saccharine at 2.3 mg per ounce (5 mg/ kg) of body weight. This needs if your weigh 154 ounce (70 kg), You can consume 350 mg/ day. Excess consumption can lead to health effects like diabetes, breathing problems, diarrhea, head ache, bladder cancer, and other health issues. [4]

Materials and methodology:

The system is integrated with 5v power supply to operate the microcontroller and sensors .the sensor is interfaced in analogue pin of the microcontroller which is then converted in to digital value using inbuilt A/D converter [5] present in the microcontroller if the level of saccharin reaches above the threshold value the alert is printed through lcd module and the buzzer alert is Produced.

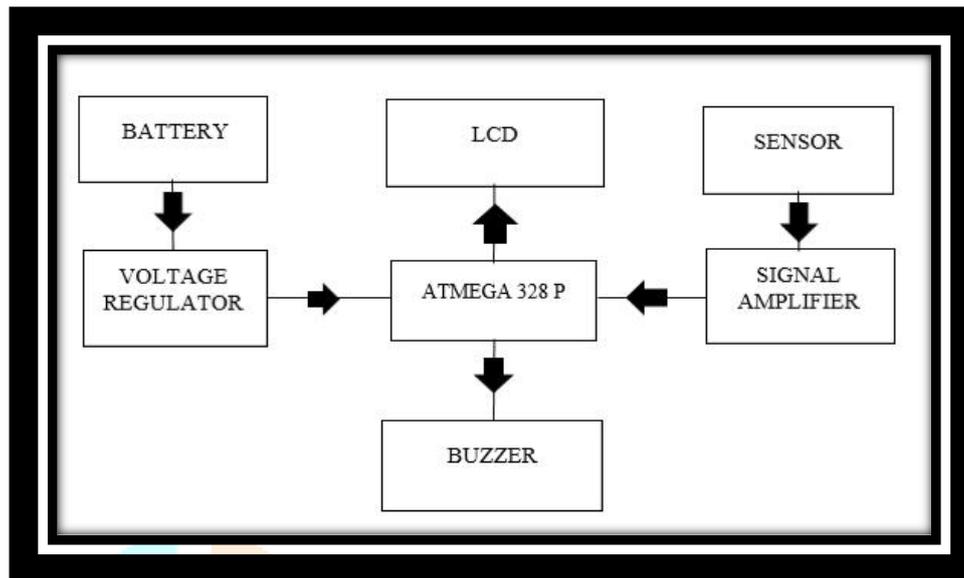


Figure 1 Block diagram of Saccharin detector

Working of sensor:

The device is intended victimization electrodes that changes the output voltage supported acidic level it's the term interprets the values of the proton concentration that usually ranges between concerning one and ten x -14 gram-equivalents per cubic decimeter - into numbers between zero and fourteen.

On the size a really acidic answer features a low price like zero, 1, or a pair of (which corresponds to an oversized concentration of H ions; 10 x zero, 10 x -1, or ten x -2 gram-equivalents per liter) whereas a really basic answer features a high price, such as 12, 13, or fourteen that corresponds to a tiny low range of H ions (10 x -12, 10 x -13, or ten x -14 gram-equivalents per liter).[6] A neutral answer like water has around seven. A mensuration loop is created from 2 elements, the device, which has a mensuration conductor, a reference electrode; a preamplifier; Associate in Nursing an analyzer or transmitter. A mensuration loop is basically electric battery wherever the positive terminal is that the mensuration conductor and also the negative terminal is that the reference conductor. The mensuration conductor, that is sensitive to the proton, develops a possible (voltage) directly associated with the proton concentration of the answer. The reference conductor and mensuration conductor are relatively stable in potentiality. References conductor doesn't amendment once immersed in solution within the reference conductor conjointly makes contact with the sample solution and also the mensuration conductor through a junction, finishing the circuit[7] . this is often done through package . The device elements are typically combined into one device known as a mix conductor. The mensuration conductor is typically glass and quite fragile.[9] Recent developments have replaced the glass with a lot of sturdy solid-state sensors. Preamplifier amplifies the signal ensuing with less electrical noise. The sensor's electrical signal is then displayed.

Specification:

Draw -5.5 mA and sensor output

Warm Up Time- 3 seconds minimum

Operating Temperature- 23 to +131°F (-5 to +55°C)

Operating Voltage - 5V

Microcontroller Working:

The Arduino Uno is Associate in Nursing ASCII text file microcontroller board supported the semiconductor device atmega328p microcontroller and developed by Arduino.cc. The board is provided with sets of digital and analog input/output (I/O) pins which will be interfaced to varied growth boards (shields) and different circuits[10].[11] The board has fourteen digital I/O pins (six capable of PWM output), half-dozen analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a kind B USB cable. It are often steam-powered by the USB cable or by Associate in Nursing external 9-volt battery, though' it accepts voltages between seven and twenty volts. [10]

LCD Display:

A liquid show (LCD) is Associate in Nursing electronically-modulated device formed into a skinny, flat panel created from any range of color or monochrome pixels full of liquid crystals and clothed ahead of a light-weight supply (backlight) or reflector. [12] it's usually utilized in powered electronic devices as a result of it uses terribly little amounts of electrical power. liquid crystal display has material, that continues the properties of each liquid and crystals. instead of having a temperature, they need a temperature vary inside that the molecules are virtually as mobile as they'd be in an exceedingly liquid, however are sorted along in Associate in Nursing ordered from just like a crystal. [10] That they are utilized in similar applications wherever LEDs are used. These applications are show of show of numeric and AL numeric characters in matrix and segmental displays.

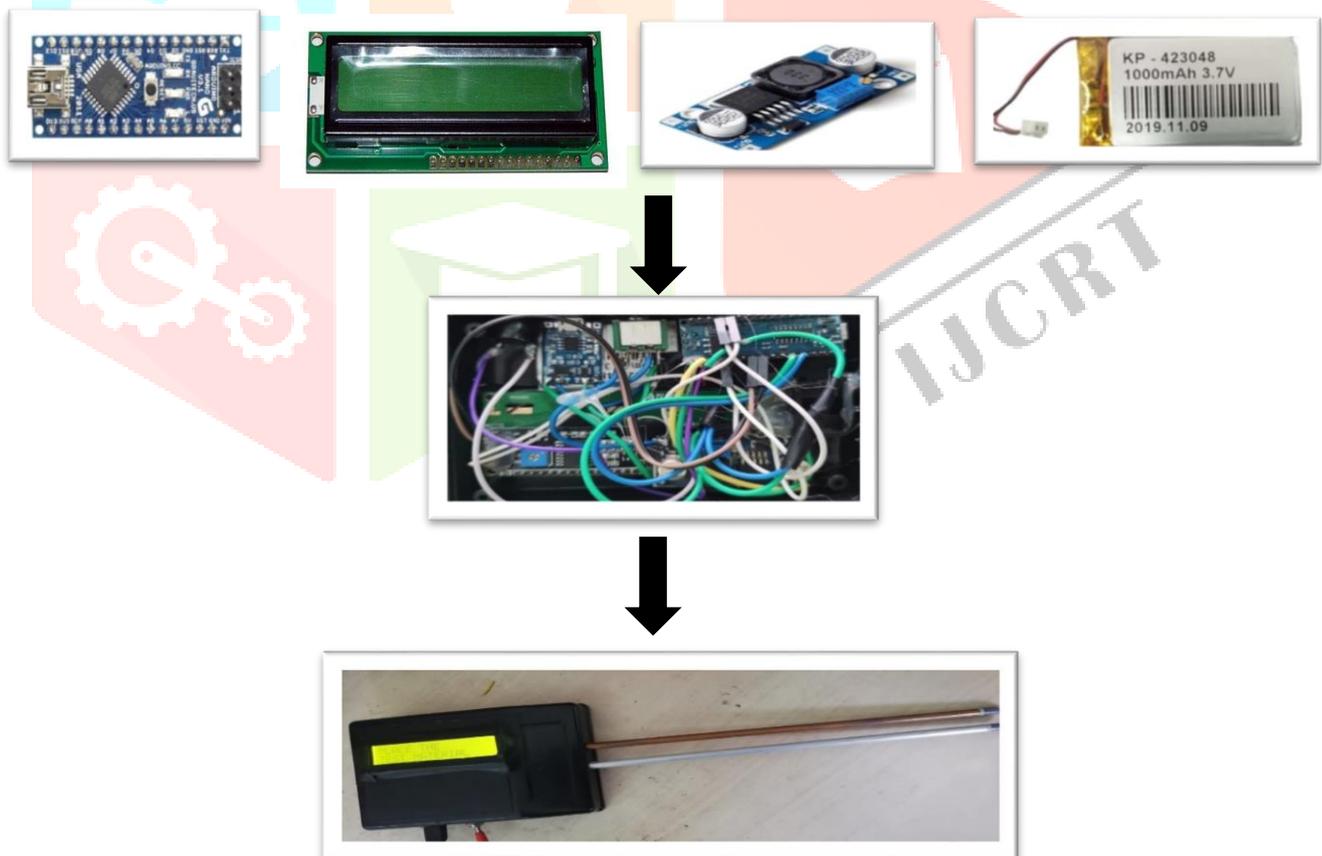
LCD consists of 2 glass panels, with the liquid materials sandwiched in between them. The inner surface of the glass plates is coated with clear electrodes that outline in between the electrodes and also the crystal, that makes the liquid molecules to keep up an outlined orientation angle. once a possible is applied across the cell, charge carriers flowing through the liquid can disrupt the molecular alignment and turn out turbulence. [13] When the liquid isn't activated, it's clear. once the liquid is activated, the molecular turbulence causes lightweight to be scattered all told directions and also the cell seems to be bright. Thus, the desired message is displayed. once the liquid crystal display is within the off state, the 2 polarizers and also the liquid rotate the sunshine rays, specified they are available out of the liquid crystal display with none orientation, and thus the liquid crystal display seems clear.

Lead-Acid Battery:

The lead-acid accumulator may be a kind of reversible. it's the primary kind of reversible battery ever created. Compared to trendy reversible batteries,[14] lead-acid batteries have comparatively low energy density. Despite this, its ability to produce high surge currents implies that the cells have a comparatively giant power-to-weight quantitative relation. These options, at the side of their low price, build them engaging to be used in motorized vehicles to produce the high current needed by starter motors.

As they're cheap compared to newer technologies, lead-acid batteries are wide used even once surge current isn't necessary and different styles may offer higher energy densities. In the charged state, the energy of the battery is kept within the electric potential between the pure lead at the negative aspect and also the PbO₂ on the positive aspect, and the liquid vitriol. The power made by a discharging lead-acid battery are often attributed to the energy discharged once the sturdy chemical bonds of water (H₂O) molecules are shaped from H⁺ ions of the acid and O₂⁻ ions of PbO₂. Conversely, throughout charging, the battery acts as a water-splitting device.

Flow Chart:



Result and discussion:

The following table represents the comparative values obtained from 5 samples that were tested using the device for the standard value of saccharin is 2.3 mg approved by FDA. The efficiency of the device was tested by adding one table spoon of saccharin in Bovonto to ensure the inference is high. The highest value derived was 4.1 from the sample kissan jam and the lowest value derived was 1.3 from Bovonto .

Table 1: -Comparison of samples between standard value and derived value

S NO	SAMPLE	STANDARD VALUE (mg)	DERIVED VALUE (mg)	INFERENCE
1	Coco cola	2.3	2.9	High
2	Bovonto + saccharin	2.3	2.6	High
3	Bovonto	2.3	1.3	Normal
4	Kissan jam	2.3	4.1	High
5	Mango drink	2.3	2.8	High

Table 2:- Comparison table between analytical inference and device inference

SNO	sample	Device inference	Analytical inference
1	Coco cola	High	High
2	Bovonto + saccharin	High	High
3	Bovonto	Normal	Normal
4	Kissan jam	High	High
5	Mango drink	High	High

The above tabulation is a comparison between analytical method and device inferences, they show similar results the sample bovonto shows normal saccharine level were as other samples like coco cola, bovonto+saacharine, kissan jam, mango drink shows high saacharine content as it was derived from device.

Conclusion:

The determination of sweetening on an individual basis or at the same time with different sweeteners in mixtures is incredibly vital for shopper safety. Here our projected system focus their efforts on developing analytical strategies for easy, speedy and cheap sensitive determination. Sensitive and sturdy analytical strategies area unit essential to satisfy the wants of growing markets in internal control and shopper safety. Scientists have applied a good kind of instrumental techniques. Today, the tactic of alternative for the determination of artificial sweeteners in search approach that is easy and straightforward. However, biosensor technology has offered some strategies of direct detection in less complicated and cheaper matrices, while not sample preparation. Thanks to a continuing rising demand for different strategies for determination of sweetening, and thanks to the increasing development of mass spectrographic analysis or bicycle-built-for-two mass qualitative analysis strategies, variety of procedures supported mass spectrographic analysis plus liquid action for determination of sweetening

Reference:

- [1] D. submal, national Library of medicine, article in germany,1973 Oct
- [2] FDA government of India, 2018
- [3] Ammar A. Razzak Mahmood Ibn Al Haitham journal for pure and applied science,2020
- [4]Louis Z.G ,Saccharin deemed “not hazardous” in United States and abroad, PMC article, dec20,2010
- [5]D. M. Fraser, ”Biosensors : Making Sense of Them”, Medical Device Technology, Vol.5,No.8, pp.38-41, 1994.[5] D. M. Fraser, ”Glucose biosensors – the Sweet Smell of Success”, Medical Device Technology, Vol.5, No.9, pp.44-47, 1994.
- [6] REVIEW ARTICLEA review on pH sensitive materials for sensors and detection methods, Muhammad Imran Khan1,2•Koushik Mukherjee3•Rizwan Shoukat4•Huang Dong2,5Received: 10 June 2017
- [7] A MEMS Capacitive pH Sensor for High Acidic and Basic Solutions Md. Shamsul Arefin*, M. Bulut Coskun
- [8] MDPI Open Access Journals z Signal Amplification Gains of Compressive Sampling for Photocurrent Response Mapping of Optoelectronic Devices by George Koutsourakis 1,*ORCID,James C. Blakesley 1 andFernando A. Castro
- [9] Sensors and Amplifiers: Sensor Output Signal Amplification system September 2016Amir FathiSarkis Azizian
- [10] Joseph S. Chang, ‘The study of microcontroller based embedded system for smart lighting applications’, IEEE journal of embedded system , 2013
- [11] Dimosthensis E. Bolanakis A Survey of Research in Microcontroller Education, IEEE journal in emerging and topic of circuit system , 2019
- [12] New LCD Display Technology for High Performance with Low Cost-shared Pixel Rendering Display April 2006 DOI:10.1109/VDAT.2006.258113Authors:Chih-Chung Chien Adom Wang
- [13] Transmissive and Transflective Blue-Phase LCDs With Double-Layer IPS Electrodes, journal of Display Technology Yan Li, etrl,2016
- [14] IEEE Guide for Selecting, Charging, Testing, and Evaluating Lead-Acid Batteries Used in Stand-Alone Photovoltaic (PV) Systems, journal of emerging and circuit system

