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Measurement of Nutrients and Adulterants in Milk

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Abstract *- Milk is a nutrient-dense liquid. Before they can digest solid food, it is the principal source of sustenance for young mammals (including breastfed human new borns). Milk and its products are consumed by people of all generations. Colostrum, or early- lactation milk, contains antibodies that improve the immune system, lowering the risk of several diseases. Other nutrients included in milk include protein and lactose. However, it has been shown that some people purposefully add certain compounds to milk in order to increase its quantity and therefore adulterate it. Milk adulteration is the deliberate lowering of the quality of milk offered for sale, either by admixing or substituting lesser components, or by removing a valuable ingredient. Adulterants are the term for these chemicals. For the authorities, milk adulteration has always been a source of concern. Despite the government's efforts to reduce fraudulent activities that adulterate milk in an illegal manner, milk adulteration remains a big problem. If consumed in large quantities, adulterants such as detergents in milk, synthetic components, urea, caustic soda, and formalin can cause serious health problems such as food poisoning, gastrointestinal complications, impairments, heart problems, cancer, and even death. Our project's goal is to use electronic sensors and processors to track the presence of certain adulterants and other attributes in milk.*

Keywords *– Milk, Quality, Measurement, Adulteration, Fat*

I . INTRODUCTION

Milk is an important source of protein for adults and the elderly, as well as the primary source of nutrition for all new-borns. For the rest of our lives, it is an important part of our diet. People of all ages partake in it. Calcium is an essential vitamin for strong bones and teeth, as well as muscular activity and nerve messages,and it is found in milk. A sufficient calcium level is recommended by health authorities to help prevent bone fractures and osteoporosis. Drinking milk provides a significant amount of calcium. Milk contains potassium, which aids in the dilation of blood vessels, lowering blood pressure.

Increasing potassium and sodium levels in the body can help to reduce blood pressure. Milk and milk products are consumed by more than six billion people worldwide, according to the FAO. The milk can provide an unlimited number of goods. One of the primary difficulties that may be seen in today's culture is the contamination of natural food products. Adulteration is a frequent practise in poor countries. The act of lowering the quality of food by adding adulterants, substituting subordinate substances, or omitting key elements.

Food adulteration refers to the contamination of a food product. Food adulterants are compounds that are intentionally introduced to food for financial gain. These adulterants lower the nutritional value of the food, causing it to become polluted and unfit for human consumption. Milk is one of the foods that can be readilycontaminated. Milk can be contaminated by adding water, skimming off the cream or adding wheat, detergents, acids, or alkaline substances. These adulterants are poisonous and induce irreparable organ damage. As a result, electronic sensors can be used to identify whether milk is contaminated or not in order to avoid the adulteration of milk and some of its products There are chemical ways for determining the same. However, these approaches have drawbacks such as the inability to be reused, the fact that they do not always produce accurate findings, the fact that they are time demanding, and the fact that they are not user friendly.Our goal is to create an electrical gadget that can detect

if milk and its products have been tampered with. This equipment is reusable, offers reliable results, and is simple to use. The suggested device instantaneouslydisplays the results.

II. RELATED WORKS

ManjotKaur and JiwanjotKaur [1] discussed several dairy products and the main adulterants in them. However, this document only provides information on a small number of the products used in this study.

Jai Desai et al. [2] goal was to offer a non-contact adulteration technology. This can address the issue of relying on conventional techniques, which waste a lot of sample material during adulteration detection. The results from the optical sensors employed are good, but they do not take into account the amount of fat in the milk sample. Milk's refractive index is impacted by the density shift caused by fat content. Compared to buffalo milk, cow milk contains less fat.

Dr. G. Rajakumar and colleagues' [3] presentation is about estimating milk quality and quantity. When milk is kept in storage for an extended period of time, microbial activity begins, giving the milk a bad odour that can be picked up by a gas sensor. However, this method is unable to identify steroid use in milk. Additionally, it hasn't been mentioned that milk products can use it.

Saadia H.H. Shinawy, Adel M. EL-Kholy, et al.[4] provide thorough information about the materials and methods that will be employed as well as the outcomes. The main issue raised by the authors is that cow's milk has a lower fat content and is more frequently tainted by the addition of water than buffalo's milk. The solutions listed here are for some laboratory-examined samples that are difficult for the average person to notice. Therefore, in this project, we're going to go around this by creating a tool that's accessible to everyone and simple to use.

The goal of Arshak Poghossian et al [5] was to disseminate knowledge regarding quick techniques for spotting and keeping track of milk quality and spoiling using electronic sensors.

According to Vinod Kumar Verma et al. [6], ultrasonic techniques can be used to identify milk adulteration. However, this approach is fairly ineffective and limited to milk alone. But the sensor approach helps to get around these problems.

Rupak Nagraik et al. [7] review of traditional and biosensor-based methods for identifying impurities in milk was provided by in their publication.

Neha Gheek Batra et al[8] goal was to give information on the examination of adulterants frequently discovered in milk samples. Additionally, problems with health brought on by adulteration and bacterial contamination of raw milk are discussed.

D Maheswara Reddy et al. [9] discussed about typical milk adulterants and the risks they pose to human health. Additionally, on the quick methods for identifying various adulterants in food.

Mohit Kamthania et al. [10] provided information on methods of detecting and corrective actions for adulterated mi. Also includes information on sample preparation, GMP detection, several techniques for fat removal, added water detection, starch detection, and the detection of cane sugar, glucose, salt chloride, ammonium sulphate, and urea. The document also offers ways to look for cow milk that has been mixed with buffalo milk.

Kedija Hussen Mohammed [11] mentioned full information regarding qualitative and quantitative detection techniques, milk adulterants and associated health issues, as well as strategies to reduce tainted milk and its products.

Neelam Upadhyay et al [12] provided review on the preservation of milk and its products. The document provides information on

the chemicals used to preserve milk and milk products, their impact on human health.

Tanzina Azad et al. [13] gave detailed information on common milk adulterants is provided by along with several techniques for their quantitative and qualitative detection. Compared to the methods used to find them, this report provides greater details about the adulterants.

Siuli das et al. [14] provided review of milk adulteration and detection methods. This review study mentions a number of strategies, including the use of conductance measurement, ultrasonic sensors, E-Nose, E-Tongue, and potentiometric sensors.

Dadasaheb Navale et al. [15], numerous tests are carried out to determine the presence of water, starch, urea, detergent, glucose, as well as to detect the presence of gelatin in cream and sucrose in khoa. These adulterants are found in milk and its products. This study looks for several kinds of adulteration in milk and milk products.

III. METHODS

3.1 BLOCK DIAGRAM

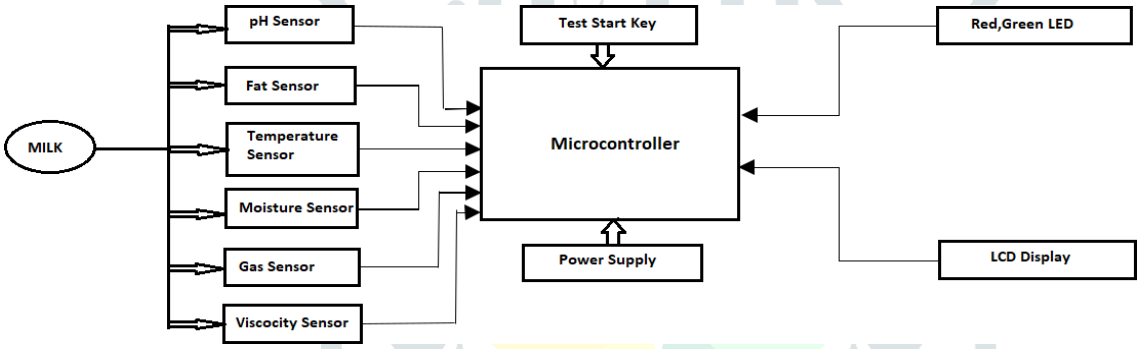


Fig. 1. Block diagram of measurement of nutrients and adulterants present in milk.

As shown in Fig.1it includes mainly 4 blocks

- Milk sample block
- Sensors block
- Uno Mega
- Power supply
- LCD and LED block

The proposed method makes sure that the milk is of high quality for both sellers and consumers by employing e-technique to detect pollutants in milk and its products. With a shorter time frame, this project can be used to provide straightforward and quick test procedures. With the aid of this effort, we can also ensure that consumers don't pay extra for milk that isn't up to par, thereby reducing corruption.

The suggested system consists of an Arduino board connected to pH, temperature, viscosity, moisture, a battery, a gas sensor, and an LCD. The use of smart sensors allows for the administration of milk quality. Utilizing LCD, it is possible to detect adulteration.

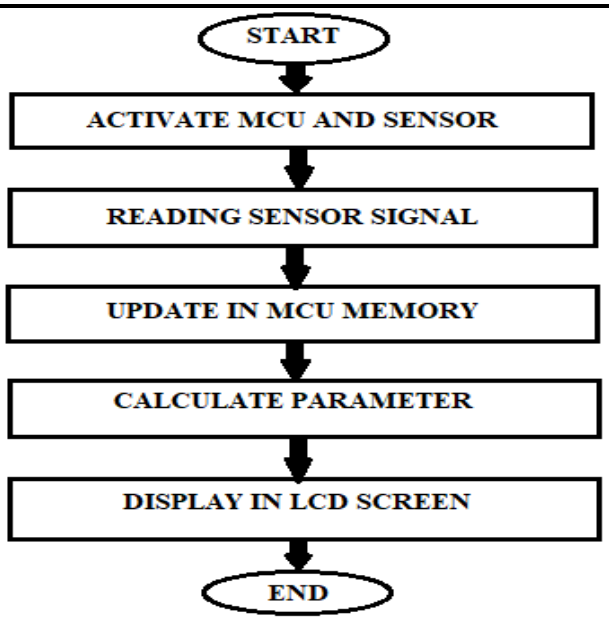


Fig 2: Flow chart

3.2 Milk and its types

Pure milk, packet milk, skimmed milk, milk powder, adulterated milk, milk powder are all used as sources in this project.

Pure Milk

Protein, calcium, and other minerals like vitamin B12 and iodine are all found in large quantities in pure milk. Along with whey and casein, two high-quality proteins that have been found to help lower blood pressure, it also contains magnesium, which supports the immune system, heart, and muscles in their optimal functioning. Protein, calcium, and other vitamins and minerals including iodine and vitamin B12 are all abundant in pure milk. It also contains magnesium, which supports the health of the muscles, heart, and immune system.

Skimmed Milk

Skimmed milk is fat-free and has fewer calories than whole milk. Skimmed milk is sometimes drunk with the purpose of lowering calorie intake. It is beneficial to persons on a diet[15]. Initially, 100ml of skimmed milk is placed in a glass as a sample, with a pH range of 5.32 -5.70 (experimental value decreased to 90% accuracy), a temperature range of 25-30deg C, high viscosity, and a pleasant odour. The Skimmed milk sample is dipped into all of the sensors in the sensor block, and the associated test is run.

Adulterated Milk

A chemical found in milk is known as an adulterant. Urea, detergents, ammonia, boric acid, formalin, sugar,hydrogen peroxide, and melamine are some of the major adulterants found in milk, which can cause serioushealth problems[6]. In this experiment, 100ml of milk was mixed with 50ml of water, 100ml of milk was mixed with 2.5ml of detergent (1gm of detergent diluted with 100ml of H20), 100ml of milk was mixed with 2g of chalk powder, and 100ml of milk was mixed with 0.5ml of ammonia (1:1 NH3) When the sensors in the block are dipped in each contaminated sample, the sensors will detect a change in the standard referencevalues of pH, temperature, smell, and taste, and this change in parameter values will be passed to the Arduino Mega for further calibration. Adulterated milk is as shown in Fig. 2.

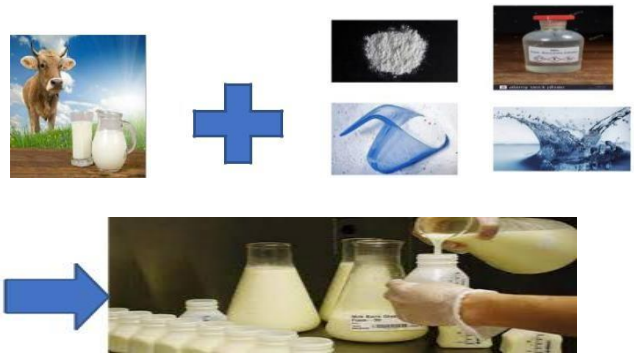


Fig. 3: Adulterated Milk

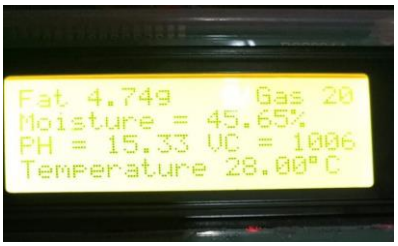
Milk Powder

Another name for milk powder is dry milk. This particular dairy product is created by drying milk. Milk powder doesn't require refrigeration because it has a lower moisture content and a longer shelf life than liquid milk. A sample with a pH between 5.47 and 5.70, a temperature between 25 and 30 degrees Celsius, a high viscosity, and a pleasant odour is first prepared by combining 12 grammes of milk powder with 100 milliliters of water and placing it in a glass. Every sensor in the sensor block is dipped in the milk powder sample before the associated test is run.

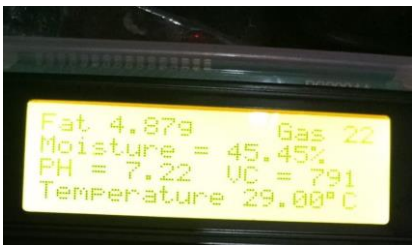
1V. CONCLUSION

When milk is tampered with, illegal substances are frequently introduced, or the milk itself may be totally manufactured. Usually, the goal is to gain financial gain by doing this. Negligence and unclean processing, storing, transporting, and marketing procedures frequently result in adulteration. These types of adulteration are fairly common in underdeveloped and affluent countries. Milk adulteration is a significant issue in developed countries. Since common detection techniques are not always simple or readily available, it is difficult to deal with the various ways that milk is fraudulently tainted in these countries. There is a need for sophisticated ways of detection since these countries use sophisticated methods to adulterate milk. Consumers are either misled or regularly get infections by consuming tainted milk. Testing milk for quality control is an important step in assuring that it is free of adulterants for consumption. Gastroenteritis, hypertension, renal disorders, skin, eye, heart, and stomach issues, as well as cancer, are a few of the prevalent diseases triggered by consuming tainted milk. There are several methods of detection, from simple visual inspection to complex biological procedures. This page gives a general overview of the various components that can be used to tamper with milk, the adulteration procedure, and a detailed study of the electronic techniques that can be used to spot adulterants. Researchers hope that our technique will help them better understand how to detect adulterants using electrical sensors.

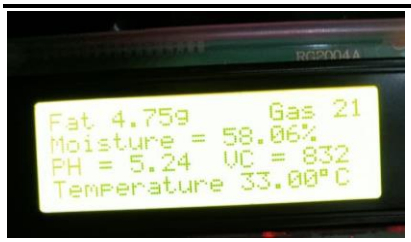
V. RESULT



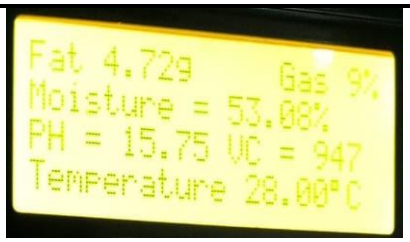
Adulterated milk(phenol)



Normal milk



Hot milk



Adulterated milk (Milk powder)

Fig 4: Results of different adulterated milk

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