

Adulteration Detection in Milk

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Milk is a complex mixture and a liquid food, which can easily be adulterated. According to PFA definition, "Milk is the normal mammary secretion derived from complete milking of healthy milch animal without either addition thereto 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*.

Detection of Neutralizers in milk

Rosalic acid test (Soda Test)

In milk neutralizers like hydrated lime, sodium hydroxide, sodium carbonate or sodium bicarbonate are added which are generally prohibited.

How to detect?

Take 5 ml of milk in a test tube and add 5 ml alcohol followed by 4-5 drops of rosalic acid. If the colour of milk changes to pinkish red, then it is inferred that the milk is adulterated with sodium carbonate / sodium bicarbonate and hence unfit for human consumption.

This test will be effective only if the neutralizers are present in milk. If the added neutralizers are nullified by the developed acidity, then this test will be negative. In that case, the alkaline condition of the milk for the presence of soda ash has to be estimated.

How to proceed?

Take 20 ml of milk in a silica crucible and then the water is evaporated and the contents are burnt in a muffle furnace. The ash is dispersed in 10 ml distilled water and it is titrated against decinormal (N/10) hydrochloric acid using phenolphthalein as an indicator. If the titre value exceeds 1.2 ml, then it is construed that the milk is *adulterated* with neutralizers.

Test for detection of hydrogen peroxide

Take 5 ml milk in a test tube and then add 5 drops of paraphenylene diamine and shake it well. Change of the colour of milk to blue confirms that the milk is added with hydrogen peroxide.

Test for detection of formalin

Formalin (40%) is poisonous though it can preserve milk for a long time.

How to detect?

Take 10 ml of milk in test tube and 5 ml of conc. sulphuric acid is added on the sides of the test tube with out shaking. If a violet or blue ring appears at the intersection of the two layers, then it shows the presence of formalin.

Test for detection of sugar in milk

Generally sugar is mixed in the milk to increase the solids not fat content of milk i.e. to increase the lactometer reading of milk, which was already diluted with water.

How to detect?

Take 10 ml of milk in a test tube and add 5 ml of hydrochloric acid along with 0.1 g of resorcinol. Then shake the test tube well and place the test tube in a boiling water bath for 5 min. Appearance of red colour indicates the presence of added sugar in milk.

Test for detection of starch

Addition of starch also increases the SNF content of milk. Apart from the starch, wheat flour, arrowroot, rice flour are also added.

How to detect?

Take 3 ml milk in a test tube and boil it thoroughly. Then milk is cooled to room temperature and added with 2 to 3 drops of 1% iodine solution. Change of colour to blue indicates that the milk is *adulterated* with starch.

Test for detection of glucose

Usually poor quality glucose is added to milk to increase the lactometer reading. There are two tests available to detect the **adulteration** of milk with glucose.

How to proceed?**Phosphomolybdic or Barford Test**

Take 3 ml of milk in a test tube and add 3 ml Barford's reagent and mix it thoroughly. Then keep it in a boiling water bath for 3 min and then cool it for 2 min by immersing in tap water with out disturbance. Then add 1 ml of phosphomolybdic acid and shake. If blue colour is visible, then glucose is present in the milk sample.

Diacetic test

Take a strip of diacetic strip and dip it in the milk for 30 sec to 1 min. If the strip changes colour, then it shows that the sample of milk contains glucose. If there is no change in the colour of the strip, then glucose is absent. In this method the presence of glucose in milk can be quantified by comparing the colour developed with the chart strip.

Test for detection of urea

1. Urea is generally added in the preparation of synthetic milk to raise the SNF value.

Five ml of milk is mixed well with 5 ml paradimethyl amino benzaldehyde (16%). If the solution turns yellow in colour, then the given sample of milk is added with urea.

2. Take 5 ml of milk in a test tube and add 0.2 ml of urease (20 mg / ml). Shake well at room temperature and then add 0.1 ml of bromothymol blue solution (0.5%). Appearance of blue colour after 10-15 min indicates the *adulteration* milk with urea.

Test for detection of ammonium sulphate

The presence of sulphate in milk increases the lactometer reading.

How to proceed?

5 ml of hot milk is taken in a test tube and added with a suitable acid for e.g. citric acid and the whey thus separated is filtered. Collect the whey in another test tube and add 0.5 ml of 5% barium chloride. Appearance of precipitate indicates the presence of ammonium sulphate in milk.

Test for detection of salt

Addition of salt in milk is mainly resorted to with the aim of increasing the corrected lactometer reading.

How to detect?

Five ml of silver nitrate (0.8%) is taken in a test tube and added with 2 to 3 drops of 1% potassium dichromate and 1 ml of milk and thoroughly mixed. If the contents of the test tube turn yellow in colour, then milk contains salt in it. If it is chocolate coloured, then the milk is free from salt.

Test for detection of pulverized soap

Take 10 ml of milk in a test tube and dilute it with equal quantity of hot water and then add 1 – 2 drops of phenolphthalein indicator. Development of pink colour indicates that the milk is adulterated with soap.

Detection of detergents in milk

Take 5 ml of milk in a test tube and add 0.1 ml of bromocresol purple solution. Appearance of violet colour indicates the presence of detergent in milk. Unadulterated milk samples show a faint violet colour.

Detection of water in milk

Though the adulteration of milk with water can be checked by lactometer reading, other adulterations too affect the lactometer reading. Hence freezing point depression, recognized by AOAC, is usually adopted.

$$\text{Percentage of water added} = \frac{\text{Normal freezing point} - \text{Observed freezing point}}{\text{Normal freezing point}} \times 100$$

Normal freezing point of milk is taken as -0.55°C . A tolerance level of 3% is given which is equivalent to specifying a minimum freezing point depression for authentic milk of -0.55°C .

Detection of skim milk powder in milk

If the addition of nitric acid drop by drop in to the test milk sample results in the development of orange colour, it indicates the milk is adulterated with skim milk powder. Samples without skim milk powder shows yellow colour.

Detection of vegetable fat in milk

The characteristic feature of milk is its fatty acid composition, which mainly consists of short chain fatty acids such as butyric, caproic, caprylic acid; whereas the vegetable fats consist mainly of long chain fatty acids and hence *adulteration* of vegetable fat in *milk* can be easily found out by analyzing the fatty acid profile by gas chromatography.

Detection of buffalo milk in cow milk

The presence of buffalo milk in cow milk is tested by Hansa test. It is based on immunological assay. One ml of milk is diluted with 4 ml of water and then it is treated with 1 ml of antiserum. The characteristic precipitation reaction indicates the presence of buffalo milk in the sample taken. (The antiserum is developed by injecting buffalo milk proteins into rabbits).

Detection of benzoic and salicylic acid in milk

Five ml of milk is taken in a test tube and acidified with concentrated sulphuric acid. 0.5% ferric chloride solution is added drop by drop and mixed well. Development of buff colour indicates presence of benzoic acid and violet colour indicates salicylic acid.

Detection of borax and boric acid in milk

Five ml of milk is taken in a test tube to which 1 ml of concentrated hydrochloric acid is added and mixed well. Tip of a turmeric paper is dipped into the acidified milk and it is dried in a watch glass at 100°C or over a small flame. If the turmeric paper turns red, it indicates the presence of borax or boric acid.

Confirmation can be made by adding a drop of ammonia solution on the turmeric paper and if the red colour changes to green, it shows the presence of boric acid.

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