Photometric Based Sensor for Fat Detection in Fresh Milk

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ABSTRACT: In recent years there is a substantial increase in milk production in India. The method described in this paper helped to make information symmetric in the market, thereby minimizing problems of adverse selection and tedious work. It is only recently that automation has been introduced into agriculture. Embedded Technology is now in its prime and the amount of knowledge available is mind-blowing. An embedded system can be defined as a control system or computer system designed to perform a specific task. Embedded systems are playing important roles in our lives every day, even though they might not be visible. This paper describes one of the applications of embedded system MILKOTESTER. It is Small compact, embedded in a single unit, requires less power and measures milk parameters like SNF (Solid but Not FAT), FAT, CLR, with less cost.

KEYWORDS: Milk fat, Milkotester, SNF, CLR, Photometric, Gerber

I. INTRODUCTION

This paper deals with the concept of electronic milk fat analyzer. With the initiatives of National Dairy Development Board (NDDB), out of 70,000 dairy cooperative societies in the country, around 26000 are using Electronic Milko-Testers (EMT) and around 2500 are using the PC connected electronic milko-tester machines (known as Automatic Milk Collection Systems - AMCS). These systems introduced very satisfactory milk collection methods and facilitated immediate payments to farmers based on the quality and quantity of milk delivered [1].

The success of these systems coupled with inexpensive connectivity opportunity offered by Internet, motivated the CEG-IIMA to enhance the PC at the Automatic Milk Collection Systems (AMCS) into a Dairy Information Services Kiosk (DISK) and offer an extensive knowledge and service delivery mechanism through a Dairy Portal. The DISK when used with a Dairy Portal of the Union enhances the scope of services that would benefit the farmers as well as the dairy industry [2].

II. RELATED WORK

Effective January 1, 1991, for the first time in the forty-two year history of the dairy pricesupport program, dairy product surpluses are being measured on a basis different from thetraditional milk fat equivalent basis. The new term is 'total solids basis'. The intent of the newmeasurement is to offer a more balanced definition of what constitutes dairy product surplus inrelation to the composition of cow's milk, as compared to letting the milk fat in butter dictate the definition of surplus.

III. PRIMARY METHOD

The Gerber Method is a primary and historic chemical test to determine the fat content of substances, most commonly milk and cream. The Gerber Method is the primary testing method used of worldwide. The Gerber Method was developed and patented by Dr. Niklaus Gerber of Switzerland in 1891.
Milk fat is separated from proteins by adding sulfuric acid. The separation is facilitated by using amyl alcohol and centrifugation. The fat content is read directly via a special calibrated butyrometer. Gerber developed specialized butyrometers (tubes), pipettes, and centrifuges. Water baths built specifically for the Gerber tubes are often used.

Procedure

➢ Here, for every 100 ml of H2SO4 10 ml of water is to dilute the sulphuric acid since it is very hot.
➢ 10 ml of H2SO4 is taken in butyrometer.
➢ 10.75 ml of milk is taken in a pipette and added to the H2SO4 diluted sample.
➢ CLR is calculated manually at room temperature which is approximately 21 degree Celsius.
➢ 1 ml of amyl alcohol is added to the acid milk mixture.
➢ For leveling distilled water is added so that fat is measured accurately.
➢ Put butyrometer in centrifuge using stabilizer.

Fig1.GERBER'S Equipment

IV. PROPOSED METHOD

Milkotester:
An instrument to measure fat in milk using the opto-electronic principle is popularly referred to as the Milkotester.
The function of the milk analyser is to make quick analyses of milk on fat (FAT), non-fat solids (SNF), proteins, lactose and water content percentages, temperature, pH, freezing point, salts, conductivity as well as density of one and the same sample directly after milking, at collecting and during processing.

Block Diagram:

Sensor is a device that detects the quantities required and provides a corresponding output generally as electrical or optical signal. A Light Dependent Resistor (LDR) or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called as photo conductors or photo resistors. They are made up of semiconductor materials having high resistance. There are many different symbols used to indicate a LDR, one of the most commonly used symbol is shown in the figure below. The arrow indicates light falling on it.
A light dependent resistor works on the principle of photo conductivity. Photo conductivity is an optical phenomenon in which the materials conductivity (Hence resistivity) reduces when light is absorbed by the material. When light falls i.e. when the photons fall on the device, the electrons in the valence band of the semiconductor material are excited to the conduction band. When light having enough energy is incident on the device more & more electrons are excited to the conduction band which results in large number of charge carriers. The result of this process is more and more current starts flowing and hence it is said that the resistance of the device has decreased.

The scattering of a beam of light by the fat globules present in the homogenized milk is the principle in the Milkotester. The amount of light scattered by the milk sample is a measure of the fat content in the milk.
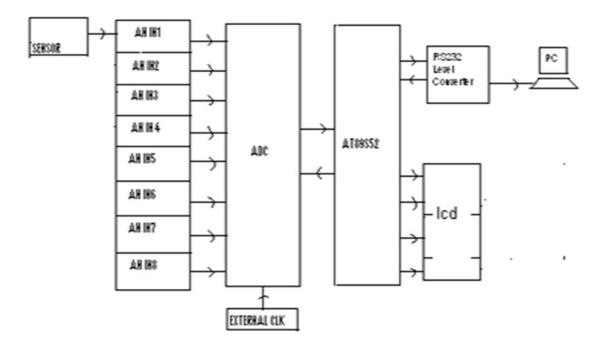

Fig2.General Block Diagram

Construction:

A high intensity LED is used as a light source. The light beam is made to pass through the sample solution contained in the test tube. A LDR is placed exactly on the opposite side of the test tube to detect the amount of light passing through the test tube un-scattered. To obtain maximum sensitivity the test tube is covered in wooden shield which has opening only for LED and LDR to pass through.

V.   EXPERIMENTAL RESULTS

Taking milk samples of 20ml we carried the Gerber's test and then checked it on the electric equipment present in the dairy. After carrying on the above two steps we then carried the test on our equipment. The obtained results are as follows.

	Buffalo Milk	Cow Milk
GERBER'S Method	6.9%	5.00%
Dairy Machine	6.85%	4.90%
Proposed Method	7.00%	4.95%

Fig.2. Proposed method

VI.   CONCLUSION AND FUTURE WORK

The system which provides visualization, control and coordination of fat in dairy was validated. It can be concluded that the overall performance of the developed system to monitor and control the temperature inside is satisfactory. As "milk fat tester" is a micro controller based system, it is having high accuracy and reliability. Hardware used in this circuit is very less, so the cost gets reduced as compared to the other control systems designs. Sensors used in the systems are having wide range for inputs so the system can be used for large scale applications. In this system, we can use LCD also.

Thus "milk fat tester" is very helpful for the remote area applications…

"Milk fat tester" is a multipurpose project. Temperature Controller, PH meter, Spectrum analyzer, Portable data Acquisition, Data logger, Weather monitoring system; these are some other applications of the Green House Control system. System performance of a recently developed computer-based control and monitoring system which provides visualization, control and coordination of fat in dairy was validated. It can be concluded that the overall performance of the developed system to monitor and control the temperature inside is satisfactory.

In future we can also calculate other values of milk such as SNF, degree, lacto, etc. which will help the organizations to fixed the milk rates. This system will be very low budget so common dairy people can also afford to purchase this system and also accurate as compared to other heavy budget system.

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