To Test an Adulteration Present in Milk Sample

Dadasaheb Navale[1], Shelley Gupta[2]

[1]*Sinhgad Jr. College Vadgaon. Pune.*

[2]*Parvatibai Genba Moze Engineering College Wagholi. Pune*

***Abstract*: Milk may contain some harmful microorganisms like bacteria along with some potentially beneficial microbes. Microbiological analysis of milk is carried out to determine the degree of bacterial contamination in milk and to understand the chemical changes brought in milk as a result of microbial action. Pasteurization is done to destroy such harmful bacteria. If pasteurization of milk is not carried out properly there will be presence of larger count of bacteria in the milk. Methylene blue Reduction test is used to detect the presence of bacteria in milk. This test works on the principle that the methylene blue indicator is present in an oxidized form, but in the presence of bacteria, leads to the reduction of this indicator in a comparatively short span of time. The blue color developed on addition of the indicator to the milk will change to white color within a short period indicates the presence of bacteria in the milk and thus denotes improper pasteurization.**

Milk contains many other nutrients and the carbohydrate lactose. An emulsion is a suspension of droplets of one liquid into another liquid. Milk is an emulsion of fat in water. Butter is an emulsion of water in fat. The solute is known as the dispersed phase and the solvent is known as the continuous phase. Other examples of emulsions include margarine, mayonnaise, cream, and salad dressing. A colloidal solution is when matter exists in a state of division in between a true solution, which is sugar in water, and a suspension, which is chalk in water. The characteristics of a colloid are small particle size, electrical charge, and affinity of the particles for water molecules. In milk, the whey proteins are in colloidal solution. Milk is a pale liquid produced by the mammary glands of mammals. It is the primary source of nutrition for young mammals before they are able to digest other types of food. Early-lactation milk contains colostrums, which carries the mother's antibodies to its young and can reduce the risk of many diseases.

Milk may contain some harmful microorganisms like bacteria along with some potentially beneficial microbes. Microbiological analysis of milk is carried out to determine the degree of bacterial contamination in milk and to understand the chemical changes brought in milk as a result of microbial action. Pasteurization is done to destroy such harmful bacteria. If pasteurization of milk is not carried out properly there will be presence of larger count of bacteria in the milk. Methylene blue Reduction test is used to detect the presence of bacteria in milk. This test works on the principle that the methylene blue indicator is present in an oxidized form, but in the presence of bacteria, leads to the reduction of this indicator in a comparatively short span of time. The blue color developed on addition of the indicator to the milk will change to white color within a short period indicates the presence of bacteria in the milk and thus denotes improper pasteurization. This paper detects various types of adulteration present in the milk sample.

***Keywords*: Types of adulterants and adulterations etc.**

I. INTRODUCTION

Milk is a complex mixture and a liquid food, which can easily be adulterated. According to PFA-1954 (prevention of food adulteration act) definition, "Milk is the normal mammary secretion derived from complete milking of healthy milk animal without either addition there to or extraction there from. There are many methods known for detection of adulteration in milk but the methods discussed below are simple but rapid and sensitive methods to detect adulteration. in Milk contains more than 100 substances that are either in solution, suspension or emulsion in water, the important being casein -the major protein of milk, lactose - milk sugar, whey and mineral salts

Milk is an almost ideal food. It has high nutritive value. It supplies body building proteins, bone forming minerals and health giving vitamins and furnishes energy giving lactose and milk fat. Besides supplying certain essential fatty acids. A national survey in India has revealed that almost 70% of the milk sold and consumed in India is adulterated by contaminants such as detergent and skim milk powder, but impure water is the highest contaminant. According to National Survey on Milk Adulteration conducted by FSSAI (India) in 2011, water is the most common adulterant followed by detergent in milk. A survey by FSSAI in 2012, 68% milk samples was found to be adulterated in which 31 % were from rural areas of these 16.7 % were packet or branded milk and rest were loose milk samples from dairies. In the urban areas, 68.9 % milk was found to be adulterated with water, detergent, urea and skim milk powder.

In Gujarat, 89% milk was found to be adulterated. Despite the Jivraj Makadiya et al/Int.J. Pharm Tech Res. 2015,8(4),pp 602-607.603 laws governing the quality and sale of milk existing in India for decades, the adulteration of milk has not been checked completely. Water is an adulterant in milk which is often always added to increase the volume of milk which in turn decreases the nutritive value of milk which if contaminated poses a health risk especially to infants and children. Detergents are added to emulsify and dissolve the oil in water giving a frothy solution, the characteristic white color of milk.

Detergents cause gastro –intestinal complications. Urea is added to milk to provide whiteness, increase the consistency of milk and for leveling the contents of solid-not-fat (SNF) as are present in natural milk. The presence of urea in milk overburdens the kidneys as they have to filter out more content from the body. Hydrogen Peroxide is also added to milk to prolong its freshness, but peroxides damages the gastro intestinal cells which can lead to gastritis and inflammation of the intestine. Starch, cereal flours or arrowroot are added to make up the density of milk to prevent detection of added water. Starch is also used as an adulterant and if high amounts of starch are added to milk this can cause diarrhea due to the effects of undigested starch in colon. Its accumulation in the body may prove very fatal for diabetic patients. Carbonates and bicarbonates are added to milk too, this can cause disruption in hormone signaling that regulate development and reproduction. Cane Sugar is added to raise the density to prevent detection of extraneous water.

Sodium chloride (common salt) is added to make up the density (lactometer reading) of watered milk. Like urea, ammonium sulphate is a chemical fertilizer, which Is added to milk to raise the density of watered milk. Neutralizers such as caustic soda, caustic potash sodium carbonate, sodium bicarbonate and lime water etc. are commonly added to milk to neutralize the developed acidity in milk. Some of these chemicals (neutralizers) are also ingredients of detergents which are major components of synthetic milk. Sodium and potassium nitrates are oxidizing agents and hence act as preservative Pond water also contains appreciable quantities of nitrates and such water is usually mixed with milk by rural milk producers. This paper detects various types of adulteration present in the milk sample.

II. ADULTERATION

Noun contamination, corruption, degradation, deterioration, fraudulence, infection, perversion, pollution, spuriousness.

*Associated concepts***:** drugs, food, purity of food

*See also***:** contaminate, defilement, detriment, dissolution

Adulteration: This term denotes the act of mixing something impure with something pure, as, to mix inerior liquor with wino; au inferior article with coffee, tea, .and the like.

Full definition of adulterate:

1. Transitive verb
2. To corrupt, debase, or make impure by the addition of a foreign or inferior substance or element; especially*:* to prepare for sale by replacing more valuable with less valuable or inert ingredients

Adulteration" is a legal term meaning that a food product fails to meet federal or state standards. Adulteration is an addition of another substance to a food item in order to increase the quantity of the food item in raw form or prepared form, which may result in the loss of actual quality of food item. These substances may be other available food items or non-food items. Among meat and meat products some of the items used to adulterate are water or ice, carcasses, or carcasses of animals other than the animal meant to be consumer.

III. MATERIALS AND METHODS

(1) Detection of Hypochlorites and Chloramines:

Reagents:

1. Potassium Iodide solution: Prepare fresh by dissolving 7 gm of Potassium Iodide in 100 ml of water
2. Dilute HCl: To 100 ml of Concentrated Hydrochloric acid (sp gr 1.16) add 200 ml of water.
3. Starch solution: Boil 1 gm starch in 100 ml water. Cool before using.

Tests:

To 5 ml of sample in a test tube add 1.5 ml of Pot. Iodide solution, mix thoroughly and observe colour. A yellowish brown to deep yellow colour may be formed. If unaltered, add 4 ml of dil HCl, mix thoroughly with a glass rod flattened at one end and note colour of curd.. A yellowish brown to deep yellow colour may be formed. Next place tube in a large water bath previously heated to 85 0 C and allow it to remain for 10 minutes. The curd will rise to the surface. The liquid and the curd will have yellowish brown to deep blue colour. Next add 0.5 to 1.0 ml of starch solution to the liquid below curd. A blue purple colour shall be formed.

(2) Detection of Cane Sugar in Milk:

Modified Seliwanoff Method:

Fructose formed in cane sugar reacts with resorcinol in HCl to give red colour.

Reagent:

Dissolve 1.0 g of resorcinol in 100 ml HCl (1:1.5), 1 volume of concentrated HCl of sp. gr. 1.18 mixed with 1.5 volume of water

N. B. The resorcinol flakes should be white in colour.

Procedure:

Curdle an aliquot of the milk by adding a little concentrated HCl (for 25 ml of milk usually one ml of concentrated HCl is required). Let stand for about 10 minute and filter. To 5 ml of the modified resorcinol - HCl reagent taken in a test tube, add 1ml of the filtered milk serum and mix. Place the test tube in boiling water bath for exactly 1 min. Withdraw the tube and observe the colour. Appearance of deep red colour indicates presence of sucrose, or a ketose sugar.

(3) Test For Detergent Containing Alkyl Benzene Sulphonic Acid (Abs):

Principle:

A solution of anionic detergent containing added methylene blue is shaken with chloroform, which dissolves the methylene blue salt of the detergent. The mixture is treated with a cationic active reagent, which after it has combined with all the free anionic detergent, begins to displace methylene blue from the salt. The end point is taken when sufficient methylene blue has been displaced into the aqueous layer to produce phases of equal colour intensity. As the reaction is not stoichiometric, it is essential to carry out standardisation using a known cationic detergent similar in nature to the unknown.

Procedure:

Pipette 10 ml of milk sample containing approximately 100-168 mg of active detergent powder; add 25 ml of methylene blue (0.005%) and 15 ml of chloroform. Mix well in a separating funnel. If the chloroform layer is blue or greenish blue the test for detergent containing ABS is positive. Confirm by titrating with 0.004M Sodium Louryl Sulphate solution. On titration louryl sulphate reacts firstly with anionic detergent, then displaces methylene blue from the salt. The end point is taken when sufficient methylene blue has been displaced into aqueous layer phase resembling both the phase equal in colour intensity.

(4) Test for Skimmed Milk Powder in Natural Milk:

Principle:

The method is based on the fact that the coagulum obtained from reconstituted skim milk powder by addition of acetic acid, gives intense blue colour on boiling with Phosphomolybdic acid due to certain reducing groups present in the proteins of milk powder which are able to cause reduction of molybdenum blue resulting in formation of blue colour.

Reagents:

(1) Acetic acid 4 %

(2) Phospho molybdic acid 1% solution in water.

Procedure:

Take 50 ml of milk in a 60 ml centrifuge tube. Place the tube in the centrifuge and balance it properly. Centrifuge at 3000 rpm for 15 minutes. Decant the supernatant creamy layer carefully. Add 0.5 ml of 4 % acetic acid for coagulation and then add 2 ml of 1 % phosphomolybdic acid. Mix the contents thoroughly and heat in a water bath at boiling temperature for 15 minutes and then cool.

The curd obtained from pure milk shall be greenish in colour whereas the curd of sample containing skimmed milk powder shall be bluish in colour. The intensity of bluish colour depends on the amount of the skim milk powder presentin the sample.

IV. CONCLUSION

Adulterated Milk and Milk Products are dangerous to any leaving organism. Knowledge of adulteration of any food is essentional for each and every leaving organism.

REFERENCES

[1]. .DGHS (2005). Manual of Methods of Analysis of Foods – Milk and Milk Products. Directorate General of Health Services, Ministry of Health and Family Welfare, Government of India.
[2]. FAO (2009). Milk Testing and Payment Systems Resource Book – A Practical Guide to Assist Milk Producer Groups. FAO, Rome. Pp. 38-43
[3]. Roy, N.K. and Sen, D.C. (1994). Rapid Analysis of Milk. In Textbook of Practical Dairy Chemistry. Kalyani Publishers. New Delhi. Pp. 85-118.
[4]. Darshan Lal, Raman Seth, Rajan Sharma and Arun Kumar (2005). Approaches for detection of Adulteration in Milk Fat –An Overview. Indian Dairyman, 57, 10. Pp. 31-43.
[5]. Gunnery, K.S. (1979). Additives in Milk and Their Detection. Indian Dairyman, 31, 9. Pp. 665 669.
[6]. BIS (1960). Indian Standard – Methods of Test for Dairy Industry. Part I Rapid Examination of Milk (IS 1479 (Part I): 1960)
[7]. BIS (1961). Indian Standard – Methods of Test for Dairy Industry. Part II Chemical Analysis of Milk (IS 1479 (Part II): 1961)
[8]. BIS (2006). Indian Standard: Quick Methods for Detection of Adulterants/Contaminants in Common Food Products – Chemical Methods (IS 15642 (Part 2): 2006)
[9]. Ferreira, I. M., & Oliveira, M. B. P. P. (2003). Determination of Caseinomacropeptide by an RP-HPLC Method and Monitoring of the Addition of Rennet Whey to Powdered Milk. J. Liq. Chrom. Relat. Tech., 26(1), 99-107.
[10]. Panda, D. And Bindal, M.P (1998 B) Detection Of Adulteration In Ghee With Animal Body Fats And Vegetable Oils Using Crystallization Tests Indian Dairyman 50: 13-16
[11]. Kumar, R., Singh, D.K. And Chawla, N.K. (1998). Adulteration / Contamination Of Milk Demystified. Indian Dairyman 50: 25-33
[12]. Miralles, B., Bartolomé, B., Amigo, L., & Ramos, M. (2000). Comparison of three methods to determine the whey protein to total protein ratio in milk. Journal of dairy science, 83(12), 2759-2765.
[13]. Kumar A., Lal, D., Seth, R. And Sharma, R (2002) Recent Trends In Detection Of Adulteration In Milk Fat A Review Indian J. Dairy Sci. 55: 319-330
[14]. PFA Act (1954) Prevention of Food Adulteration Act And Rules. GovtOf India Publication As Amended Upto Date.
[15]. Sharma, S. K., Hill, A. R., & Mittal, G. S. (1993). An improved method to measure glycomacropeptides (GMP) in renneted milk.Milchwissenschaft,48, 71-73.
[16]. Singhal, O. P. (1980). Adulterants and methods for detection. Indian dairyman, 32(10), 771-774.
[17]. Ghodekar, D.R., Dudani, A.J AndRanganathan, B (1974). J. Milk FdTechn 37,199.
[18]. Bordin, G., CordeiroRaposo, F., De la Calle, B., & Rodriguez, A. R. (2001). Identification and quantification of major bovine milk proteins by liquid chromatography. Journal of chromatography A, 928(1), 63-76
[19]. Dubey, P.C. And Gupta, M.P. (1986) Studies on Quality of Rabri. J. AgricSci Res 28:9-14. Milk Adultration: Methods Of Detection & Remedial Measures www.eshancollege.com20www.erpublication.org

[20]. Kumar M., Rao, Y.S And Gupta, M.P. (1981) Chemical Quality Of Milk Based Sweets Sold In Agra And Mathura Cities. J. AgricSci Re 23:13-17
[21]. Meisel H (1995) Application of fourth derivative spectroscopy to quantitation of whey protein and casein in total milk protein. Milchwissenschaft 50 247–251.

[22]. Reid, J. R., Coolbear T., Ayers J.S., and Coolbear K.P.. (1998). The action of chymosin on k-casein and its macropeptide: effect of pH.and analysis of products of secondary hydrolysis, Int. Dairy. J., 7, 559-569,. 1998.
[23]. Meisel, H., &Carstens, J. (1989). Vergleichende Untersuchungenzur Bestimmung des Molkenprotein-und Caseinanteils in Milchproduktenmittels Casein-Phosphor-Methode, SDS-Elektrophorese und Polarographie. Milchwissenschaft, 44(5), 271-277.
[24]. Varadaraj, M.C. Mahadev, B.S. And Ahmed, Ashfaq (1983). Indian Dairyman 35: 301.
[25]. Calvo, M. M. (2002). Influence of fat, heat treatments and species on milk rennet clotting properties and glycomacropeptide formation.European Food Research and Technology,214(3), 182-185.
[26]. Bector, B.S., Ram, M. And Singhal, O.P. (1998) Rapid Platform Test for Detection / Determination Of Urea In Milk. Indian Dairy Man 50: 59-60.
[27]. Varadaraj, M.C. KandNambudripad, V.K.N. (1982). J. Fd. Sc. Techn. 19: 53.
[28]. Bitri L., Rolland M.P., Besancon P. (1993). Immunological Detection of Bovine Caseinomacropeptide in Ovine and Caprine Dairy Products, Milchwissenschaft, 48, 367–371.
[29]. Subrahmanyam, M. (1981). Market survey of the quality of butter. Indian dairyman.
[30]. Sharma G.S (1991) Quality Of Creamery Buller Marketed In Agra City M.Sc Thesis Submitted To Agra Univ. Agra
[31]. Sharma M.B. Gupta M.P. (1982) Quality Of MawaBhurfi Sold In Agra City Asian J. Dairy Res 1: 165-168
[32]. Batis, V.K., Garg, S.K., Chander, H. And Ranganathan, B. (1981) .Indian Dairyman 33,435.
[33]. IS:1479.(1960). Methods of test for dairy industry. Part 1. Rapid examination of milk Bureau of Indian Standards, New Delhi.
[34]. Roy, N.K. and Sen, D.C. (1991).Rapid analysis of milk In: Textbook of Practical Dairy Chemistry. Vol. 1. Chemical analysis of fluid milk Kalyani Publishers, New Delhi, India.
[35]. Manual in Dairy Chemistry (1964, Revised in 1979).ICAR (Indian Council of Agricultural Research) Sub-Committee on Dairy Education, ICAR, New Delhi.