

# The detection of Urea, Sugar, Sodium Chloride, and Measurement of PH Parameter in the Milk

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**Abstract:** Milk contains all types of macro and micro nutrients. The common adulterants found in milk are urea; starch/blotting paper, glucose/sugar, caustic soda, ammonia refined vegetable oil (cheap cooking oil), white paint and common detergent or shampoo. These not only reduce the nutritious value of the milk but also such milk pose risk to health. Concentrations of mixing other components (Milk blend) detection system is use to detect the blend added in the milk such as urea or sugar. It is having content such as glucose & PH in the milk sample. Also the sodium chloride is detected. All parameters are monitored and it will be display in the percentage form. The advantage of this system is that the all parameters are detected by the sensors, so there is no requirement of any chemical reaction.

**Keywords:** Urea, Sugar, Sodium Chloride, PH Parameter, Milk, pH Scale.

## I. INTRODUCTION

The purpose of milk blend detection system is to detect the extra blend added in the milk. For increasing the economy from the milk than actual economy people are added the component such as sugar, oil, urea, sodium chloride. This component is easily available in low cost so it is easy to add this component in milk.[1] This system uses the physical method than the chemical method therefore for detecting the blend requires very less time. is commonly consumed by people of all age groups. Also, India is the largest producer and consumer of milk [5]. The supply of milk is predominantly from the local suppliers which many a times gets delivered to the consumers without pasteurization. Hence, great care should be taken in the production and distribution process as water activity, moderate pH and ambient temperature is sufficient for the microbial activity in milk. In order to increase the SNF value which in turn increases the economic value of milk and to increase the productivity, urea, a nitrogen containing molecule is added as a common adulterant in milk [3]. The presence of urea in milk is detrimental to human health because they vary the amount of protein in the diet, amount of urine excreted, amount of water intake, dry matter intake. Therefore it is essential that the milk should be tested for purity before consumption. [4]In this paper an attempt is made to study the different methods to estimate the presence of urea in milk. This system will be going to change the lifestyle of Indian farmer and milk collection system. India is highly populated country made up of large number of small villages so it is not easy to have milk analysis of every sample by time consuming chemical methods. So system is made such that it will analyse the milk sample in the ample time [2].

Since more number of farmers is depositing their milk in the dairy, it is a daily task of the dairy to assess the quality of milk from each farmer, verify it & meets the quality norms specified and make payments based on quality and quantity of milk. Though several tests are available for quality assessment of milk like the content of protein, water, detergent, lactose etc., most dairies use only the fat

content test and CLR (Corrected Lactometer Reading) to judge milk quality. System consists of some sensors which sense the element such as ammonia, sodium chloride, and calculate sugar and the PH of the milk sample [5]. Knowing the PH value of the milk sample we can estimate the value of acidity or the basicity, it is required for acceptance of milk. System generates result in the ample time so the system can be used in daily milk collection system that is dairy system. So we can prohibit people from doing this adulteration in the milk.

### 1.1 PH Parameter

Basically PH sensor measures the  $H^+$  ion concentration in solution. PH measurement sensor is made up of three components which include the measuring electrode, reference electrode and temperature sensor .a preamplifier amplifies the mill volt signal at electrode at certain amplitude [2]. The positive terminal is measuring electrode and negative is reference electrode. Measuring electrode is sensitive to hydrogen ion and develop voltage directly to hydrogen ion concentration at solution .reference electrode provides stable potential. When immersed in solution the reference electrode make contact with solution and measuring electrode through junction.

In chemistry, pH is a measure of the activity of the (solvated) hydrogen ion. PH, which measures the hydrogen ion concentration is closely related to, and is often written as, Ph.

Pure water has a pH very close to 7 at 25°C. Solutions with a pH less than 7 are said to be acidic and solutions with a pH greater than 7 are basic or alkaline. Primary pH standard values are determined using a concentration cell with transference, by measuring the potential difference between a hydrogen electrode and a standard electrode such as the silver chloride electrode.[6] Measurement of pH for aqueous solutions can be done with a glass electrode and a pH meter, or using indicators. According to the Carlsberg Foundation pH stands for "power of hydrogen.

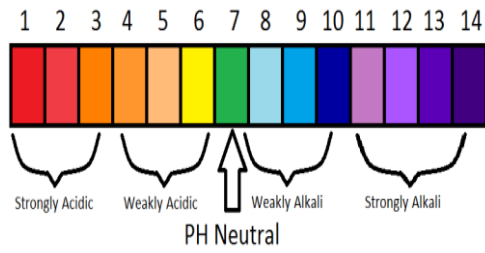


Fig 1.1.A PH scale

The pH scale is traceable to a set of standard solutions whose pH is established by international agreement.

1.2 NACL:

The NACL sensor is made by placing the identical plate close to each other conductive plating. When these plate dipped in solution of milk & salt. The milk solution containing Na<sup>+</sup> and Cl<sup>-</sup> ion are attracted towards the opposite poles of electrode. Due to this electric current flow through circuit. Flowing current is proportional to percentage of salt in milk. The current magnitude is measure by signal conditioning circuit. The ADC and microcontroller convert this data and send to pc. UREA sensor for milk:

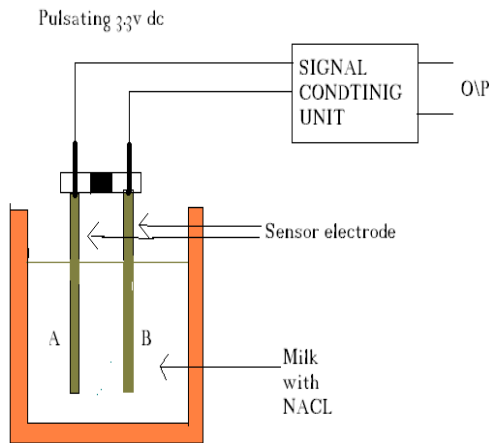


Fig 1.2.NACLdetection sensor for milk

A PT100 sensor is enclosed in a Teflon sheet .this assembly is dipped in milk and urea mixture. The natural property of ammonia is Teflon attracts the ammonia toward the Teflon sheet .this phenomenon generate the heat this heat sensed [6]

1.3 UREA sensor for milk:

A PT100 sensor is enclosed in a Teflon sheet .this assembly is dipped in milk and urea mixture. The natural property of ammonia is Teflon attracts the ammonia toward the Teflon sheet .this phenomenon generate the heat this heat sensed by PT100 sensor which is proportional to the percentage of urea in milk change in temperature is converted in change in resistance of PT100 sensor. Change in resistance is sense by bridge circuit and signal conditioning unit. This signal is digitized by ADC and microcontroller

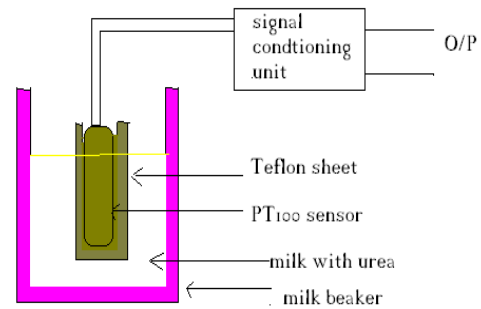


Fig.1.3 Urea detection sensor for milk

II. BLOCK DIAGRAM

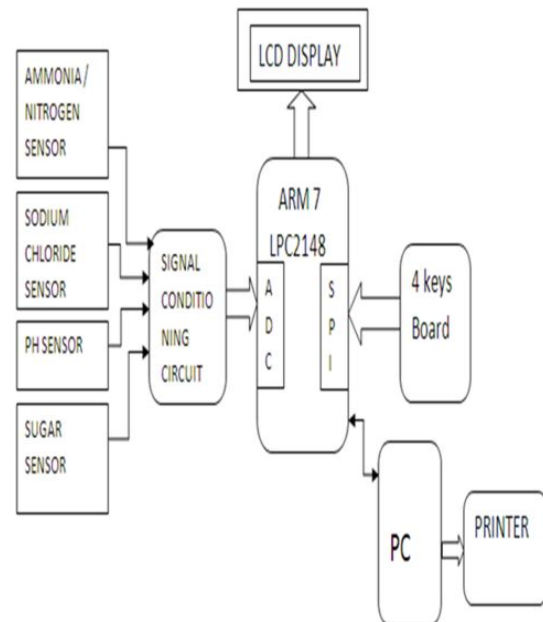


Fig.4 Block diagram of milk blend detection system

A. BLOCK DIAGRAM DESCRIPTION

The milk adulteration system is ARM processor and the modules connected to processor include the ammonia sensor, sodium chloride sensor, pH sensor, sugar sensor, and power supply module, key board, PC and the display module. All modules constitute the milk blend detection system. Four sensors passes the analog data to ARM for A/D conversion through the signal conditioning block, then the percentage of blend detection in milk is displayed on the LCD and also the data is stored in PC. Printer is use for taking out the printout of that particular data. PC and printer are connected through data transfer protocol for exchange of information. The LPC2148 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support that combine microcontroller with embedded high speed flash memory ranging from 32 KB to 512 KB. A 128-bit wide Memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate [2].The main function of the whole system is detection of percentage blend in the milk. Start and stop press button are used for manual control of system.

### B. CENTRAL PROCESSING UNIT

In the milk detection system LPC2148 chip is chosen as the signal processing and control unit. It integrates an 8 channels 10 bit analog to digital Converter (ADC), 4 channels of Pulse Width Modulation (PWM) outputs, USB interface, 117 bit universal I/O port and 24 bit exterior interrupt, 3 channels UART, watch dog timer (WDT), JTAG interface, etc. This chip is manufactured with CMOS technique and could work under 3.3V. This CPU provides the integrated functional modules thereby lowering the complexity of the whole control system and making the system tightly packed, faster, accurate and reliable[4].

### C. GENERAL DESCRIPTION

The LPC2141/42/44/46/48 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support that combine microcontroller with embedded high speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide Memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb Mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, LPC2141/42/44/46/48 is ideal for applications where miniaturization is a key requirement, such as access control and Point-of-sale. Serial communications interfaces ranging from a USB 2.0 Full-speed device, Multiple UARTs, SPI, SSP to I2C-bus and on-chip SRAM of 8 kB up to 40 KB, make these Devices very well suited for communication gateways and protocol converters, soft Modems, voice recognition and low end imaging, providing both large buffer size and high Processing power. Various 32-bit timers, single or dual 10-bit ADC(s), 10-bit DAC, PWM Channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt Pins make these microcontrollers.

### III. ALGORITHM OF SYSTEM

1. Start.
2. Initialize the CPU&SFR.
3. Initialize UART, ADC, SFR and LCD
4. Display Initialization Measurement of LCD.
5. Initialize the data storage array.
6. Data array Initialize for Urea, Sugar, pH and NaCl.
7. Check for key pressed.
8. If key pressed then check for key state=1.
9. If Yes then convert data to ASCII and Display the data on LCD (Sugar),go to the step no.7.
10. If No then check for key state=2.
11. If yes then convert data to ASCII and Display the data on LCD (Urea) goes to the step no.7.
12. If No then check for key state=3.
13. If yes then convert data to ASCII and Display the data on LCD (pH) goes to the step no.7.
14. If No then check for key state=4.
15. If yes then convert data to ASCII and Display the data on LCD(NaCl).Go to the step no.7.

16. If No then Go to the step no.8.
17. If key is NOT pressed then Read ADC Channel 0 to 4.
18. Calculate percentage value of respective channel.
19. Convert the data to ASCII format and Display the value on LCD.
20. Fill the array of Urea, Sugar, pH and NaCl.
21. Send the array value to the serial port.
22. Again goto the step no.7.

### IV. ADVANTAGES

1. Uses physical rather than the chemical technique: There are different chemical methods are available which time consuming methods are. So system uses spectroscopic method for urea detection which is one of the physical methods.
2. Easy to implement: We have directly used particular sensor in this system, so this sensor directly detect the blend in the milk.
3. User friendly: System has made automatically operating; by just placing the sample of milk it gives analysis of blend elements in the milk.
4. Reduces human Error: As the chemical methods include human participation to change the chemical composition of the chemical component, but this system is work automatically, so the human errors are reduced.
5. Easy to Handle.
6. Real time monitoring and fault diagnosis.
7. Centralized control.
8. Accuracy is more.

### V. APPLICATION

1. Used in milk dairies: In the milk dairies this system is also useful to detect the blend such as Urea, Sodium Chloride, Sugar, PH parameter in properly.
2. Used to detect impurities present in the milk.
3. To punish the people whoever added extra content or impurities like Urea, water, sodium chloride, sulphur, urea etc.
4. To know the quality of the milk. As the pH of the milk is detected in the system, so that we can know milk is fresh or not.
5. To prohibit adulteration in the milk.

### VI. RESULTS

1. Urea Sensor:  
Teflon attracts the ammonia toward the Teflon sheet. This phenomenon generate the heat this heat sensed by PT100 sensor which is proportional to the percentage of urea in milk change in temperature is converted in change in resistance of PT100 sensor. The Urea sensor has an advantage of this sensor is to detect or showing result in terms of percentage in the 16 by 2 LCD display for the given milk.
2. Sugar Sensor:  
Sugar sensor sense the sugar content in the given milk and simultaneously to show the Percentage of sugar in the LCD display. The sugar is also present in the sugar.

### 3. Sodium chloride Sensor:

The milk solution containing Na<sup>+</sup> and Cl<sup>-</sup> ion are attracted towards the opposite poles of electrode. Due to this electric current flow through circuit. Flowing current is proportional to percentage of salt in milk. Sodium Chloride sensor sense the sodium content in the milk and show the percentage of given content in the LCD display. These types of content are also present in the sodium bicarbonate that means soda or salt content [7].

### 4. PH sensor:

PH is the measurement of potential activity of hydrogen ions in the sample. PH was positively correlated with electrical conductance and total conductivity. It is used to know whether the milk sample is acidic or basic or neutral.( Fresh milk has a pH of 6.7 and is therefore slightly acidic.)

## VII. CONCLUSION

A developed system is used to test milk for different concentrations of urea, sodium chloride, sugar. This system detects the blend of the milk sample such as sugar, sodium chloride & urea within the ample time. PH level of the milk is also determine by this system. Further research in this area may be carried out to increase the sensitivity of the instrument by estimating the effects of external factors. Change in temperature, atmospheric pressure and also, residual pressure exerted by the stray gases present in the sample that affects the performance of the sensor can thus be minimized. This system prevents the people from doing the adulteration and maintains the quality of the milk good.

## VIII. FUTURE SCOPE

1. We can measure other parameters like Dissolved Oxygen, Nitrate, pesticides, Chlorides, Fluorides etc.
2. We can use GPRS, GSM module in place of ZIG-BEE module.
3. We can implement different purification process to make milk fit for use.
4. We can also use our system to monitor river water, dam water, and lake water, sea water etc. parameter continuously. In order to monitor water quality in different sites, future works can be focused on establishing a system with more sensor nodes and more base stations. Connections between nodes and base station are via WSN, while connections among different base stations are via Ethernet. The Ethernet can also be connected to Internet so that Users can login to the system and get real time water quality data faraway. Another interesting field lies on the optimization of power consumption and data throughput of the WSN. The wireless data acquisition from remote places and database storage is the supporting structure of the system which can be used for further research studies like soil content analysis using different simulators. The simulation can be used for water pollution control in varying conditions.

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