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# MILK ADULTERATION AND DETECTION: A REVIEW

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**ABSTRACT**

Adulteration of milk is an international problem and a social concern. It emerges in both the unstable countries and advanced ones. Owing to shortage of tracking and policies, developing nations are at greater threat. Usage of misbranded milk poses severe safety hazards leading to deadly diseases and a significant problem for the food sector. Excess supply, intense demand in the milk industry and personal profit create the milk adulterate by certain manufacturers. This paper presents a detailed review of common adulterants in milk as well as various methods of detecting adulterants and their health hazards.

**Keywords**: Milk Adulteration, Detection Techniques, Electrical methods, Health Hazards

## INTRODUCTION

Milk is called the 'perfect food' as it has an abundance of nutrient supply for babies and adults alike. It contains muscle-building proteins, mineral-forming muscles, vitamins, minerals and energy providing lactose, milk fat and some essential fatty acids as well. Following the major advance of melamine toxicity in Chinese newborn dairy goods, adulteration of milk arose into concern worldwide. Regrettably, in underdeveloped and developing nations, milk is very quickly tainted worldwide and considerably poorly due to the absence of sufficient tracking and lack of adequate regulation. Besides the moral and economic problem, it also generates risks to health. Much of the times, additives are deliberate in order to make more income, but occasionally this may be attributed to a shortage of clear consciousness. probable factors behind this may include: request and distribution gap, the consumable nature of milk, weak consumer buying power and lack of appropriate detection tests (Kamthania et al., 2014) **[9].** Adulterants of chemicals are employed for various objectives. Popular additives include sugar, water, salt, starch, chlorine, hydrated lime, sodium carbonate, formalin, ammonium sulphate, $H_2O_2$ and among others. Many individuals are processing artificial milk to fulfill the milk shortage by combining urea, caustic soda, refined oil, and popular toxic-effect cleaning products. The present study thus illustrates the additives in the milk sector, their identification and their health risks for consumers.

**Standard adulterants and its potential threats to public safety:**

**$H_2O$:**

Water is the main popular adulterant used to raise milk volume that in effect reduces milk nutritional value. But if polluted water is applied to milk, then the dairy-consuming population is highly concerned about safety.

**Melamine:**

To falsely increase the protein content melamine is added to the milk and milk powder. In severe circumstances it induces renal insufficiency and death (Cheng et al., 2010) **[2].**

**Urea:**

Urea is introduced to milk to supply whiteness, to boost milk consistency, to increase non - protein nitrogen material and to levell SNF content as found in biological milk. Urea is also utilised for the artificial milk preparation. The related health risks include acidity, indigestion, ulcers and cancers. Urea is harmful to the heart, particularly to the liver for the kidneys, because the kidneys have to do more to remove urea from the body (Kandpal et al., 2012) **[10].** In milk, ammonia causes deterioration, loss of learned expression and sensory disorders.

**Detergents:**

Cleaning solvents are applied to emulsify and disperse the oil in water providing the typical white color of milk, a frothy solution (Singuluri & Sukumaran, 2014) **[18].** We further improve milk 's cosmetic quality. Gastrointestinal problems caused by detergents.

**Hydrogen peroxide (H2O2):**

To prolong its freshness, hydrogen peroxide is added to the milk, but peroxides damage the gastrointestinal cells which can lead to gastritis and intestinal inflammation. H2O2 irritates the body's antioxidants, disrupting the normal immunity and, therefore, through aging.

**Starch:**

Starch is utilized to raise SNF (solid-not-fat ), and if large levels of starch are introduced to milk, the effect of indigestible starch in the colon will cause diarrhoea. Its body build-up can be very dangerous for diabetic patients (Singuluri & Sukumaran, 2014) **[18].** Besides the starch, wheat flour, arrowroot, and rice flours are introduced.

**Sugar:**

Usually sugar is blended in the milk to boost the amount of solids not fat in the milk, i.e. to ramp up the lactometer reading of milk that has already been diluted by water**.**

**Chlorine:**

After adding water chlorine is applied to compensate for the density of the diluted milk. Chlorinated milk can cause artery clogging and cause heart problems (Hattersley, 2000) **[7].** In the milk, chloride bothers the body's acid base equilibrium and even the pH of blood.

**Antibiotics:**

Antibiotics are primarily utilized to cure a wide range of illnesses, and 80 percent of clinicians are using medications to treat mastitis. These antibiotics are present in milk, in the form of antimicrobial residue. The existence of tetracycline, aromatic amines, residue of gentamicin after care with mastitis, residues of neomycin, residues of sulfamethazine, residues of chloramphenicol, contamination of aflatoxin M1, etc. are also of major concern as milk adulterants (Das et al., 2016) **[3].** Mastitis therapy intramammary infusion of antibiotics is a significant factor for toxicity of the milk. Traces of such medications in milk present significant health hazards such as adverse reactions, increased antibiotic resistance, involvement in the intestinal flora and a few of these (such as residues of sulfamethazine) may have cancer causing tendencies.

**Food colors:**

Many food coloring agents are made to enhance looks and have dangerous health impacts.

**Milk powder:**

The milk powder is often introduced in new milk as an ingredient. This is completed for financial advantage whenever a nation has surplus milk powder or is given subsidy for dried powder milk (Guan et al., 2005) **[4].**

**Non-Milk Proteins & fats:**

Cheap quasi-milk proteins like soy, pea and dissolved wheat proteins almost always adulterate milk, milk powder and other dairy products. In milk powder, bovine rennet whey powder is also combined (Haasnoot et al., 2006) **[5].**

**Determining milk adulterants:**

Table 1 describes a number of milk adulterants and the process that used identify such adulterants

**Table 1:** Various milk adulterants and the process employed to identify these adulterants

| Kinds of Adulterant | Methods to detect the adulterants |
|---|---|
| $H_2O$ | freezing point cryoscopic and Freezing point osmometry method, E-nose |
| Whey/Liquid whey | ELISA, HPLC method (reverse phase), NIR spectroscopy |
| Urea | Biosensors, Manometric biosensor, Potentiometric biosensor |
| Neutralizers | Conductivity or pH measurement |
| Preservatives | Impedimetric |
| Color | Capillary electrophoresis |
| Milk powder | Fluorescence of advanced maillard products and soluble tryptophan |
| Non-milk proteins | Analysis of triacylglycerols using gas liquid, Reversed Phase HPLC method in combination with fluorescence detec |
| Antibiotics | BRT Test (Test kit), Spot Test |
| Chlorine | Flow Injection Analysis (FIA), Potentiometric detection |

Source: Das S, Goswami B and Biswass K 2016. Milk Adulteration and Detection" A Review. Sensor Letters, 14:4-18 **[3].**

**Table 2:** Various electric approaches for detecting adulteration of milk

| S. N. | Electrical approaches |
|---|---|
| 1 | Impedance probe |
| 2 | Piezoelectric Sensor |
| 3 | E-nose |
| 4 | E- tongue |
| 5 | Ultrasonic detectors |
| 6 | Electrical conductivity method |
| 7 | Potentiometric sensor |

Source: Das S, Goswami B and Biswass K 2016. Milk Adulteration and Detection" A Review. Sensor Letters, 14:4-18 **[3].**

**Table 3:** Quick qualitative identification of various dangerous materials in the milk

| Adulterant | Approaches | Monitoring | References |
|---|---|---|---|
| Coloring matter | Take 5 ml milk sample in test tube, add 5ml diethyl ether, shake properly and stand it. | Yellow colure appearance in layer of ether indicate existence of coloure. | Batis et al. 1981) **[1]** |
| Detergents | Take 10 ml test tube add 0.2 ml bromocresol | violet color indicates the existence of detergent | Singh et al. 2012 |
| Pulverized soap | Take 5 ml milk add same amount of hot water, add 2 drop phenolphthalein indicator | Pink color shows existence of soap. | Singh et al. 2012) **[17]** (Kamthania et al.2014) [9] |
| Nitrate | Take 5 ml sample milk, add 10 ml mercuric chloride, filter it, 1 ml filtraten a test tube and add 4 ml of diphenyl amine sulphate | Blue color indicates the presence of nitrates. | (Sharma et al. 2011) |
| Urea | Take 10 ml milk sampl , Add 10 ml p-Dimethyl Amino Benzaldehyde reagent | yellow color indicates presence of added urea | (Singh et al. 2012) **[17]** |
| Neutralizers | Take 5 ml of milk I, add 5 ml alcohol followed by 4-5 drops of rosalic acid | pinkish red, then indicates existence of sodium carbonate /bicarbonates | Singh et al. 2012) **[17]** |
| Formalin | Take 10 m milk, Add 5 m conc. sulphuric acid, little amount of ferric chloride | violet or blue color indicates the presence of formalin. | ingh et al. 2012) **[17]** (Kamthania et al.2014) |

## CONCLUSION

Based on the preceding evaluation, we can deduce that there is a serious problem with milk adulteration. Even though economic incentive is regarded to be one of the main reasons for milk adulteration, insufficient supply has paved the surface for this as well for the increasing population around the world. Nearly 68 % milk supplied to consumer is not as per standards. Utilization of low quality milk may cause severe health issues. That's why it is very crucial to control the milk adult rants. The connection between man and technology, knowledge and access to information will perform a crucial function in milk adulteration irradiation.

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