DETECTION OF ADULTERANTS IN MILK AND TRANSMISSION OF OBTAINED RESULTS

Dhakshayini G[1], Dharani V[2], Indhu P V[3], Ashok P[4]

[1]*Department of ECE, PSVP Engineering College, Tamilnadu, India*
[2]*Department of ECE, PSVP Engineering College, Tamilnadu, India*
[3]*Department of ECE, PSVP Engineering College, Tamilnadu, India*
[4]*Assistant Professor, Department of ECE, PSVP Engineering College, Tamilnadu, India*

ABSTRACT

Melamine is a small polar compound which is very rich in nitrogen (67% by mass). It is recently been found in milk products and animal food, where it possibly has been added to give a false impression of high protein content. It is believed that melamine combined with cyanuric acid can cause fatal kidney stone due to the formation of an insoluble melamine-cyanurate complex. The consequences are fatal for the youngest, the babies and small kids. The reason for adding Melamine to milk is to make it appear in protein in order to achieve a better price for the milk.

The protein content of the milk is measured non-specifically as cumulative parameter with nitrogen compound determination by Kjehldahl so that the addition of Melamine was not detected. So determination of Melamine and other small nitrogen-rich- compounds is there for of large importance to ensure food safety. The project determined the best way meet the various method criteria (suitable procedures to handling the sample, preparation standard).

The main aim of the paper is to find the contamination of milk such as melamine content, water content and the color changes in the milk using Surface Enhanced Raman Spectroscopy and Beer Lambert law. The adulteration in milk could be found so that it can be reported to the food safety department by which it can minimize the health problems and get pure milk.

Keyword: - *Beer Lambert law, Surface Enhanced Raman Spectroscopy, melamine*.

1. INTRODUCTION

Nowadays there are many health problems arising in India relating to food safety. Milk is one of the primary sources of nutrition for infants. Milk is mostly diluted with water. This not only reduces its nutrition value but contaminated water can also cause other health problems. The other adulterants used in milk are ;starch, caustic soda, sugar, hydrated lime, formalin ,ammonium sulphate and melamine .The Indian council of medical research has reported that milk adulteration have hazardous health effects. Melamine is not considered very toxic for adults it can combine with other chemical compounds to cause kidney stones and renal failures in infants.

2. PROPOSED SYSTEM

In the proposed system the milk contamination will be detected using surface enhanced Raman spectroscopy and beer Lambert law. The light from the IR emitter array will be sent through the sample to detect the changes in the milk which is then passed through the detector array. Array of detectors is used since the light is absorbed from all the directions (top and sides).The detected light is passed through signal amplifier to amplify the obtained signal. The obtained signal will be passed through the embedded microcontroller where the analog signal will be converted to digital and then passed through the PC .In the PC the comparison operation takes place. The

stored accepted values will be compared with the actual obtained values and the results will be transmitted to the necessary organizations.

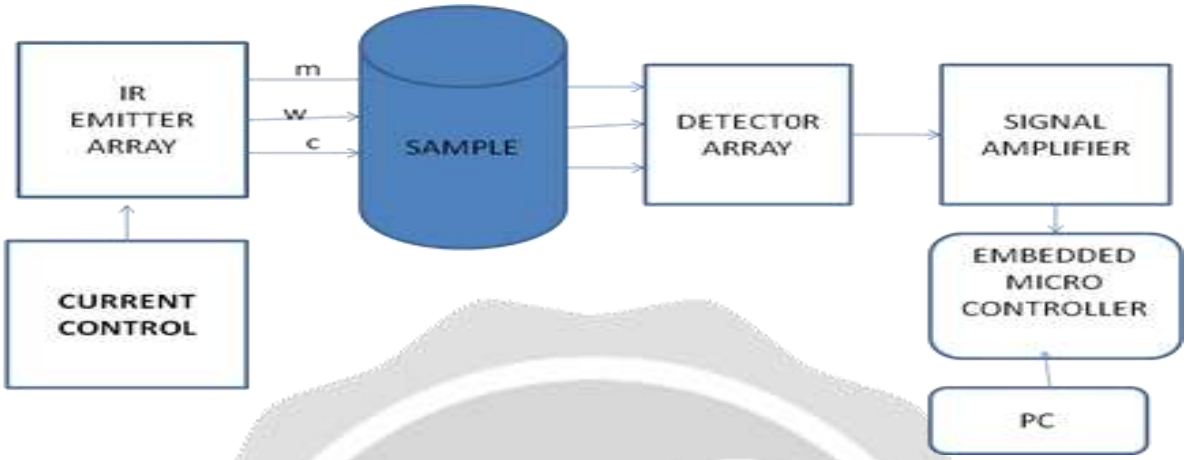

Fig -1: Block diagram

3. MILK ADULTERATION LAW

Milk adulteration should amount to life imprisonment says, Supreme Court and asked the government to take all possible measures to prevent it. The supreme court of India urged that anyone found involved in the illicit activity should be dealt with a firm hand. The standard authority of India in 2011 revealed milk samples collected by Food safety and the availability of adulterants in large scale across the country.

4. SURFACE RAMAN SPECTROSCOPY

This is a surfaced sensitive technique shown in fig 2 that increases the enhancement factor for Raman spectroscopy as 1010 1011.This technique is used because every single molecule of the sample could be detected. SERS is used because of its high sensitivity, specificity and the use of low power lasers. It is sufficient to use low magnification optics to obtain SERS. SERS could be combined with techniques like chemical separation, biological capturing, colorimetry, micro fluidic devices and labeling techniques. In this technique metallic nano structures are used to enhance the intensity of Raman scattering.

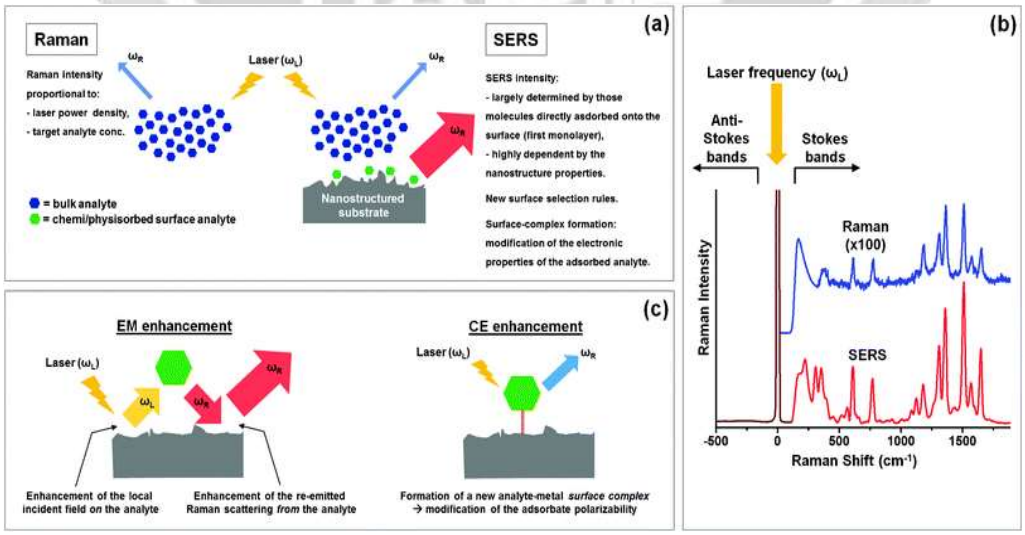

Fig -2: Surface Raman Spectroscopy

5. BEER LAMBERT LAW

The Beer Lambert law is the linear relationship between absorbance and concentration of an absorber (sample solution).

According to Beer's law, two external assumptions are made.

1. The absorbance is directly proportional to the concentration of the sample in the experiment.
2. The absorbance is directly proportional to the length of the light path or width of the container.

The light is passed from the sides of the container in Beer Lambert law. Here, the light intensity changes from the initial intensity after it passes through the sample solution .From this the absorbance can be obtained as

$A=-\log (I/I_0)$

I is the light intensity

I_0 is the initial light intensity

Unknown concentration of a sample solution can be obtained by measuring the amount of light the sample absorbs by applying Beer's law.

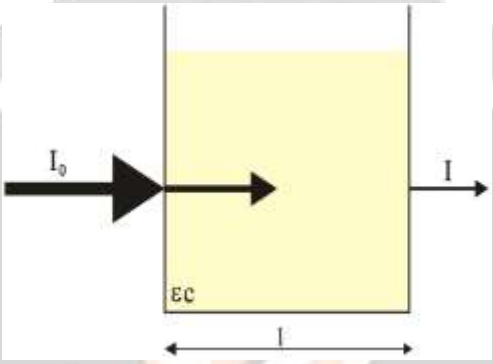

Fig -3: Beer Lambert Law

6. SENSING SYSTEM

A group of six sensors will be used to sense the adulterants present in the milk based on the characteristics of the light emitted out of sensor in the top and Beer Lambert law uses the sensors in the sides respective modes will be placed on the sides and top of the sample.

7. DETECTOR ARRAY

A detector array [photodiode array [PDA], InGaAs array or CCD array] is a linear arrangement of discrete detectors [e.g. photodiodes] on an integrated circuit [IC] chip. Placed at the image plane of a spectrometer it allows a range of wavelengths to be measured simultaneously. Incident light is dispersed by a fixed grating. Since the sensors have no moving parts, a full spectrum can be acquired in milliseconds or less. In addition, the rugged and compact design of the monolithic spectral sensors allows reliable, accurate data acquisition without any need for recalibration. NIR and CCD devices with significant dark current are thermoelectrically cooled or stabilized for drift-free operation. Thus, diode-array based spectrometers detectors are especially useful in industrial environment, where samples are rapidly passing, with application examples like quality inspection of a wafer or a LED in production.

8. SIGNAL CONDITIONING

Here, signal conditioning is done using sigma volt board. This signal conditioning circuit consists mainly of three voltage regulator. Signal conditioning is the process of preparing or tuning the signal suitable for next stage. Here, signal conditioning is done using Sigma volt board. The three voltage regulators are,

- IC7805
- IC7812
- IC7912

It also consists of two UA741cp amplifiers. This is a general purpose operational amplifier in an 8 pin package. This is suitable for voltage follower applications because of the high common mode input voltage and

absence of latch up .Another important component in the signal conditioning is 103 Trimpot which is used for tuning purpose.

9. SENSING SYSTEM

The user interface used is visual basic. VB is a third generation event driven programming language developed by Microsoft. This enables RAD i.e. rapid application development of graphical user interface.

The values obtained will be compared with the previously stored standardized values .The deviations from the original value will be displayed in form of graphs for transmission. The obtained information is transmitted to the respective authorities through mobile IOT.

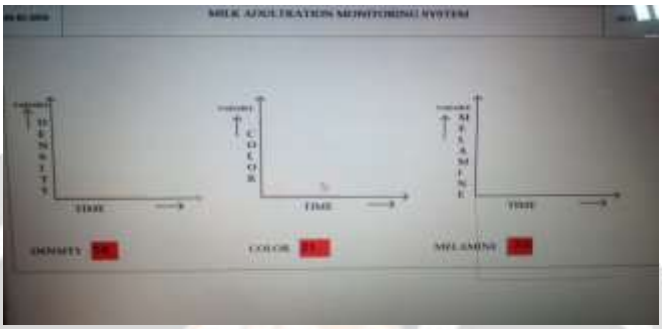

Fig -4: Output

10. CONCLUSION

This research demonstrated the potential IR spectroscopy combined with analysis to identify the adulteration in milk. The main work of the research is to extract the valid information of adulterants and discriminate them from the raw milk. Due to the complexity of the milk which can result in overlapped peaks of many constituents, the main constituents in milk are identified according to the fingerprint characters, including absorbance peak intensities, positions, wave numbers and shapes of the absorption peaks of original IR spectra. This research indicates the need for a rapid, convenient and available technique for detecting adulteration in milk. For further study, new quantitative methods are required for precisely detecting the possible adulterants in milk and this method can also be applied to other food safety detection areas.

Recent product recalls and food safety incidents due to melamine adulteration or contamination have caused a worldwide food security concern. This has led to many methods being developed to detect melamine in foods, but few methods have been reported that can rapidly and reliably measure melamine in environmental samples. To meet the need, in this project it is possible to detect and quantify melamine at concentrations relevant to food authorities in less than 25 minutes with relatively with low cost. It is simple, sensitive and robust and allows for analysis of large number of samples, without degradation in column performance. Very low noise is observed, emphasizing the effectiveness of the clean-up procedure for complicated matrix. Because of the simplicity and the sensitivity, this proposed method has the potential to be a useful tool for the routine melamine monitoring in real-time.

11. FUTURE ENHANCEMENT

Since adulteration of food is becoming a common practice due to exploding population in India, it is essential that consumers be aware of the methods for detecting these adulterants and most importantly about the ill effects on human health by short term and long term consumption. Keeping this in mind and by considering the tolerable level of the adulterants, a biosensor can be devised that incorporates the above tests for detection of adulterants. By a single input the adulterants can be detected based on pH change, color change resulting due to induced chemical reactions and conductance measurements for qualitative analysis. Furthermore, research can be done to increase the sensor's sensitivity and repeatability by considering the extraneous factors like temperature etc. The sensor can be made such that it can be utilized by consumers at home for easy detection of these adulterants

6. REFERENCES

[1]. Aditya Dave, 2011, 'Optical sensing system for detecting water adulteration in milk'.
[2].Ansoon Kim, Steven J. Barcelo, R. Stanley Williams and Zhiyong Li, 2012, 'Melamine Sensing in Milk Products by Using Surface Enhanced Raman Scattering' Cognitive Systems Lab, Hewlett-Packard Laboratories, 1501 Page Mill Road, Palo Alto, California 94304, United States.
[3]. Faraz A., Lateef M, Mustafa M.I., Akhtar P., Yaqoob M. and Rehman S.,2013, 'Detection of Adulteration, Chemical Composition and Hygienic Status of Milk Supplied to various Canteens of Educational Institutes and Public Places' in Faisalabad of Animal and plant science, vol.23, pp. 119-124.
[4]. KandapalS.D. ,Srivastava A.K. and NegiK.S., 2012, 'Estimation of Quality of Raw Milk(open and branded) by Milk Adulteration Testing Kit', Ind. J. of Community Health, vol. 24(3), pp. 188-192.
[5]. Xiao-Fang Zhang, Ming-Qiang Zou, Xiao-Hua Qi, Feng Liu, Xin-Hua Zhu, Bin-Han Zhao, 2010, 'Detection of melamine in liquid milk using surface enhanced Raman scattering spectroscopy'.