

Development of Sensor Based , Portable Instrument to Test Milk Quality

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Milk, a traditional and vital component of human meals, is highly valued for its nutritional content, providing crucial proteins, lipids, minerals, and vitamins. Consumers' widespread perception of milk as a wholesome food option is a significant incentive for dishonest people to adulterate the milk to maximize financial gains.

Due to its high perishability, milk is susceptible to quick bacterial contamination, making raw milk unfit for processing or consumption for a long duration. Frequently, illicit utilization of chemical preservatives augments the longevity of milk and milk products, hence presenting significant health hazards to consumers. To evaluate the severity of adulteration, a risk analysis model was developed based on input from medical professionals. Each adulterant was categorized according to its health impact on consumers. Possessing detection tools for identifying adulteration in milk is crucial to ensure consumer safety. Several detection technologies are available, but their widespread use is severely constrained by their high cost, complicated nature, and need for laboratory settings. This thesis addresses the critical issue of milk adulteration and its associated health risks by introducing an innovative, low-cost, portable sensor for detecting chemical adulterants in milk.

The developed sensor operates on the principle of electrical conductivity measurement, identifying changes caused by adulterants such as sodium hydroxide, hydrogen peroxide, and water. The prototype effectively detects and quantifies adulterants' impact on milk composition by analysing impedance shifts and output voltage variations. The developed device is compact, user-friendly, and cost-effective, requiring only 4 mL of milk per test and operating on a low-power battery or USB adapter. Under laboratory conditions, the sensor demonstrated high sensitivity, detecting minimum adulteration levels of 0.5% formaldehyde, 0.2% sodium hydroxide, 0.025% sodium bicarbonate, and 2.5% hydrogen peroxide.

Additionally, the prototype successfully distinguished adulteration levels up to 0.5% for sodium hydroxide and hydrogen peroxide and up to 10% for water adulteration. The findings highlight the potential of this sensor-based device as a practical first-line defense against milk adulteration, offering consumers and small-scale dairy producers an accessible and efficient milk quality assessment tool.