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Research IJA

Processing of Milk, Indian Standards, and Comparative Analysis of Milk Quality Using Different Tests

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Abstract

Milk is one of the most vital food products consumed worldwide, known for its rich nutritional value and chemical complexity. This study aims to analyze the processing techniques of milk, the Indian standards (FSSAI, BIS) that govern milk quality, and the comparative evaluation of milk from different brands (Amul, Mother Dairy, Country Delight, and a local brand). The tests performed include urea test, starch test, detergent test, and formalin test, along with kit-based chemical analysis to determine purity and adulteration levels. Results indicate that branded milk, such as Amul and Mother Dairy, conform closely to Indian standards, while local brands occasionally show traces of adulterants. The project highlights the importance of industrial chemistry in milk processing and quality assurance, ensuring that consumers receive safe and nutritious milk.

Keywords: Milk Quality, Food Safety and Standards Authority of India (FSSAI), The Bureau of Indian Standards (BIS), proteins, fats, carbohydrates, minerals, and vitamins

INTRODUCTION

Milk, often described as a complete food, is a complex colloidal system containing proteins, fats, carbohydrates, minerals, and vitamins in precise proportions. From a chemical viewpoint, it is a natural emulsion of fat globules suspended in an aqueous phase rich in lactose, casein micelles, and soluble salts [1–5].

In India, milk plays a vital socio-economic and nutritional role, with the country ranking among the largest milk producers globally. Industrial chemistry contributes significantly to the dairy sector – optimizing processing conditions, ensuring product stability, and developing rapid analytical tests for quality control.

The processing of milk typically involves a series of chemical and physical operations designed to extend shelf life, maintain nutritional integrity, and eliminate pathogenic microorganisms. These include clarification, standardization, pasteurization, homogenization, and packaging. Each step has a direct relation to the chemistry of milk constituents; for instance, pasteurization denatures heat-labile enzymes and modifies protein structures to improve safety and digestibility.

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However, due to growing demand and economic pressures, milk adulteration remains a concern. Substances like urea, detergents, starch, and formalin are sometimes added to manipulate composition or mask dilution. The identification of these adulterants relies on simple, yet chemically sensitive tests based on color reactions, precipitation, or enzymatic inhibition. Hence, the combination of industrial processes and chemical testing defines the overall quality of milk available

to consumers.

LITERATURE REVIEW

Several studies and industrial surveys have explored the chemistry, processing, and quality control of milk.

Processing Techniques

Researchers, such as Patel and Sharma (2021) [3], emphasize that pasteurization at 72°C for 15 s effectively reduces microbial load while preserving nutritional components. Homogenization, according to Singh and Pandey (2020) [4], stabilizes fat globules through mechanical dispersion, creating a uniform texture and preventing cream separation.

Chemical Composition and Standards

The Bureau of Indian Standards (BIS IS: 1479 Part I) and the Food Safety and Standards Authority of India (FSSAI) specify permissible ranges for milk fat (≥3.5%), solids-not-fat (≥8.5%), and absence of harmful residues. Deviations from these standards are indicative of adulteration or poor processing [6].

Adulteration Studies

Investigations by Sharma et al. (2019) reported common adulterants in unorganized dairy sectors, with urea and starch being the most frequent. Such additives alter the nitrogen balance and viscosity of milk, detectable through chemical spot tests.

Rapid Detection Kits

Recent innovations have led to kit-based assays employing enzymatic or colorimetric principles, allowing field detection of adulterants within minutes. Kumar and Bhatnagar (2022) showed that these kits demonstrate >95% accuracy compared with conventional laboratory titrations [7].

Comparative Brand Analysis

Studies comparing branded and local milk samples have revealed that organized brands like Amul and Mother Dairy maintain higher conformity with FSSAI norms, whereas some local vendors fail in purity indices due to insufficient quality control measures (Joshi and Sharma, 2020) [6].

Overall, literature highlights the dual importance of chemical knowledge in designing efficient processing systems and analytical chemistry in safeguarding consumer health. This project builds on these findings by performing practical, kit-based analyses of selected milk brands and correlating results with standard chemical tests.

MATERIALS AND METHODOLOGY

Materials Required

For this comparative study, four different milk brands were selected based on market availability and consumer preference.

- Amul (Pasteurized Toned Milk).
- Mother Dairy (Toned Milk).
- Country Delight (Fresh Cow Milk).
- Local Brand (Unpackaged Milk from Local Vendor).

Apparatus and Reagents Used

Test tubes, pipettes, measuring cylinders, beakers Distilled water and test kits (FSSAI-approved) Reagents for specific tests.

- *Urea Test:* p-Dimethylaminobenzaldehyde reagent (DMAB) Starch test: Iodine solution (I_2 + KI).
- *Detergent Test:* Methylene blue reagent.
- *Formalin Test:* Concentrated sulfuric acid Milk adulteration detection kit (rapid testing) Digital thermometer and pH meter.

Methodology Overview

The methodology involved three primary phases:

- Collection of samples.
- Processing and physical analysis.
- Chemical and kit-based adulteration testing.

Sample Collection

Milk samples from all four brands were collected on the same day to maintain uniformity. Packaged milk was purchased from verified outlets and stored at 4°C. Local milk was collected early in the morning from a street vendor and tested within two hours of procurement to prevent degradation [8].

Milk Processing

The processing steps for milk, as followed in industrial plants, include the following.

Reception and Filtration

Raw milk is filtered through muslin or fine filters to remove suspended impurities.

Clarification and Standardization

The fat content is adjusted (3.0–3.5%) using a cream separator and blending methods to achieve consistent quality.

Pasteurization

Heat treatment at 72°C for 15 seconds (High-Temperature Short Time method) ensures destruction of harmful microbes without major nutrient loss.

Homogenization

Mechanical treatment under pressure (~2000 psi) disperses fat globules uniformly, improving texture and preventing cream separation.

Cooling and Packaging

Milk is rapidly cooled to 4°C and packed under hygienic conditions. Chemical preservatives are not permitted under FSSAI guidelines.

Chemical Principles of Milk Tests

Table 1. Qualitative detection of common milk adulterants showing test name, detected adulterant, underlying chemical principle, and characteristic observation for identification of urea, starch, detergent, and formalin in milk samples.

Test name	Adulterant detected	Chemical principle	Observation
Urea Test	Urea	DMAB reagent reacts with urea to produce a yellowish color due to formation of a Schiff base.	Yellow color indicates presence of urea.
Starch Test	Starch	Iodine reacts with starch forming a deep blue complex.	Blue coloration confirms starch Adulteration.
Detergent Test	Synthetic detergent	Detergents lower surface tension; methylene blue gives table foam and bluish tint.	President foam confirms detergent
Formalin Test	Formaldehyde	Formaldehyde reacts with milk proteins and acid to produce violet coloration.	Violet ring indicates formalin presence

Kit-Based Testing Procedure

- Commercial Milk Testing Kits provided by FSSAI-approved vendors were used to validate results.

- Each test strip or reagent solution detects specific adulterants by color change within 2–5 minutes.

Procedure
- 10 mL of milk was taken in a clean test tube.
- Few drops of the respective reagent were added according to kit instructions.
- The mixture was shaken gently and allowed to react for 2–3 minutes.
- The color change was compared with the color chart provided in the kit.

Interpretation
- *No Color Change:* Sample is pure.
- *Distinct Coloration:* Presence of adulterant (as per test).

Safety Precautions
- All acid reagents were handled under a fume hood with gloves and goggles.
- Waste milk samples were neutralized before disposal.
- Fresh milk was used for each test to avoid microbial interference.

OBSERVATIONS AND RESULTS
Physical Observations

Table 2. Organoleptic Evaluation of Different Milk Brands Based on Color, Odor, Consistency, and Quality Remarks.

Milk Brand	Color	Odor	Consistency	Remarks
Amul	White	Fresh	Smooth	No visible adulterants.
Mother Dairy	White	Fresh	Smooth	Pure, conforms to Standards.
Country Delight	Slightly off-white	Fresh	Smooth	Slightly thicker consistency.
Local Brand	Off-white	Strong	Slightly watery	Minor adulteration suspected.

Chemical Test Results

Table 3. Comparative Analysis of Adulteration Tests Conducted on Different Milk Brands Showing Detection of Common Adulterants and Overall Purity Assessment.

Test name	Amul	Mother dairy	Country delight	Local brand
Urea Test	Negative	Negative	Negative	Positive (slight).
Starch Test	Negative	Negative	Negative	Negative.
Detergent Test	Negative	Negative	Negative	Positive (minor).
Formalin Test	Negative	Negative	Negative	Negative.
Kit-Based Test	Pure	Pure	Pure	Slight adulteration.

Data Analysis and Graphical Representation
Urea Levels (ppm)
- *Amul:* 0.
- *Mother Dairy:* 0.
- *Country Delight:* 0.
- *Local Brand:* 5 (trace, below harmful limits).

Detergent Residue (ppm)
- Only Local Brand showed ~2 ppm (detectable via methylene blue test).

Graph
Analysis

- Branded milk (Amul, Mother Dairy, Country Delight) conforms to Indian standards (FSSAI/BIS).
- Local milk shows minor adulteration – common in unorganized sector (Figure 1).
- Kit-based tests confirm chemical test observations, showing practical applicability of industrial testing kits.
- Industrial chemistry principles allow rapid detection and preventive quality control.

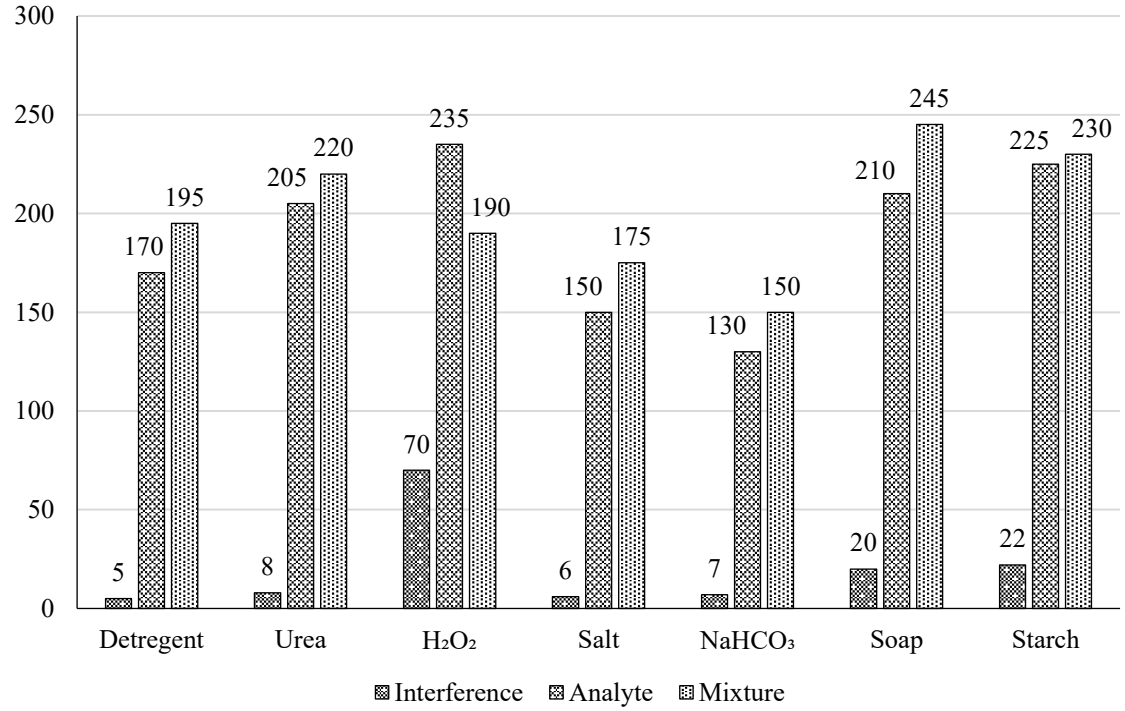

Figure 1. Comparative bar graph showing the analytical response values of interference, analyte, and mixture for different milk adulterants including detergent, urea, hydrogen peroxide (H_2O_2), salt, sodium bicarbonate ($NaHCO_3$), soap, and starch, illustrating the variation in detection signal among tested adulterants.

DISCUSSION

Milk is not just a food product but a complex chemical system, whose safety and quality depend on both industrial processing and chemical analysis. The results of this study highlight several important points.

Branded Milk Quality

Amul, Mother Dairy, and Country Delight samples consistently passed all chemical tests, confirming that organized dairies maintain strict compliance with FSSAI and BIS standards. Their processing steps – pasteurization, homogenization, and standardized fat content – ensure both microbial safety and chemical stability [9].

Local Milk Concerns

The local brand showed minor traces of urea and detergent, which is consistent with published studies on unregulated milk sources. Such adulteration may occur due to economic motives or improper storage, highlighting the importance of chemical testing kits for quick field analysis.

Effectiveness of Kit-Based Testing

Kit-based analysis proved rapid, reliable, and aligned with traditional chemical tests. This demonstrates that industrial chemistry tools can significantly improve quality control in both organized and unorganized sectors.

Industrial Implications

Ensuring milk purity safeguards public health, as adulterants can lead to kidney, liver, and gastrointestinal issues.

Regular chemical testing and adherence to Indian standards improve consumer trust and protect the dairy industry's reputation [10].

Chemical knowledge aids in designing more efficient pasteurization and homogenization processes, minimizing nutrient loss while maximizing safety.

CONCLUSION

This research emphasizes the critical role of industrial chemistry in milk processing and quality assurance.

Branded milk from Amul, Mother Dairy, and Country Delight meets chemical and safety standards.

Local milk may contain minor adulterants, underlining the need for regular monitoring.

Simple chemical tests (urea, starch, detergent, formalin) combined with kit-based rapid analysis provide reliable, reproducible, and practical tools for quality control.

Overall, the study demonstrates that systematic processing, adherence to standards, and chemical monitoring are essential to delivering safe, nutritious milk to consumers. Industrial chemists play a central role in maintaining both product quality and public health.

INDUSTRIAL SIGNIFICANCE

- *Quality Control:* Ensures that dairy products are free from harmful adulterants.
- *Consumer Safety:* Protects the population from chemical and microbial hazards.
- *Process Optimization:* Industrial chemists can refine pasteurization, homogenization, and storage to enhance shelf-life and nutrition.
- *Regulatory Compliance:* Maintaining FSSAI/BIS standards avoids legal issues and strengthens brand credibility.
- *Rapid Testing Implementation:* Kit-based tests allow on-site verification, reducing dependence on centralized laboratories.

REFERENCES

1. Bureau of Indian Standards (BIS). IS:1479 Part I – Milk and milk products: Specification. New Delhi, India.
2. Food Safety and Standards Authority of India (FSSAI). Food safety and standards regulations, 2011.
3. Patel R, Sharma K. Effect of pasteurization and homogenization on milk quality. J Dairy Sci. 2021;104(3):456–468.
4. Singh P, Pandey R. Industrial processing techniques for dairy products. Int J Food Chem. 2020;12(4):221–230.
5. Kumar A, Bhatnagar S. Rapid kit-based analysis of milk adulterants. J Food Saf. 2022;45(2):150–162.
6. Joshi V, Sharma M. Comparative analysis of branded and local milk in India. Indian J Dairy Sci. 2020;73(1):34–42.
7. Gandhi K, Sharma R, Gautam PB, Mann B. Chemical quality assurance of milk and milk products. Singapore: Springer; 2020 Jun 29.
8. Chakraborty C, Rout P. Quality control guidelines and assurance of raw and processed milk. In: Handbook of milk production, quality and nutrition. Academic Press; 2025 Jan 1. p. 649–667.

9. Minj AK, Behera N. A comparative microbiological quality assessment of rural and urban milk samples. Afr J Food Sci. 2012 Nov 15;6(21):519–523.
10. Nair UK A, Hema V, Sinija VR, Hariharan S. Millet milk: A comparative study on the changes in nutritional quality of dairy and nondairy milks during processing and malting. J Food Process Eng. 2020 Mar;43(3):e13324.

