Paper No.: 07

Paper Title: TECHNOLOGY OF MILK AND MILK PRODUCTS

Module – 3: Raw milk quality and Market milk

INTRODUCTION

Milk at the processing plant is received either in cans or in tankers (road/rail). The first stage at which raw milk is received is known as milk reception dock or platform or raw milk receiving dock (RMRD). Raw milk quality at RMRD is immediately checked to make decision regarding accepting the milk. Delay during milk reception may lead to deterioration of milk. Reception of raw milk include following operations: unloading, grading, conveying, sampling, testing, weighing or measuring and recording, dumping and pumping.

Before unloading raw milk has to pass through rigorous examination which may include organoleptic evaluation, physical and chemical tests to assess the quality of milk rapidly, and decide for its acceptance or rejection. All these tests known as "platform tests" are performed on each can/tanker to assess the quality of the incoming milk before it is accepted and weighed. These tests must be easy to perform, give quick and reliable results and should not require complicated and elaborate equipment.

EXAMINATION OF RAW MILK QUALITY

Market milk requires milk of a higher quality from the standpoint of healthfulness. However, sanitary quality, keeping quality and aesthetic background is required by any branch of the dairy industry. The initiative in attaining such a high standard must almost invariably be taken by the milk producers. To attain this milk processor must constantly check on the quality of the milk received and follow up, any defects or lapses in quality through, educational work for the producers. In food industry, it is universally recognized that a high quality product cannot be manufactured from low quality raw material.

Secondly milk produced under unsanitary conditions and exposed to warm atmospheric temperature for long period will have poor keeping quality and also show various defects due to excessive bacterial growth. Such milk supply is likely to be found unsuitable for processing or for manufacture of milk products and if they are bulked with other lots of milk the entire quality of milk may be spoiled. It is, therefore, necessary to detect and weed out such milk supplies of unsatisfactory quality received at milk collection centers, dairies or milk product factories. Any pronounced defect may be recognized by the flavour and odour of the milk but more accurate tests of objective nature are required to be used for obtaining

reliable information regarding the quality of milk supplies and for judging their acceptability. The tests should be simple as well as rapid so as to give results immediately since large number of consignments of milk which have to be screened for their quality within a few minutes. A number of platform tests are generally used for rapid assessment of the changes brought about, in the milk, as a result of bacteria growth.

Organoleptic Test: Milk consumers judge the quality of the product by the flavour (smell and taste) and appearance of milk. Therefore, organoleptic test is of obvious importance at a market milk plant. Each can of milk should be carefully examined by the sense of smell before the milk is dumped, those with objectionable odours should be rejected. It is not practical to taste each can but in special cases, tasting is necessary. It is desirable to verify one's judgment by tasting in the case of bitter and certain weed flavours. The sense of smell will not detect such flavours it is, therefore, necessary to taste the milk. An experienced person can pick out such samples of milk with a fair degree of accuracy. Thus, this test involves visual observation, smelling and tasting of milk.

Temperature of Milk: Temperature measurement of milk, especially in the case of chilled milk supplied from distant chilling centers, renders a great help towards the judgment of the bacterial quality of milk at the chilling center which collects milk from the round places. The milk is rapidly and immediately chilled to a temperature of about 5 °C before it reaches to main processing plant. During transit of this milk from chilling centre to main processing plant, the temperature of milk may rise which leads to the growth and multiplication of the microflora of milk. This doubtlessly lowers the bacteriological quality of milk.

Thus, keeping these in view, it requires that the milk for pasteurization should be delivered at the reception dock of dairy plant within 2 hours of its drawing. The milk should be cooled immediately after it has been drawn and must be maintained at or below this temperature till processing.

Acidity Test: Fresh milk contains no lactic acid. The acidity of fresh milk is due to casein, albumin, globulin, CO_2, citrates and phosphates together with soluble calcium salts. The lactose present in milk is fermented upon bacterial action. The fermentation products are responsible for increase in titratable acidity and subsequent souring of milk. In general average acidity of mixed milk is 0.15% to 0.16% LA.

Sediment Test: Visible foreign matter in milk is objectionable for several reasons. The presence of dirt is an objection, in itself, but it is further more an indication of carelessness in handling which usually means a lack of sanitation. Presence of particles of visible dirt usually means that a considerable amount of other foreign matter has entered the milk but cannot be

seen because it is in solution. The test is especially useful in educating producers as to the need for cleanliness and as a general check on incoming milk at a collecting centre of processing plant. Thus, sediment test present a simple rapid and quantitative means of indicating the cleanliness of milk with respect to visible dirt. However, it need not necessarily indicate heavy bacterial contamination.

Clot-on-Boiling: (C.O.B.) Test: It is based on the fact that milk samples having high acidity, due to bacterial growth, are coagulated when heated to boiling temperature. Samples of milk having poor stability due to disturbed salt balance also shows signs of coagulation when heated to boiling, however, the acidity at which milk coagulates in such a test varies greatly, depending upon the salt composition of milk.

Alcohol Test: The alcohol test determines the susceptibility of milk to coagulation due to developed acidity, disturbed salt balance or high albumin-globulin content. The alcohol test determines the heat stability of milk. This test is of importance in evaporated milk plants to detect milk which has a tendency to curdle during the sterilization process. The colostrum, stripper milk and high in salt content, usually gives positive test.

Buffalo milk has been observed to be less stable than cow milk under the influence of alcohol. The lower stability of buffalo milk has been ascribed to its higher soluble Ca content. The coagulation time with ethanol decreases with rise in temperature and increases on dilution with water. Generally, for bulk milk samples of buffalo milk 72 to 88% alcohol and for individual samples 64 to 92 % alcohol gives positive test.

Alizarin Alcohol Test: Adding alizarin along with alcohol test helps in finding out whether milk is acidic or alkaline. This indicator gives a yellow or brownish colour in high acid milk, a yellowish brown or reddish brown colour in normal milk and a brownish red (purple) to violet red in milk that is less acidic than normal milk. This test is normally for the milk which is alkaline in nature and high in salt content.

Ten Minutes Resazurin Test: Resazurin is an oxidation-reduction indicator. It is initially blue in colour and gets reduced in two stages. First to a pink compound (resorufin) and then to a colourless compound (dihidro resorufin), as a result of bacterial activity. The first stage of reduction is an irreversible change and second is revisable. In the course of reduction of resazurin in milk, there will be series of colour changes which can be compared with standard colour discs, in a lovibond comparator and expressed in term of a standard resazurin disc number (6 to 0). The time taken for the reduction of resazurin in milk to any particular stage of the colour change (disc. No.) recorded at the end of any particular period (10 min) of incubation of the milk sample and the same is used as criterion of bacterial activity in milk.

Rapid reduction of the dye indicates high bacterial count and poor keeping quality. Since resazurin is also affected by reducing activity of leucocytes cells present in mastitis milk and late lactation milk, this test also helps in detecting such abnormal milks.

Methylene Blue Reduction Test: This test is based on the principle that methylene blue (an oxidation- reduction dye or indicator) which is blue in its oxidized state, is reduced to a colourless compound (Leuco form) as a result of the metabolic activities of bacteria in milk. When a solution of methylene blue is added the organisms present in milk consume the dissolved oxygen and lower the O-R potential to a level, when methylene blue and similar indicators are reduced or decolourized. The time taken for the reduction of the dye (methylene blue reduction time) is influenced by the number and types of bacteria present in milk. The greater the numbers of organisms present in milk and greater their activity, more rapidly is the dye reduced.

Fat Content of Milk: Dr. N. Gerber of Switzerland and Dr. Babcock of U.S.A. invented simple methods of determining the fat content of milk in the year 1892 and 1890 respectively. In India, Gerber's method is most commonly used.

Principle: Concentrated H_2SO_4 when mixed with milk in correct proportion digests the protein of milk turning them into simpler substances which are deprived of the power of maintaining fat droplets in the emulsified state. This enables the fat globules free and melted due to generation of heat and rise to the surface and forms a single mass. The heat generated also reduces the viscosity of the mixture.

The second principle explains the separation and collection of fat particles. The content of the butyrometer is a mixture of two fluids of different specific gravity viz., fat having specific gravity 0.90 and the acid mixture having specific gravity 1.43 at the temperature attained. The specific gravity of the substances being different in the centrifuge the greatest force is exerted on the heavier portion, which is in this case is the acid mixture. In the butyrometer, therefore, which remain horizontal in the centrifuge the fat is collected near the centre and the acid mixture is collected at its lower end, away from the centre.

Total Solids (TS) and Solids-Not-Fat (SNF) Using Lactometer: As a matter of convenience, the specific gravity of milk is measured usually with lactometer. The lactometer is a hydrometer with a scale adopted to the limits of specific gravity of milk. It works on the principles that the body floating in liquid sinks to such a level that it displaces a volume of liquid equal in weight of the floating body. In liquid of low specific gravity the hydrometer sinks more than the liquid of higher specific gravity.

MARKET MILK

Raw milk which passes prescribed platform tests is then received at the processing plant. Fresh raw milk is cooled to 4°C to extend its shelf-life. At this temperature, the activity of enzymes and the growth of microorganisms and metabolic processes are all slowed down. The chilled raw milk at the milk processing plant is processed for distribution in fluid form as market milk or converted into various products.

The treatments that milk is required to undergo at a dairy plant include filtration or clarification, separation and standardization. Filtration or clarification of milk is done to remove dirt, dust or any foreign mater present in milk. Separation and standardization of milk is carried out to achieve compositional modification of milk so that it meets legal requirements prescribed by FSSR, 2011 for its conversion into market milk.

STANDARDIZATION OF MILK

Standardization of milk refers to the adjustment, i.e. raising or lowering, of the fat and/or solids-not-fat percentages of milk to a desired value, so as to conform to the legal or other requirements prescribed. Milk is standardized by the addition of milk or cream with a higher or lower fat percentage than that of the material to be standardized; sometimes the addition of skim milk will fulfill the purpose. Standardization method may involve batch processing or continuous processing.

In batch processing Pearson's square method may be used to calculate the volumes of whole milk and skim milk/cream needed and the two can be simply mixed to yield the required product. Continuous standardization system consists of a cream separator with in-line densitometer at the skim milk and cream outlets. Whole milk is fed to the separator and, with careful control of the cream and skim milk fat contents and measurements of the flow rates of the two streams, cream can be metered back into the skim milk stream to yield standardized milk with the required fat level.

To solve the standardization problem, it is necessary to find the relative amounts of the original material and the standardizing material to be mixed together to give a product with the desired fat content. Once these relative amounts/proportions have been determined, it is easy to calculate the exact amount of each which must be mixed together to give a certain weight of the finished product or the weight of milk or cream.

There are two calculation methods by which we can solve the standardization problems.

(1) Pearson's Square Method

(2) Algebraic Method

PASTEURIZATION OF MARKET MILK

Fresh milk produced from healthy milch animals generally contains minimum load of microorganisms. In the course of handling at the farm, milk is liable to be contaminated by various microorganisms mainly bacteria.

Pasteurization kills the organisms responsible for spread of diseases through milk and makes it safe for consumption. The term as applied to market milk refers to the process of heating every particle of milk to a temperature of at least 63°C (145.4°F) for 30 minutes or 71.7°C (161°F) for 15 seconds (or to the temp-time combination which is equally efficient) in properly designed equipment. Milk is immediately cooled to 4°C and stored in cold storage maintained at 4°+1°C. After pasteurization, milk must be packaged either in glass bottles or polypacks and then stored below 5°C till distribution.

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