

## STRATEGIES TO ENSURE CLEAN MILK PRODUCTION IN THE DAIRY INDUSTRY

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### **Clean milk production**

The importance of dairy industry in India has become an important segment of the food industry with the increasing vegetarian population. The import of milk products due to liberalization of Indian economy has necessitated the production of quality milk by our farmers.

### **Need for milk production**

The objective of clean milk can be achieved by practical application of science-based systems such as Hazard Analysis Critical Control Point (HACCP). Not only it should produce quantum milk, but must also be free from debris, microbes and must remain so, till it is consumed. Raw milk quickly becomes sour when it is stored for long periods at high ambient temperatures prevalent in tropical and subtropical countries. This is because the inherent lactic acid bacteria and contaminating microorganisms from milk vessels or the environment break down the lactose in milk to lactic acid. When sufficient lactic acid has accumulated, the milk becomes sour and coagulates. Raw milk that contains too much lactic acid, even if it does not appear to be curdled, will coagulate when heated. This acidity is known as “developed acidity” and such milk is not acceptable for sale.

### **Nature of milk**

Normal whole milk contains a balanced proportion of milk fat (4 %), lactose (4.8 %), proteins (3.5 %), minerals (0.7 %), vitamins and other minor constituents such as enzymes and hormones. The pH of normal raw milk is about neutral (pH 6.7) with a corresponding titratable acidity of 0.16-0.17 % due to the natural buffering capacity of milk proteins and salts. Wholesome milk should contain only a few bacteria and no extraneous matter if it has been produced hygienically.

### Factors affecting nature of milk

Depending on how milk is handled during and after milking, the natural composition and Physico-chemical properties of raw milk may change.

- **Effect of milking practices:** Incomplete milking results in low milk yield and low fat content because the last milk (strippings) contains more fat than the foremilk.
- **Stage of lactation:** Immediately after calving, a cow produces colostrum during the first five days, after which the milk reverts to its normal composition. Colostrum is also more alkaline (pH 6.8–6.9) than normal milk.
- **Effect of mastitis:** On farms practicing good husbandry, 20 to 30 % of lactating cows have one or more quarters infected with sub-clinical mastitis. With poor hygiene, up to 70–80 % of the cows may be affected. The composition of mastitis milk approaches that of blood. It has more whey proteins, less casein, and fewer water-soluble vitamins. It also tends to be more alkaline, has a higher chloride content than normal milk, and tastes salty like the milk of very old cows (more than six lactations) or milk of cows in late lactation (near drying off).
- **Effect of feeding:** Cows have to be fed properly. If cows are fed a diet low in forages and high in starch, the butterfat content of the milk may fall below 2.5 %. A good forage-to-concentrate ratio is important to enabling cows to produce good quality milk to their potential.
- **Effect of cold storage:** On cooling milk, the multiplication of bacteria delays, except for a few cold-tolerant bacteria (psychrotrophs) which can even grow at refrigeration temperatures. If milk is kept chilled at 4°C for more than 72 hours, the cold-tolerant bacteria will multiply and produce lipase and protease enzymes that, respectively, break down milk fat and proteins. These enzymes are also heat resistant and can cause spoilage of pasteurized milk and other processed dairy products. Extended cooling also makes calcium in the milk less soluble and unavailable during coagulation of milk by rennet in cheese making.
- **Effect of heating:** Pasteurisation of milk involves heating it to 63°C for 30 minutes or 72°C for 15 seconds in order to destroy harmful microorganisms. Pasteurization kills more than 90% of bacteria and causes minor denaturation of proteins and loss of some water-soluble vitamins.
- **Effect of treatment of cows with antibiotics:** When cows suffer from mastitis, they are treated with antibiotics by intramammary or intramuscular injection. The antibiotics circulate

in the blood and are secreted in the milk for up to 72 hours. Longer-acting (slow release) antibiotics, such as are used in dry cow therapy against mastitis, remain in the blood longer. Drug residues in milk are undesirable because they can trigger allergies and drug resistance in humans, and inhibit the lactic acid starter cultures used in the manufacture of fermented milk products. For this reason, milk processors routinely screen raw milk for antibiotics.

### **Clean milk production in India**

Village entrepreneurship is the mainstay for bringing India as the number one milk producer in the world. As a result, there is limited scope for mechanizing milking procedures but that does not mean that India cannot produce clean milk. By launching the vigorous campaign, clean milk can be produced by good animal Husbandry practices in villages, small farms with the help of Dairy Development Boards, different Cooperative Dairy Federations, etc.

### **Strategies for clean milk production**

The first step to clean milk production should be education and training of milk producers on hygiene, housekeeping, sanitation, milking methods and good animal husbandry practices.

1. **Awareness and training:** Educational aids and programmes should be organized for the farmers for making them aware of the importance of clean milk production. This should be in the form of charts/posters displayed at village, society and milk collection centres. Make them aware of the correct handling of the milk from udder to reception dock, maintenance of the hygienic environment, clean utensils to availability of milk cooling bulk tanks and coolers.
2. **Feeding practices:** The feeds and fodder of the animals should not introduce directly or indirectly microbiological or chemical contaminants in the milk in amounts that is unacceptable to health. Feed fodder and silage should be procured from a reliable source and should be stored properly.
3. **Housing management:** The shed should be comfortable and clean with a suitable arrangement to dispose dung, urine, feed, and fodder residues. There should be a proper supply of clean drinking water and electricity. The shed should be washed before milking.

### **Sanitation and Disinfection of the Animal Houses**

- Cleaning and sanitation are complementary. By sanitation we adopt hygienic measures aiming at creating conducive to health of animals and assuring product quality.

- The measures include proper cleaning of habitation, adequate drainage system, adequate lighting of building and sheds, proper ventilation, and proper disinfection measures.

- It involves cleaning of bedding material like sawdust, paddy, straw etc. once daily

- Watering and feeding material to be thoroughly cleaned

- In case of mud floor, a top of 12-15 cm soil is removed and replaced with clean soil

- Cleaning and washing of milk parlours

- Sloped drains having a width of 6-12 inches and 2inch depth. It should maintain a proper gradient of 1 in 60 for easy flow of drain water.

- Provide adequate lighting & ventilation

- Disinfect the houses by washing the houses with boiling water, flame blower or by using suitable disinfectants such as formaldehyde, phenols, cresols, washing soda, quick lime, bleaching powder etc.

- The hygiene and sanitation process practiced in a dairy herd can not only keep the animal and surrounding healthy but will also find its way for the export of milk and milk products thereby, enhancing the efficiency of livestock and its productivity, survivability and longevity.

4. **Handling of milking vessels:** The milking vessel should be made of stainless steel. It should be cleaned before and after milking with hot water and certified detergents/chemicals. It should have smallmouth. The milker should wear clean clothes and maintain personal hygiene. He should wash his hands before milking and should not spit or smoke. Shaving the hair of the hind legs and tail should be carried out routinely. Also, the fore milk should be discarded in a proper place.

5. **Udder Hygiene:** Effective milking practice is one important criterion in order to produce safe and suitable milk; failure of which may introduce contamination of milk. From an ethological perspective, the cow rests in a lying position, which inevitably leads to contact of the udder skin with filth on the bedding surface. As much as  $1 \times 10^{10}$  of total microorganisms can be found in one gram of filth from the udder surface.

- With unsuitable udder hygiene, the microorganisms present on the teat skin can contaminate the milk during milking or through the teat tip will penetrate the teat canal

increasing the possibility of mastitis. Hence it is necessary to implement hygienic-prophylactic measures in maintaining cleanliness and udder health before and after milking of dairy herds, with the aid of disinfecting agents.

There are many procedures for udder hygiene prior to milking such as:

- i. washing by spraying water and wiping of teats
- ii. washing of teats with a cloth immersed in the warm disinfectant solution and drying with a dry cloth
- iii. immersing of teats in disinfectant and wiping with a paper cloth.

· Appropriate hygiene, such as dry cleaning, is necessary for lowering teat contamination whereas only the substantially soiled udders require washing with water. Therefore, if the udder is not substantially soiled, the teats should be immersed in active foam disinfectant and wiped with disposable paper cloths after 1-2 minutes.

· Disinfection prior to milking by immersing teats in a special cup, containing active foam based on surface-active compounds, organic acids, and hydrogen peroxide, and disinfection after milking by immersing teats in the agent containing 1.94% linear dodecylbenzene sulphonic acid (LDBS) and skincare substances.

· The implementation of udder hygiene after milking is a very rational method for maintaining acceptable udder health status and is conducted by immersing teats in a disinfecting agent. This procedure removes the milk droplets that are left behind which can serve as a breeding ground for surrounding pathogenic microorganisms. Subsequent drying of the disinfectant creates a thin layer over the teat orifice, mechanically preventing the incursion of microorganisms through the teat canal.

· The benefits are manifested through a decrease in post secretory milk contamination, reduction of udder infections by so-called environmental microbes, and by a decrease in the number of subclinical mastitis.

· Nowadays, the priority in conducting udder hygiene is given to ecologically acceptable disinfecting agents that are not harmful to animals and the environment.

6. **Health management**: Good animal husbandry practices including regular monitoring of disease such as mastitis should be a part of the routine work. During milking, using teat dips, and washing of udder should be an ongoing activity of the dairy farm. Sick animal shed

should be far away from the milking barn and separated from the healthy ones. The healthy animals must be milked first. Improper use of veterinary drugs should be avoided.

7. ***Milk collection and transportation:*** There should be a provision of bulk cooling tanks in order to reduce the bacteriological load in the milk immediately after collection. Introducing differential pricing system based on bacteriological quality of milk will help in overall improvement of milk quality reaching the dairy dock. Other prerequisites for clean milk production include hygienic norms, good animal husbandry practices and proper handling, storage and transportation of milk are important elements to produce quality milk. The lids of the milk cans should fit tightly preventing from entry of rain and dust. The cans should be stored in an inverted condition on stand. Excessive agitation while transportation should be avoided. When milk is agitated, the milk fat is destabilised which becomes easily oxidised. The milk tanker should have proper insulation. The number of spoilage bacteria in raw milk depends on the level of hygiene during milking and the cleanliness of the vessels used for storing and transporting the milk. During the first 2–3 hours after milking, raw milk is protected from spoilage by inherent natural antibacterial substances that inhibit the growth of spoilage bacteria. However, if the milk is not cooled, these antibacterial substances break down causing bacteria to multiply rapidly. Cooling milk to less than 10°C may prevent spoilage for up to three days. High storage temperatures result in faster microbial growth and hence faster milk spoilage.