ADULTERATION ANALYSIS AND MONITORING SYSTEM TOWARDS HEALTH HAZARDS

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Abstract

Our project is about finding the contamination of Milk, oil And Other Food such as melamine contamination, water content added to the milk and to find the colour changes in the milk using Laser Induced Break Down Spectroscopy Technique And Beer Lambert Law. Since ancient time in India; it is a significant part of the diet for a high proportion of the population. As a result of the large demand and growth in competition in the dairy market and the increasing complexity of the supply chain, some producers are involved in milk fraud. This malpractice has become a common problem in India, which lack strict vigilance by food safety authorities. Milk adulteration is done for financial gain, but it can also be adulterated due to unhygienic conditions. Water is the most common adulterant used, which decreases the nutritional value of milk. To the diluted milk, inferior cheaper materials are added such as reconstituted milk powder, urea, cane sugar and even more hazardous chemicals including melamine, formalin, caustic soda and detergents. This review aims to investigate the impacts of milk adulteration on food safety and it points out the adverse human health effects associated with the consumption of adulterated milk.

Keywords: Breakdown Spectrography, Milk Adulteration, Contamination, Consumption, caustic soda and detergents, lack strict vigilance, unhygienic conditions.

1.Introduction

Food is essential for sustenance of life. Adulteration of food can pose serious risk to human health. Major food adulteration occurs with milk and milk products. Milk in its natural form has a high food value, since it is comprised of a wide variety of nutrients which are essential for proper growth and maintenance of the human body. Since ancient time in India; it is a significant part of the diet for a high proportion of the population. As a result of the large demand and growth in competition in the dairy market and the increasing complexity of the supply chain, some producers are involved in milk fraud.

2.Objectives

We are Going to use Laser Induced Breakdown Spectroscopy (LIBS) is a rapid chemical analysis technology that uses a short laser pulse to create a micro plasma on the sample surface. This analytical technique offers many compelling advantages compared to other elemental analysis techniques. We are going to use below methods for finding the adulteration of milk. They are Surface enhancement Raman Spectroscopy, Beer Lambert Law, Laser Induced Breakdown Spectroscopy (LIBS)

3. Literature Review

Many existing systems have attempted to Food adulteration: Causes, risks, and detection techniques one such is 2024 Yeniewa Kerie Anagaw, Wondim Ayenew,Wudneh, they carried The system uses advanced technologies like spectroscopic techniques—including LIBS and Surface-Enhanced Raman Spectroscopy (SERS) —are being used for rapid and accurate detection of adulterants. These methods can identify both the type (qualitative) and amount (quantitative) of toxic elements present in food.

4. Methodology

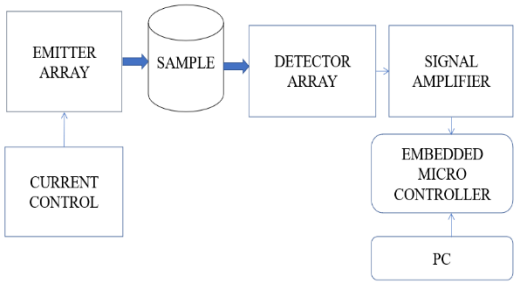
Data Acquiring will be the initial Sensors acquiring process then it moves to data processing containers to signal data execution then Data conversion and microcontroller will be extracted as embedded design form, along with this data manipulation and proper communication for analysis transmission.

Collects raw data from food samples (milk/oil). Includes emitter & detector arrays, LIBS/SERS hardware setup. Data processing & analysis module implements beer-lambert law & SERS peak analysis. Extracts spectral features and compares with known adulterant profiles. Embedded microcontroller module converts analog signals to digital (ADC). Controls data acquisition flow and timing (e.g., using pic16f877a). Communicates with pc via rs232. Signal conditioning module amplifies and filters the raw signals for accurate

processing. Removes noise and ensures clean input for conversion.

5. System Architecture

Spectral Signal Acquisition: Capture light emission from food samples using LIBS/SERS sensors to obtain unique spectral signatures corresponding to different adulterants. Feature Extraction & Matching: Analyze the acquired spectra to identify characteristic peaks using Beer-Lambert Law and Raman scattering principles; compare with known adulterant signatures. Contamination Classification: Use threshold-based logic or machine learning models to classify the sample as pure or adulterated, and quantify contamination levels.



6. Components Used

IR EMITTER ARRAY: It is made up of gallium arsenide. An infrared emitter is a source of light energy in the infrared spectrum. It is a light emitting diode that is used in order to transmit infrared signals from a remote control. In general the more they are in quantity and better the emitters are, the stronger and wider the resulting signal is. A remote with strong emitters can often be used without directly pointing at the desire device.

SIGNAL AMPLIFIER: An electrical equipment that is used to increase the strength of the amplified signal passing through it.

DETECTOR ARRAY: A detector array (photodiode array) in GaAs array are CCD array is a linear array of discrete detectors (eg 512 photodiode) on an integrated circuit chip. It allows a range of wavelength to be measured simultaneously.

Microcontroller: A microcontroller is small computer on single integrated circuit containing a processor code, memory and programmable input and output peripherals. Microcontroller are designed for embedded applications, in contrast to the microprocessor used in personal computers are other general-purpose applications consisting of various discrete chips

EMBEDDED MICROCONTROLLER CIRCUIT DESCRIPTION: PIC16F877A is the embedded microcontroller used in our project for complete data acquiring to computing. PIC microcontroller consisting of 8 analog inputs and 23 logical I/O and two for serial data transmission to PC. It needs very few external components for its operation.

POWER SUPPLY CIRCUIT: Irrespective of the technological growth one must construct a reliable power source for embedded controller. To obtain reliability with repeatability in our project we have used 230V/12V step down transformers and bridge rectifiers to convert into DC. A constant voltage regulator LM7805 is used to produce constant 5V, irrespective of the fluctuations of the output at a current ratio of 1A. The necessary filters are employed to avoid unwanted signal interpretation and the output.

RS 232: The Max 232 is a dual RS-232 receiver / transmitter that meets all EIA RS232C specifications while using only a +5V power supply. It has 2 onboard charge pump voltage converters which generate +10V and –10V power supplies from a single 5V power supply. It has four level translators, two of which are RS232 transmitters that convert TTL\ CMOS input levels into + 9V RS232 outputs. The other two level translators are RS232 receivers that convert RS232 inputs to 5V TTL\CMOS output level. These receivers have a nominal threshold of 1.3V, a typical hysterisis of 0.5V and can operate up to + 30V input.

7. Software Tools

- **SURFACE ENHANCEMENT RAMAN SPECTROSCOPY:** SERS is a surface sensitive technique that results in the enhancement of Raman scattering by molecules adsorbed on rough metal surfaces. The enhancement factor can be as much as 10^{14} – 10^{15}, which allows the technique to be sensitive enough to detect single molecules.
- **Embedded C/C++:** These are the core programming languages used to control embedded systems. In this project, they enable communication between the microcontroller and sensors, handle logical decisions (such as when to irrigate), and ensure accurate timing and data acquisition processes. They offer low-level access to hardware features for optimal system performance.

8. Results and Discussion

In our project we ensure that the contaminations of milk can be identified so that the required preventive measures can be taken at the right time.By this we can minimize the health hazards and we can gain pure form of milk which will be good for health. The combination of automation and monitoring made the system not only efficient but also easy to use, especially for farmers with limited technical knowledge.

9. Advantages

- Intelligent decision-making based on real-time data.
- Low maintenance and cost-effective.
- Surface enhancement Raman Spectroscopy Beer Lambert Law. Laser Induced Breakdown Spectroscopy (LIBS) Improves more performance.

10. Future Scope

The current version of the system can be further enhanced by multiple adulteration APIs to make smarter irrigation decisions. Artificial Intelligence (AI) and Machine Learning (ML) can be used to analyse and detect Health issues. Multilingual user interfaces can also be incorporated to expand usability and adoption.

11. Conclusion

In our project we ensure that the contaminations of milk can be identified so that the required preventive measures can be taken at the right time. By this we can minimize the health hazards and we can gain pure form of milk which will be good for health.

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