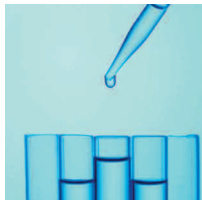


# Dairy Industry

## Background

- At Praxair, we are making our planet more productive. The industrial gases that are used in the dairy industry allow facilities to reliably meet their wastewater treatment guidelines. Praxair's goal is to help companies improve their productivity.
- The dairy industry undertakes a number of activities that involves converting raw milk into milk, butter, cheese and yogurt using processes such as chilling, pasteurization, and homogenization
- Dairy raw wastewater is characterized by high concentrations of organic matter and nutrients. Dairy wastewater systems tend to have fluctuating loads due to the discontinuous nature of the production process in dairy processing. Dairy wastewater facilities are faced with a number of challenges in their operations, which could include:



### pH Reduction with CO<sub>2</sub>

**Challenge.** Dairy wastewater can have a wide range of pH values. Fluctuation of wastewater pH (3.0 to 10.0) is a consequence of the cleaning of production equipment using alkaline and acidic cleaning agents. Some facilities manufacture dairy derived acids that contribute to low pH values. Dairy wastewater might contain acids, alkali, detergents, disinfectants and quaternary ammonia compounds. Mineral acids are traditionally used in the equalization tank for pH control

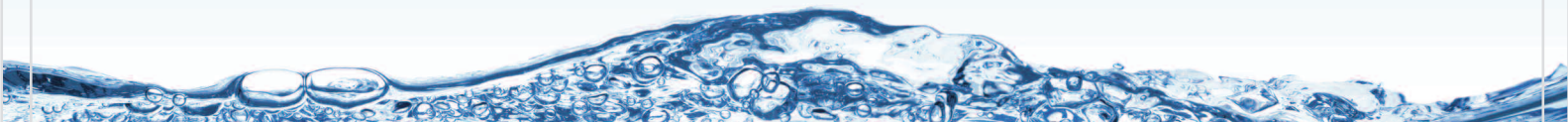
**Proven Approach.** Praxair's CO<sub>2</sub> application for pH control allows facilities to safely and effectively neutralize alkali wastewaters. The main benefit is the safer handling CO<sub>2</sub> offers versus the handling requirements of mineral acids. When using CO<sub>2</sub>, facilities do not require spill protection or corrosion resistant piping. CO<sub>2</sub> is also more environmentally friendly and eliminates the possibility of over-treating. CO<sub>2</sub>-water equilibrium conditions ensure that pH levels do not drop below 6.5. handling CO<sub>2</sub> offers versus the handling requirements of mineral acids. When using CO<sub>2</sub>, facilities do not require spill protection or corrosion resistant piping. CO<sub>2</sub> is also more environmentally friendly and eliminates the possibility of over-treating. CO<sub>2</sub>-water equilibrium conditions ensure that pH levels do not drop below 6.5.



### Removal of Fats, Oil, Grease and Suspended Solids loads

**Challenge.** Large amounts of water are used during the dairy process, resulting in about 0.2-10 L of wastewater per liter of processed milk. These wastewater streams contain fats, oil and greases (FOGs), phosphorus, suspended solids (TSS) and heavy metals. Flocculation and Coagulation is used to remove these contaminants. The amount of coagulant and flocculent that is used and the effectiveness of this process are dependent on the pH and alkalinity of the wastewater.

**Proven Approach.** Praxair's CO<sub>2</sub> application enables more accurate control of pH during physico-chemical treatment. In some facilities, solids and FOGs removal is achieved using dissolved gas flotation systems where inert gases like nitrogen (N<sub>2</sub>) can be used.





## High strength organic loads

**Challenge:** Due to the presence of milk solids (e.g. protein, fat and carbohydrates like lactose) untreated wastewater from dairy processing facilities has a significant organic content. The biochemical oxygen demand (BOD) of dairy wastewater can range from about 0.8 to 2.5 kilograms per metric ton (kg/t) of milk in the untreated effluent. The chemical oxygen demand (COD), is normally about 1.5 times the BOD level and ranges from about 1.2 to 3.8 kilograms of COD per metric ton (kg/t) of milk.

**Praxair Approach:** High purity oxygen systems enable wastewater facilities to treat up to ten times the organic load that can be treated by a conventional air based system. With our efficient and proven oxygenation systems, mixing and oxygen transfer is decoupled. Providing enough oxygen to meet an increased organic load is as simple as turning up an oxygen supply valve to feed more oxygen to the wastewater process.

# N<sub>2</sub>

## High nitrogen and phosphorous loads

**Challenge:** Dairy wastewater contains milk based substances that include ammonium (from the amino acids) and phosphate (from the caseins) as well as residual cleaning agents such as detergents, which may contain phosphorus. The concentration of nutrients (Nitrogen and Phosphorus) could be around 20-800 mg/l total nitrogen and between 10-250 mg/l total phosphorus

**Praxair Approach:** Pure oxygen devices offer an integral solution for reducing organic matter and nitrogen. By allowing for effective nitrification and denitrification, we provide a comprehensive solution for allowing dairy facilities to meet their treatment goals. Using intermittent oxygenation, we enable facilities to utilize a single basin to achieve nitrification and denitrification. The solution is very flexible to changes in flow and composition



## Odors

**Challenge:** Odors in and around milk processing plants come from the biological decomposition of milk derived organic matter, generally found in wastewater. Dairy wastes are slightly alkaline and have a tendency to become acidic quite rapidly, because of the fermentation of milk sugar to lactic acid. This fermentation should be controlled in the equalization tank

**Praxair Approach:** Using high purity oxygen and delivery systems from Praxair ensures that sufficient oxygen is provided in the main aeration basins. This prevents septic conditions from occurring that would result in odor production.



## Sludge Reduction

**Challenge:** About 0.13 to 0.45 kg of dry matter is generated per cubic meter of treated sewage. If a dairy facility does not have readily available sources for sludge disposal, getting rid of this sludge can be challenging and costly.

**Proven Approach:** Praxair's patented Lyso™ sludge ozonation process enables wastewater facilities to reduce biological sludge generation by as much as 80%-90%. The use of ozone also provides additional benefits such as enhanced sludge settling in clarifiers, and better sludge dewatering.

## Conclusion

- Whether your wastewater treatment system is an extensive aerated lagoon, or a compact wastewater process, our technology offerings will provide you with effective and reliable treatment.
- Praxair's tested and proven wastewater offerings have been extensively deployed in dairy wastewater treatment facilities.
- Call us today to discuss your particular wastewater treatment process needs and let us help you improve your productivity



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