

Protecting product quality and hygiene in milk processing

While the dairy industry has continued to see many changes over the years, one thing has remained constant: a high consumer demand for milk products.

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Although fluid milk consumption in the US is slightly declining, consumption of all milk products has consistently grown globally over the past two decades. In fact, more than six billion people worldwide consume milk and milk products (cheese, butter, etc), according to the Food and Agriculture Organisation of the United Nations (FAO). As dairy manufacturers continue to explore diverse new milk products and applications – such as food and beverages for on-the-go lifestyles, healthy diets and more – the demand for milk only continues to increase.

What does all of this mean for dairy farmers and processors? As you might imagine, milk production is also on the rise in order to meet growing consumer demand. As reported by the FAO, world milk production has increased by more than 60% in the last three decades, from 500 million tons in 1983 to 802 million tons in 2016. Due in large part to a growing population, Asia continues to be a key milk producer for the globe with an estimated 311 million tons produced in 2015 – with India serving as the world's largest producer of milk. While keeping up with demand is certainly a high priority for dairy farmers and processors, staying on top of safety, hygiene and industry regulations is of the utmost importance to maintaining an efficient production schedule and superb product quality.

Milking systems

Although there is variety in today's milking machines, most systems consist of the same core components, where the principal



purpose is to extract milk from a cow by vacuum. Each system typically includes a cluster, or group of teatcups that attach to a cow's udder, a milk tube, a pulse tube and pulsator, a vacuum pump and a recorder jar or milk meter to measure production levels. As an integrated assembly, milking machines also require a milk tubing system that connects the various machine components in order to provide the flow paths for both air and milk.

In operation, the cluster performs the milking action through a shell and liner device that creates a vacuum within the cup device. A claw, or manifold, separates the teatcups and connects them to the milk and pulse tubes, which transport the milk and air mixture away from the cow's udder to receiving tanks. The pulse tube, or airline, carries the varying air pressure from the pulsator device to the tanks, drawing the milk and fluids out of the cows as well.

After the milk is collected and transferred into the pipeline, it is transported to a holding container to cool, then transferred again to a refrigerated tank truck for delivery to a milk processing facility.

Milk safety and quality

Understanding how temperamental raw milk can be, dairy farmers and processors are well aware of the negative effects poor equipment sanitation can have on product

quality, hygiene and production efficiency in milking applications.

To ensure proper sanitary conditions, the inner surfaces of milking equipment and pipelines, or tubing, should be cleaned daily. Regular product sampling and testing are also necessary throughout various stages of the milk collection and transfer process to ensure product quality.

Most dairy farm and processing equipment is made of stainless steel, where solvents are run through the system components to flush them clean of bacteria and other particles or debris. If not properly sanitised, the unwanted build up of protein and organic material – or milk fouling – can occur.

In many cases, deposits that are produced from fouling may be dislodged by flowing fluid, causing contamination of a product. Consequently, milk fouling can cause an unwanted taste or odor in milk during both the collection and processing stages, which can negatively impact quality and hygiene in the finished dairy product.

Regulation compliance

Proper sanitation procedures are also important to ensure that equipment and operations comply with industry standards and regulations.

For dairy farmers and processors in the United States, standards set by the Food and Drug Administration (FDA) apply, while the European Union (EU) requires compliance with its Food Contact Materials (FCM) Regulation for processors located in Europe.

United States

In particular, the Federal Food, Drug, and Cosmetic Act (FFDCA) prohibits the adulteration of food, which is aimed to ensure the US food supply is safe by preventing contamination.

This includes food contact substances (FCS), or any substance that is intended for use as a component of materials for manufacturing, processing, packing, packaging, transporting or holding food – as

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well as tubing that is typically used in food and beverage processing systems.

To date, the FDA has established a food contact notification process, or FCN process, as the primary method of regulation when the FCS is not subjected to any food additive regulation, such as the Code of Federal Regulation, Vol. 21, Parts 174 to 186, Threshold of Regulation, Food Contact Notification Clearances and more.

Other US based standards include 3-A Sanitary Standards, which are managed by an independent organisation that is dedicated to advancing hygienic equipment design for the food and beverage industries. Much like the government regulations for the food and beverage sector, 3-A also shares a common commitment to promoting food safety and public health.

The widely recognised 3-A symbol – which is also known as The Symbol of Assurance – indicates that food and beverage equipment meets 3-A's design and fabrication standards. It is considered to be among the best in the food and beverage category, particularly within the dairy industry.

European Union

The FCM Regulation covers the safety of all materials that might come into contact with food. Also known as Framework Regulation (EC) 1935/2004, it states that any material intended to come into direct contact with food must be sufficiently inert to prevent substances from being transferred to food in quantities large enough to endanger human health, bring about unacceptable changes to the food's composition or deteriorate its organoleptic properties.

In addition, Regulation (EC) 2023/2006 lays out good manufacturing practice (GMP) for the development of food contact materials, which applies to all sectors and stages of manufacturing, processing and distribution.

In Europe, all food-contact materials are required to meet both Framework

Regulation (EC) 1935/2004 and Regulation (EC) 2023/2006. There are additional safety regulations that have been put into place by the EU, which are applicable to all plastics materials and articles intended to come into contact with food.

For example, Plastics Regulation (EU) 10/2011 – also known as Plastics Implementing Measure – includes directives for food contact involving plastics. These materials can include packaging, food storage containers, kitchenware or utensils, as well as the plastics found in tubing materials that are often employed in milking applications.

The German BfR Recommendations on Food Contact Materials state that 'materials and articles that come into contact with food shall be manufactured in compliance with good manufacturing practice'.

Tubing selection and solutions

From initial collection to transfer, processing and more, tubing is a key component in nearly every part of the milking process. This means that there are several touchpoints or opportunities for milk to become contaminated if proper tubing is not specified.

Plus, unclean milking systems foster bacteria growth, which can lead to hygiene issues and milk products with limited shelf life – not to mention potentially harmful implications for consumers.

A key consideration in the selection process should include tubing that exhibits performance properties that meet the milking equipment industry's specific needs, such as flexibility in hot and cold temperatures (for proper fitting installation and retention), resistance to kinking, hardening, fat absorption and durability (to ensure long and reliable service life), among others.

Additionally, it is important to ensure the milk tubing has been rigorously tested and proven to perform under the various conditions that can be encountered in a milking application.

For instance, Saint-Gobain's Tygon II is a

high-performing silicone tubing engineered with a smooth surface and inner bore that resists sticking, encrustation and bacteria growth, while reducing the potential for particle entrapment. It does not contain plasticisers or other additives and by-products that could leach into milk and alter the quality of the milk.

Tygon II silicone tubing also provides flexibility for hot and cold temperatures, along with durability for long and reliable service. It also offers resistance to kinking and tearing, as well as reduced tackiness.

Tygon S3 M-34-R milk tubing is entirely clear, allowing for immediate visual inspection and verification of cleanliness. Its smooth, non-porous inner surface also reduces the occurrence of build up from butterfat, milkstones and milksoil and can help to eliminate the possibility of bacteria growth within the milk transport line.

Long-lasting Tygon S3 M-34-R tubing is also extremely flexible and installs quickly and easily fits milk handling equipment. It is specially formulated to reduce the risks that can occur with the use of rubber tubing, such as cracking, aging and improper hygiene.

Tygon S3 A-24 and A-24C phthalate-free vacuum tubing are ideally suited to supply air to and out of the pulsator, for actuating the milking process. Their smooth inner surfaces are less susceptible to particle entrapment, which can restrict air flow.

Tygon S3 A-24 tubing is designed to work in tandem with the milking tubing (Tygon S3 M-34-R and Tygon II) to provide a vacuum tube and easy fluid flow within the milking process. All of Saint-Gobain's Tygon tubing solutions meet or exceed various industry and governmental regulations set by the FDA, EU and more.

Summary

One effective course of action dairy farmers and processors can take to ensure product quality, safety and regulatory compliance in milking applications is to evaluate and specify appropriate tubing solutions. ■