



E-SYSTEM FOR SALT AND SODA ADULTERATION DETECTION FOR MILK QUALITY ASSESSMENT

30

¹Rajashekhar B Somasagar, ²Basavaraj G M, ³RajendraSoloni

¹Associate Professor Dept. of ECE, GMIT, Davanagere

²Associate Professor Dept. of ECE, NCET, Bangalore

³Assistant Professor Dept. of ECE, GMIT, Davanagere

¹rajashekharbs@gmail.com

²gmb2206@gmail.com

³rajendrass@gmit.ac.in

INTRODUCTION

Milk can be described in different ways. Biochemically defining, cow milk is a complex semi-liquid in which several different chemical compounds have been found. It is the most important resource of nutrition for infants and all human beings over the globe [1]. Milk adulteration is a common societal problem and consumption of contaminated milk causes serious health issues. In the last few years, the research work explored the intellectual milk analyzing schemes are being carried out in the direction of milk composition, adulteration material detection, and identification to achieve the standard requirements. However most of the existing milk testing methods are chemical testing methods and the existing methods have a very high price, which is in the range of Lakhs.

DOI Number: 10.14704/nq.2022.20.11.NQ66003

NeuroQuantology 2022; 20(11): 30-35

MILK QUALITY

Milk quality control is the routine of accepted assessments to certify the application of standard practices, permitted standards, guidelines pertaining to the milk and milk foodstuffs. Quality of milk is a measure of the superiority of milk or a state of being free from deficits and major differences. Milk quality is also defined as, the consistent and strict assurance of definite standards that accomplish the homogeneity in the composition in order to fulfill the consumer or customer necessities.

Milk adulteration is one of the most fraudulent processes of milk preparation or is an act of blending or intentional addition of substances to milk or incidental contamination during the process of preparation, storage, and transportation of milk that makes it unfit for

consumption. These impurities are added to replace the contents of milk at a cheaper price to increase the capacity. India is the largest country in milk production and consumption according to the National Dairy Development Board, India and World Society for the Protection of animals [2].

LITERATURE REVIEW

In [1-2], the milk-specific gravity is the measure of the ratio of the milk density to the water density. The standard range of milk-specific density is from 1.027 g/ml to 1.036 g/ml. Normally, milk density is measured by a Lactometer. In this method, Lactometer reading is indicated by the level of mercury filled in the instrument. Lactometer readings are the two-digit whole numbers. The density of the milk



iscalculated as Lactometer reading is divided by 1000 and adding 1 to the result.

In [4], the Gerber Method describes the measurement of milk fat. The milk is admixture by iso-amyl, sulphuric acid and alcohol in a particular Gerber tube, allowing the protein disbanding and fat discharge. The Gerber tubes are the centrifuged tubes which are used to measure the milk fat content and the rising of fat into the tube is calculated as a total fat percentage of the milk sample. This technique is appropriate for regular assessment or screening. This type of chemical method is used as empirical routine schemes and provides reproducible outcomes which can be achieved by the proper follow up of the procedures. While doing this testing, Sulphuric acid is used and is very corrosive in nature.

In [5], Lawton et al. have reported to find out the milk fat content by measuring capacitive reactance and electrical conductivity of milk. The hundred-hertz frequency was used for the measurement to avoid electrode polarization. In [6], The capillary electrophoresis (CE) is an analytical method, is used for the separation of food colorants. Capillary Electrophoresis procedure gives an optical path and lower sample capability. The detection limit is unsatisfactory.

In [7], The Foss-NIR Systems of the spectral range of 700nm to 1100 nm wavelength is used to predict lactose, protein, and fat. Their study accomplished a low typical error of prediction of 0.10 0.06 0.10%, and for protein, fat, and lactose, respectively. Once again this study used a laboratory analyzer which is not commercially feasible.

THE MOTIVATION FOR THE PRESENT WORK

The use of milk adulteration detection and quality analysis system in the society is a requirement in many countries where there is a more amount of milk consumers, needs more

amount of free adulterated, high nutritional valued milk but milk production is less as per the need, in such cases fraudulent (both producers and vendors) will start to mix some other materials to increase the quantity of milk to reach the consumer needs and it is very dangerous to the health of the consumers. How to detect and analyze milk quality became a big issue. Though several works are reported in the literature on milk adulteration detection and milk quality analysis, there is little effort in the direction of milk adulteration and quality analysis under multiple sensor scenarios [7-9].

The milk adulteration and quality analysis employ a number of classifiers and larger varieties of features. Therefore, there is a requirement for detailed research to determine the strength of already existed methods and schemes for adulterated milk quality. As per the investigation made on the milk features extraction it can be extended, develop novel methods for extraction of milk features, testing techniques, and models, in addition to currently existing techniques to advance the adulteration detection and quality analysis performance. As per the survey in many places like tea shops, sweet stalls, dairy product producer and milk sellers preparing synthetic milk to fulfill the requirement of milk. Hence, the motivations for this proposed research work.

ARTIFICIAL INTELLIGENCE AND EMBEDDED SYSTEM

Artificial intelligence (AI) is a sub-branch of computer science that stresses the construction of an intellectual mechanism that works and reacts like human senses. Research connected with artificial intelligence is very highly specialized and technical. The core problems of artificial intelligence consist of programming machines for definite talents such as learning, problem-solving, reasoning, perception, planning, knowledge, and ability to manipulate [11].



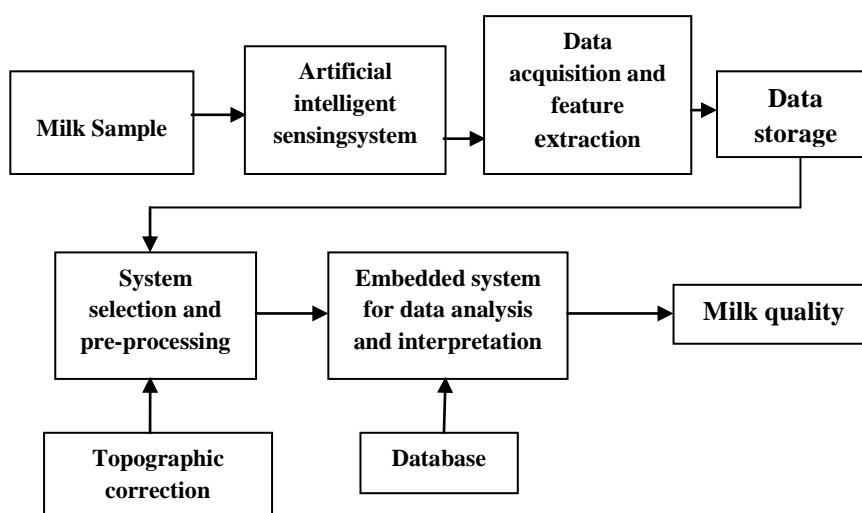


Figure 1: The basic structural block diagram of milk quality analysis

An artificial intelligence sensing system, data acquisition, and feature extraction, system selection, pre-processing, embedded system for data analysis, interpretation, and decision logic are the major tasks in milk adulteration detection, identification, and quality analysis. The artificial intelligent sensing system is dipped in the milk sample to extract the suitable information to analyze the quality. The feature extraction phase converts the input signals into electrical natured signals.

The main purpose of the system selection and pre-processing phase is to minimize the number of records while detecting the adulterants and analyzing the quality. Categorizing tools are used to construct the reference database for each parameter of milk and its adulterants using training feature vectors.

An unknown test sample of cow milk is used during milk test and is matched against the entire created reference database. The milk adulterants and the fat content decisions are made on the best equivalent matching directory. The basic structural block diagram of the cow milk quality analyzing system is shown in Figure 1.

MILK SAMPLE

Database and reference model is created by considering the standardly known fatof cow milk and raw cow milk sample of 50ml is for detection of quality analysis. Aniterative addition of adulterants has to be done into the freshly drawn milk for detectionand quantification.

FEATURE EXTRACTION

It is necessary to extract the milk features for a number of reasons. Primarily, milkis an extremely composite whitish or pale yellowish liquid which carries variousnutritional parameters. In milk quality analysis and adulteration detection, it isconcentrated on the structures and characteristics that relate to the behavioral andbiological traits of milk. For the benefits of computation and storage of milk featuresdatabase is represented in smaller dimensions.

PRE-PROCESSING AND SELECTION SYSTEM

Pre-processing system involves topographical, temperature conditions. Thepressure, gas and taste sensing devices are used to the monitor and control the dilutionsand adulterants continuously. The point of application is determined by the sensingdevice and generates



accordingly an electric signal that informs the processing device for appropriate actions.

Electronic-based human senses and brain actions are phenomenal and a great feat. It provides a lesson for the pioneers of science and technology to learn, mimic these activities by artificially creating electronic controlled devices. Artificial senses having an ability to generate a spike or impulse of activity when a threshold of the parameter is exceeded.

DECISION LOGIC

Decision logic plays a very important role in milk testing and analysis provides a control flow, combinational, and procedural logic for milk quality analysis and detection of fraudulent materials in the milk. It compares the obtained values with the standard database, find and apply to the best match. This also connects to the people to provide the ability to verify a presence of adulterants and balance in real time.

CLASSIFICATION AND INTERPRETATION

The classification is a process of grading or categorizing the milk based on the purity of milk

and amount of admixtures in the milk. Classification of milk also decides the milk consumption ability. An interpretation is a process to display the results. It explains, reframes otherwise shows in the form of human understanding symbols and languages.

TESTING

Testing, in general, is a finding out of how well something works and its main purpose is to develop, what level of knowledge or skills to identify the unknown things. It is used as a key checkpoint to create a database for findings of unwanted materials in the milk.

RESULTS and PERFORMANCE ANALYSIS

SALT/SODA DETECTION and QUANTIFICATION

Salts and sodas are more conductor of electricity due their strong bases nature in the pH scale. These adulterations generate more positive hydrogen ions when dissolved in the milk. Caustic soda is a very hazardous substance which causes heart diseases and soreness arthritis.

Table 1: Statistical averages of salt adulterated milk behavior with different fats

Temp/ Fat%	1.5		3.0		3.5	4.1			Saltingm
	pH	σ (mS)	pH	σ (mS)	pH	σ (mS)	pH	σ (mS)	
26°C	6.652	4.81	6.602	5.03	6.534	5.31	6.503	5.52	0
	6.752	5.62	6.652	5.81	6.582	5.98	6.555	6.99	0.1
	6.805	6.44	6.708	6.95	6.634	7.21	6.598	7.52	0.2
	6.856	6.98	6.782	7.48	6.727	7.83	6.644	7.98	0.3
	6.904	7.61	6.794	8.12	6.803	8.33	6.732	8.92	0.4
	7.115	8.21	7.05	8.53	6.905	8.81	6.853	10.91	0.5
	7.283	10.54	7.190	10.94	7.015	11.34	6.985	13.14	1
	7.356	13.25	7.252	13.85	7.114	14.35	7.356	15.05	1.5
	7.687	14.72	7.675	15.32	7.669	15.56	7.630	16.43	2.0



Table 2: Statistical averages of soda adulterated milk behavior with different fats

Temp/ Fat%	1.5		3.0		3.5		4.1		Soda in mg
	pH	σ (mS)	pH	σ (mS)	pH	σ (mS)	pH	σ (mS)	
27°C	6.652	4.81	6.602	5.03	6.534	5.31	6.503	5.52	0
	6.782	5.82	6.671	5.95	6.588	6.08	6.565	6.98	0.1
	6.815	6.74	6.748	7.35	6.674	7.31	6.668	7.62	0.2
	6.866	7.08	6.762	7.58	6.737	7.88	6.694	7.88	0.3
	6.914	7.71	6.814	8.22	6.813	8.40	6.792	8.97	0.4
	7.125	8.41	7.05	8.63	6.925	8.88	6.883	11.02	0.5
	7.293	10.84	7.190	10.99	7.215	11.34	6.985	13.14	1
	7.366	13.65	7.352	13.75	7.314	14.45	7.306	14.95	1.5
	7.698	14.92	7.685	15.22	7.679	15.66	7.650	16.48	2.0

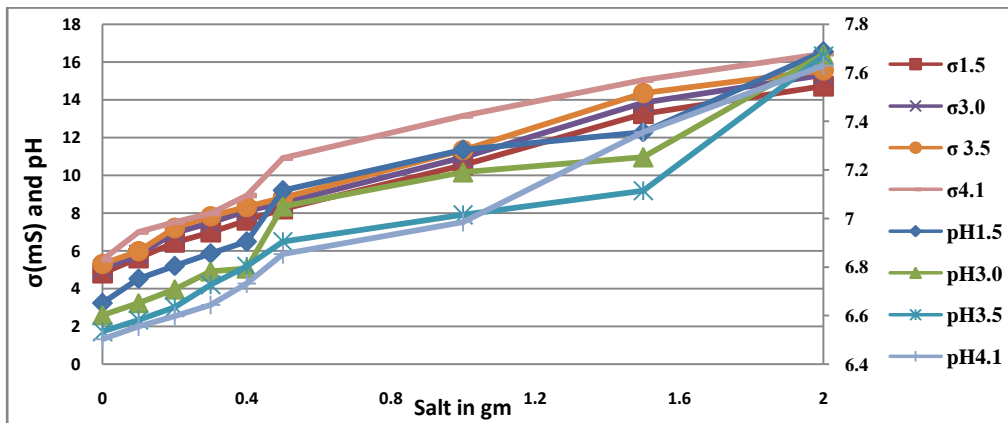


Figure 2 : A behavior of Salt adulterated milk

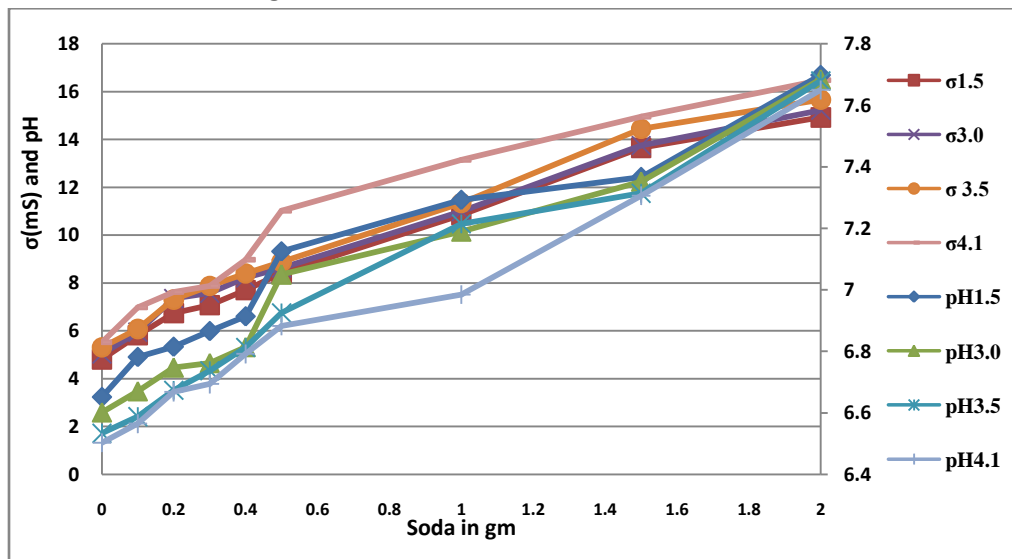


Figure 3:A behavior of Soda adulterated milk



These adulterations generate more positive hydrogen ions when dissolved in the milk. Caustic soda is a very hazardous substance which causes heart diseases and soreness arthritis. Table 1 and Table 2 shows the behavior of the salts/sodas when mixed with the milk.

It is observed from the Table 1, Table 2 and Figure 2, Figure 3 there is a large variations or above the normal cow milk range of electronic taste values if a small quantity of either a salt or sodas added. The electronic taste values also continuously increase with the increase of mixed adulterants.

CONCLUSION AND FUTURE WORK

Salts and sodas are more conductor of electricity due their strong bases nature in the pH scale. Its observed from the table 1 and 2 , figure 2 and 3 the conductivity and hydrogen ion concentrations are increasing almost linearly with the increase of salt and soda in the milk with various fat contents. In future behaviors of the salts and sodas are to be analyzed with the variation of temperature and other environmental conditions.

REFERENCES

[1]. R. B. Somasagar and A. Kusagur, "Flavor Determination for Milk Quality Assessment using Embedded Electronic Noses," *2017 2nd International Conference On Emerging Computation and Information Technologies (ICECIT)*, 2017, pp. 1-4, doi: 10.1109/ICECIT.2017.8453375.

[2]. R. B. Somasagar and A. Kusagur, "Potentiometric and pH based electronic method for dilution detection in milk," *2017 International Conference on Intelligent Computing, Instrumentation and Control Technologies (ICICT)*, 2017, pp. 1762-1765, doi: 10.1109/ICICT1.2017.8342837.

[3]. R. B. Somasagar and A. Kusagur, "Flavor detection for milk quality assessment using embedded electronic noses," *2017 International Conference on Intelligent Sustainable Systems (ICISS)*, 2017, pp. 406-409, doi: 10.1109/ISS1.2017.8389440.

[4]. <https://www.sciencepubco.com/index.php/ijet/article/download/17900/7961>

[5]. A Survey Report & a Proposal of Cost Effective Method for Milk Quality Analysis (IJSRD/Vol. 6/Issue 03/2018/280).

[6]. Malali, A. R., M. Bindushree, and V. S. Sawai. "Implementation of Standardized Digital Milk Quality Analyzer." *International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE)* 5.5 (2016).

[7]. http://www.kscst.iisc.ernet.in/spp/41_series/40S_awarded_&_selected_projs_further_devpt/40S_BE_0129.pdf.

[8]. Rajashekhhar Somasagar and Ashok Kusagur, " Sugar and Milk Powder Contamination Detection and Analysis in the Milk Using Artificial ESenses" *2018 Journal of Advanced Research in Dynamical and Control Systems (JARDCS)*, ISSN 1943-023X issue-01 pp. 58-63.

[9]. Rajashekhhar B S et. al, Electronic Based Artificial Intelligence System For Milk Quality Analysis, *IJARSE Vol 07, issue 7, ISSN 2319- 8354, April 2018.*

