Detection Techniques for Milk Adulteration

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Abstract:

Milk is a complex mixture and a liquid food that can easily be adulterated which is a social problem in India and it is exists both in backward and advanced countries. According to Prevention of Food Adulteration (PFA), that is defined as "Milk is the normal mammary secretion derived from complete milking of healthy milch animal without either addition there to or extraction there from. By the addition of urea, detergent, sugars and vanaspati oil, define the quality of milk. Adulteration in food that means cheats to consumer and consumption of adulterated food (Milk) causes serious health problems and great concern for both Government and Diary Industry. For detection of adulteration in milk, contain many different methods that are not simple and rapid but also very sensitive to detect milk adulteration. These methods can be carried out easily by consumers for identifying the most common adulteration in milk. In this paper, discuss the different methods for identifying the adulteration in milk.

Keywords: Milk Adulteration, Mammary Secretion

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Introduction

Milk is produced by mammary glands of mammals that is in pale liquid or in natural form, has high food value. It is primary source of nutrition for infant mammals because infant are not able to digest solid food but they can able to digest milk. Milk supplies nutrients like proteins, fat, carbohydrates, vitamins and minerals in moderate amount in an easily digestible form. Milk is significant to young and old people due to its nutritive value.

Constituent	Buffalo Milk (%)	Cow Milk (%)
Water	84.2	86.6
Fat	6.6	4.6
Protein	3.9	3.4
Lactose	5.2	4.9

Early lactation milk contains colostrum which carries mother's antibodies to its young and can reduce the risk of many diseases that contains many other nutrients including protein and lactose. Indian is the world largest producer of milk and leading exporter to milk powder, however it export very few other milk product.

Sometimes, milk is a complex mixture and a liquid food that can easily be of milk adulterated which is a very common food fraud and big social problem in today's world. Because India is the largest country in milk production and consumption according to WSPA (World Society for the Protection of animals) and the National Dairy Development Board, India. As per the population increase, demand will increase because milk is the more mouth feed due to which adulteration is being employed on regular basis. It also creates health hazards problem like renal and skin disease, eye and heart problem and may also leads to cancer. Most of the times, adulteration can be done for the purpose of intentionally to make profit but sometimes it may be due to the lack of proper handling, preservation, storage and detecting technology among dairy farm workers.

Physical and Chemical Properties of Milk

Within a water-based fluid, milk is an emulsion or colloid of butterfat (it is triglyceride which formed from fatty acids such as myristic, palmitic and oleic acid) globules that contains dissolved carbohydrates and protein aggregates with minerals because it is produced as a food source for young, all of its content provide benefits for growth. It contain principal that require energy (lipids, lactose and protein), biosynthesis of non-essential amino acids supplied by proteins (essential amino acids and amino groups), essential fatty acids, vitamins and inorganic elements, and water.

pH

pH of milk is ranges from 6.4 to 6.8 which is changes over time. Milk from bovine and non-bovine mammals varies in composition but has a similar pH.

Detection Methods

Most common impurities are found in milk such as urea, water, detergent, starch, glucose and Vanaspati or vegetable oils that is available in India. These impurities are detected by carrying out certain chemical test according to the protocol given by Food Safety and Standards Authority of India. Which is given in below table:

Table: Chemical Methods for Detection of Adulteration in Milk

Adulterant	Method of Detection	Observation
Urea	Urease test – Take 2ml of milk sample and add 1ml of phenol red (indicator) and keep in water bath at 35°C for 5mins. Then add 0.5 ml of urease.	• Appearance of peach in trace amount. • Reddish brown at low concentration • Pink at moderate concentration • Magenta at high concentration
Starch	Iodine test – Added a few drops of iodine solution in 5ml milk sample.	Appearance of blue black color indicates presence of starch.

Detergent	Take 5ml of milk sample, then added few drops of bromocresol purple solution.	Appearance of faint violet color indicates the presence of detergent in milk.
Glucose	Take 2ml of milk sample in test-tube and added equal volume of benedict's reagent. Keep it in boiling water bath for 5 minutes and observe color change.	• Appearance of blue color in the absence of glucose. • Green color observe in trace amount • Yellow at low concentration • Orange at moderate concentration • Red at high concentration
Inverted sugar	Prepare yeast by mixing 3g dry yeast with 20 ml of distilled water. Let it stand for 20 minutes. Fill test-tube 1/3 full with sample. Add 3 ml yeast suspension to it. Mix it well. After 10 minutes carry out Benedict's test for reducing sugars.	This results are similar as glucose test. • Blue color in the absence of glucose. • Green color observe in trace amount • Yellow at low concentration • Orange at moderate concentration • Red at high concentration
Vanaspati	Take 3ml of milk sample in test-tube, then added 10 drops of HCl. Mix one tea spoon of sugar. After 5 minutes, it is examine.	The red coloration indicates them presence of Vanaspati in milk.
Water	Put a small amount of milk on smooth slant surface.	• In case of pure milk, milk flow slowly leaving a white trail behind it. • In case of adulterated milk with water, milk flow immediately without leaving a mark.
Synthetic milk	A drop of milk should be rubbed between fingers and also boil a small amount of milk and observe the color change.	Gives soapy feeling on rubbing between the fingers and turns yellow on heating.
Soda	Take 10ml of milk sample in test-tube. Added 10 ml of alcohol and shake it well. Now add few drops of rosalic acid.	Red rose color indicate them in the presence of soda.
Common salt	Take 5ml of milk sample in test-tube, then added 1ml of 0.1N silver nitrate solution. Mix it well and finally add 0.5ml of 10% potassium chromate solution.	Appearance of yellow color in the presence of common salts, otherwise brick red color indicate the milk free from added salt.
Formalin	• Take 10ml of milk sample in test-tube + add 5ml conc. Sulfuric acid with little amount of ferric chloride without shaking.	• Appearance of violet or blue color at the junction of two liquid layers indicates the presence of formalin.

	Take 5ml of milk sample in test-tube + few drops of phloroglucinol solution and mix it well + added few drops of sodium hydroxide solution.	• Flashy pink color observe in the presence of formalin.
Hydrogen peroxide	• Take 1 ml milk sample in a test tube and add 1 ml of potassium iodide-starch reagent solution and mix it well. • Take 10ml of milk sample in test-tube + 10-20 drops of vanadium pentaoxide solution.	• Appearance of blue color them indicates the presence of hydrogen peroxide. • Appearance of pink/red color indicates the presence of hydrogen peroxide.
Boric acid and borax	Take 5ml of milk sample in test-tube + add 1ml of conc. HCl + dipped turmeric paper in it + dried in watch glass at 100ºC.	If turmeric paper turns red, it indicate the presence of boric acid or borax.
Coloring matter	• Take 10ml of milk sample in test-tube + add 10ml of diethyl ether + shake it well • Make the milk sample alkaline with sodium bicarbonate. Dip a strip of filter paper for 2 hours. • Add a few drops of hydrochloric acid to milk sample.	• Appearance of yellow color in ethereal layer that presence of added color. • Appearance of red color on filter paper indicates the presence of annatto. • Appearance of pink color indicates azo dyes.

Synthetic Milk

Synthetic milk in not milk but it is entirely a different component with high degree of adulteration to increase the volume of milk. This milk is a mixture of water, pulverized detergent or soap, sodium hydroxide, vegetable oil, salt and urea. The simplicity and rapidity with which milk can be adulterated always attracted the unscrupulous milk vendors to indulge in fraudulent practices and adulterate the milk. The ever-rising greed has given way to the development of a new type of adulterated milk known as synthetic milk.

Review of Literature

Singuluri and Sukumaran 2014, dictated that by Food Safety and Standards Authority of India (FSSAI), large number of samples obtained that did not conform to the legal standards. In this paper, conform that most of samples are adulterated. In this extent adulteration, varied significantly with least percentage for sucrose (22%) and highest for skim milk powder (80%). Most milk and milk products play an important role in different foodstuffs in India, which bring about more awareness to general public about malpractices or negligence in milk production.

Swathi and Kauser 2015, concluded that milk and milk products are collected with common adulterants like water, urea, detergent and starch, water being the most common adulterant. Collected milk found adulteration that contain excess water, starch and detergent, buttermilk and curd samples were found to be having not just excess water but also had added urea and detergent, butter & ghee samples on other hand were loaded with all the four adulterants i.e. water , urea, starch and detergent. Other adulterant in milk and milk product samples had varied proportions of common adulterants which might be harmful to human health.

Khan et.al 2015, concluded that FTIR has been promising technique for detection of food adulterants and their legality. FTIR technique is less time consuming and an efficient method eradicating the past problems of industrial members. Nowadays, industry has facing serious problem in the detection of their raw samples, either they are in pure form for their final product or not, they are required to follow old and more time consuming crude methods which ultimately trends the industry in economical loss. By FTIR technique, it is itself as well as its combined effects to achieve the resolution of food adulteration detection, it is a well-established, high throughput, rapid and non-destructive analytical technique through which wide range of sample are examined provided with fingerprint character of chemical as well as biochemical substance present in given sample.

Das, Goswami and Biswas 2016, stated that adulteration in milk is normally present in most crude form. By synthetic milk, prohibited substances are often added or sometimes the milk which is done for financial gain. Adulteration are causes by carelessness and lack of hygienic condition of processing, storing, transportation and marketing. In developing and backward countries, such types of adulteration are quite common but milk adulteration is serious problem in developing countries. For detection of adulteration, need an advanced and sophisticated methods.

Faizunisa1 et.al 2016, stated that adulterant was found in coriander powder, chilli powder and salt. Under Food Safety &Standard Authority of India (FSSAI), least amount of adulterants was found which was followed by packed and loosely available samples respectively. Food products was commonly adulterated that was significantly found more in loosely available samples of coriander powder with added starch. The problem of adulteration was still exists and this problem is reduce by educated consumer's that coupled with efforts taken in monitoring the quality of products kept for sale.

Conclusion

Milk is the nutrient rich food for human babies but not only for young one's animals and milk is the major food for infants/babies upto the occurrence of milk teeth by which start feeding on solid food too. Milk adulteration problem is increased day by day due to which causes the serious health problem on human. This adulteration is detected in milk is compulsory. Though several methods are available for the detection of adulteration of milk, due to increase in adulteration by means of several external agents, because of various reasons like increase in population growth detection of milk adulterants has become complicated now-a-days. So more sophisticated methods are required for detection some of which are mentioned above in this paper. But, it would be better not to adulterate milk in thirst of money and try to reduce the factors that leads the traders and merchants to adulterate the milk.

References:

Azad, Tanzina, and Shoeb Ahmed. "Common Milk Adulteration and Their Detection Techniques." *International Journal of Food Contamination*, vol. 3, no. 1, 2016.

Das, Siuli, et al. "Milk Adulteration and Detection: A Review." *American Scientific Publishers*, vol. 14, 2016, pp. 4–18.

Faizunisa, H., et al. "Evaluation of Food Adulteration among Selected Food Items - In Vitro Study." *International Journal of Health Sciences and Research*, vol. 6, no. 5, May 2016, pp. 139–145.

Khan, U., et al. "Non-Destructive Analysis of Food Adulteration and Legitimacy by FTIR Technology." *Journal of Food & Industrial Microbiology*, vol. 1, no. 1, 2015, pp. 1–7.

L., M. N., and Mohammad Badrud Duza. "A Review On Adulteration Of Milk." *Indo American Journal of Pharmaceutical Research*, vol. 7, no. 08, 2017, pp. 630–637.

Screening Of Adulterants In Milk." *Int J Cur Res Rev*, vol. 8, no. 12, June 2016, pp. 25–29.

Singuluri, Hemanth. "Milk Adulteration in Hyderabad, India – A Comparative Study on the Levels of Different Adulterants Present in Milk." *Journal of Chromatography & Separation Techniques*, vol. 05, no. 01, 2014.

Swathi, J. K., and Naazia Kauser. "A Study on Adulteration of Milk and Milk Products from Local Vendors." *International Journal of Biomedical and Advance Research*, vol. 6, no. 09, 2015, pp. 678–681.