Detection Techniques for Milk Adulteration

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Abstract:

Milk is an intricate mixture and a fluid diet that can effortlessly be contaminated 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 described as "Milk is a common mammary production obtained from complete milking of healthy milch animal without either addition there to or extraction there from. By the mixing of detergent, urea, vanaspati oil and sugars, express the value 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. In order to detect the degree of adulteration in milk various techniques are employed, that are easy and quick 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 the principal source of nutrition for newborn mammals because newborns 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 reasonable amount in an effortlessly digestive form. Milk is vital for young ones as well as old persons 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

Initial lactation milk comprises of colostrum which carries mother's antibodies to its newborn and can diminish the threat of a number of diseases, it also contain a large number of other nutritive elements, like protein and lactose. India is the world's largest manufacturer of milk and a prominent exporter to milk powder, however it exports very few other dairy products.

Milk, being an intricate blend and a fluid diet that can effortlessly be contaminated which is a very usual food scam and a huge public issue 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 a suspension or a colloid of butterfat (it is triglyceride which is formed from fatty acids like as myristic, palmitic and oleic acid) globules that contains dissolved carbohydrates and protein combinations with minerals for it is manufactured as a food source for young ones, all of its content offer advantages for growth. It contains principal that require energy (lactose, proteins and lipids), biosynthesis of non-essential amino acids delivered by proteins (essential amino groups and amino acids), essential fatty acids, vitamins and inorganic elements, and water.

pH

pH of milk ranges from 6.4 to 6.8 which alters over time. Milk from bovine and non-bovine mammals differs in composition but has alike 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 (FSSAI), which is given in below table:

Table: Chemical Techniques for Detecting Adulteration in Milk

Adulterant	Method of Detection	Observation
Urea	Urease test – Take 4ml of milk sample and add 2ml of phenol red (indicator) and keep in water bath at 35°C for 5mins. Then add 1ml of urease.	• Appearance of peach color in tiny amount. • Reddish brown color at a lower concentrations. • Pink at moderate concentrations. • Magenta at higher concentrations.

Starch	Iodine test – Add iodine solution drop by drop in 5ml milk sample.	Formation of blue black color shows the presence of starch.
Detergent	Take 5ml of milk sample, then add bromocresol purple solution, drop by drop.	Formation of a pale violet color shows the presence of detergent in milk.
Glucose	Take 2ml sample of milk in a test-tube and then, add equivalent amount of benedict's reagent. Keep it in a boiling water bath for approximate 5 minutes and witness for any color change.	• Appearance of blue color shows the absence of glucose. • Green color observe in trace amount. • Yellow at lower concentrations. • Orange at moderate concentrations. • Red at higher concentrations.
Inverted sugar	In order to prepare yeast, take 3g of dry yeast and then add 20ml of distilled water, then provide it a standing time of 20 minutes. Now take a test tube and fill it 1/3rd with the milk sample, then add 3m of yeast suspension to it and mix thoroughly. Then, after waiting for 10 minutes, proceed for Benedict's test for the reduction of 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	In a test-tube, add 3ml of milk sample, then add approximately 10 drops of Hydrochloric Acid. Now add 1 tsp sugar, and then examine after waiting for 5 minutes.	A red coloration shows the presence of Vanaspati in milk.
Water	Pour a little quantity of milk on a flat inclined surface.	• If milk runs gradually marking a white track behind, then it is a pure and unadulterated milk. • In case of milk mixed with water, milk shall flow immediately without tracing a mark behind.
Synthetic milk	• Rub a drop of the milk sample between your fingers. • Boil a little quantity of the milk and notice any change in the color of the milk.	• There is a soap-like sensation on rubbing between the fingers. • The milk turns to yellow color on boiling.
Soda	Put 10ml of milk specimen in a test-tube, then add 10 ml of alcohol and mix them well by shaking. Lastly add a few drops of Rosalic Acid.	Red rose color indicates the presence of soda.

Common salt	Put 5ml of milk specimen in a test-tube, then add 1ml of 0.1N silver nitrate solution. Mix both the ingredients well and finally add 0.5ml of 10% potassium chromate solution.	Formation of a yellow color shows the presence of common salts, otherwise brick red color indicate the milk devoid of any added salt.
Formalin	• Take 10ml of milk specimen in a test-tube, then add 5ml of conc. Sulphuric Acid with small quantity of ferric chloride without shaking at all. • Take 5ml of milk sample in test-tube, then add phloroglucinol solution drop by drop and mix it thoroughly by shaking, lastly add a few drops of sodium hydroxide solution.	• Formation of violet or blue color at the intersection of both the liquid layers shows the presence of formalin. • Flashy pink color observe 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.	• Formation of blue color shows the presence of hydrogen peroxide. • Formation of pink/red color shows 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.	• Formation of yellow color in ethereal layer shows the presence of added color. • Formation of red color on filter paper shows the presence of annatto. • Formation of pink color shows azo dyes.

Synthetic Milk

Synthetic milk in not milk but it is totally a diverse constituent with excess amount of adulteration to upsurge the amount of milk. This milk is a combination of water, pulverized detergent or soap, sodium hydroxide, vegetable oil, salt and urea. The ease and speediness through which milk can be mixed always fascinated the deceitful milk dealers to involve themselves in corrupt practices and contaminate the milk. The ever-rising greediness has paved a way to the progress of a fresh type of impure milk identified as synthetic milk.

Review of Literature

Singuluri and Sukumaran 2014, dictated that by Food Safety and Standards Authority of India (FSSAI), huge quantity of specimens obtained that did not follow to the lawful criterion. In this paper, conform that most of samples are adulterated. In this extent adulteration varied considerably with minimum ratio for sucrose (22%) and maximum for skim milk powder (80%). Most of the milk and milk products play a vital role in various cuisines and foodstuffs in India, which bring about more consciousness to common public about wrongdoings or inattention in milk production.

Swathi and Kauser 2015, concluded that milk and milk products are composed with common adulterants like water, urea, detergent and starch, water being the most commonly used adulterant. Collected milk found adulteration that contain too much of 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 diverse amounts of usual adulterants which might prove to be harmful to human health.

Khan et.al 2015, concluded that FTIR has been an encouraging method for detecting food adulterants and their legality. FTIR technique is less time consuming and an effective way in eliminating the previous glitches of the manufacturing bodies. Currently, the industry has been facing grave issue in detecting 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 unpolished methods which ultimately drifts the industry to huge financial 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 an extensive range of specimen are scrutinized delivered with fingerprint character of chemical as well as biochemical substance existing in the given specimen.

Das, Goswami and Biswas 2016, stated that adulteration in milk is generally present in the most basic form. By synthetic milk, forbidden ingredients 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.

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