

Brewery/ Distillery sanitation and disinfection

Breweries/ Distilleries are an energy intensive, time consuming and water demanding industry. There are many aspects in brewery operations that can improve profitability and the environmental footprint, such as:

- Reducing energy costs
- Handling, storage and administration of chemicals in cleaning and disinfection
- Prolonging the brewing equipment life time
- Reduce production down-time
- Minimizing water consumption

Ozone technology addresses all of the above.



Overview of ozone

Ozone is the most efficient disinfection agent available and replaces traditional chemicals such as hypochlorite, peracetic acid (PAA) and hydrogen peroxide. It offers at least 20 times higher microbial inactivation potential which means that both concentration and disinfection time can be significantly reduced and is very gentle on materials.

Ozone is produced in-situ and on demand only and utilizes oxygen as its only raw material. After use it quickly and naturally decomposes into oxygen, leaving no chemical by-products. Ozone cannot and should not be stored which significantly reduces storage needs at the brewery/distillery.

Ozone applications in breweries and beverage production

Ozone disinfection of fermentation and layering (maturation) tanks

Ozone technology can be used in-lieu of disinfection chemicals and integrated into a current Clean-in-Place (CIP) system for [sanitation of all brewery process equipment](#). Fermentation and lager tanks cleaning and sanitation cycles can be shortened by up to 30 minutes per CIP. Ozone is a perfect replacement of hot water disinfection which avoids frequent heat expansion of pipes, joints and tank material. Using ozone as a part of CIP of such process equipment also sanitizes pipes effectively. Since no by-products are left in the system, final rinse can be avoided, saving water and time.

Filling machines

All components of the filling line can be disinfected with ozone as a part of the CIP cycle. In addition, it can be used for [bottle rinsing](#), especially applicable in mineral water or cider production where bottle rinsing is crucial. Hot water, which is especially common for filling machine sanitation, can be replaced with cold ozone, saving time and energy.

Keg sanitation

Ozonated water is also suitable for keg filling machines and its CIP system. Ozone replaced steam and hot water in these applications, making it an economically viable application.

Aroma compounds removal

For breweries/distilleries that produce successive batches of various types of beverages - mixed batches of beer, spirits, wine, cider or flavoured mineral water - aroma cross-contamination may occur. The effective oxidizing characteristics of ozone present a novel way of removing aroma compounds which may otherwise contaminate finished

Open surface ozone sanitation

Ozonated water is an effective surface sanitizer (also known as COP, clean out of place), which means it can be used for conveyor belts (for example in the filling line) and floor areas in the brewery/distillery.

Pectinatus* and *Megasphaera

In recent years, anaerobic bacteria such as various strains of *Pectinatus* and *Megasphaera* have emerged as a serious issue in brewery/distillery operations and are often found in lagering and fermentation tanks and the filling machine. The superior disinfection capacity, as a strong oxidizing agent, of ozone offers elevated peace of mind pertaining to this emerging problem.

Supply water quality assurance

Sanitized and clean supply water for industrial use is an issue in food and beverage production in many parts of the world. Ozone is a cost-effective method to sanitize the supply water used for brewing/distillery, sanitation of process equipment and plant wide rinsing. Not only does ozone offer the most effective sanitation, it also removes BOD and COD. In addition, it provides ultra-clear water by removing particles and discolorations. Ozone leaves no by-products or taste. It is a perfect alternative to chlorine dioxide sanitation, which is commonly used in large breweries.

Cleaning and sanitation - ozone versus chemicals

It is imperative to clean the brewing/distiller equipment, such as piping, fermenters and cooling tanks, from residues left by the organic compounds from the fermentation process. In addition to unwanted particles and compounds that adhere to the inside surface of the equipment, such leftovers enable a proliferation of microorganisms, creating biofilms. This will inevitably affect the quality of the end product. The table below shows a number of cleaners and sanitizers used to clean brewing equipment today.

Compound	Application	Challenge
Acetic Acid (cleaner)	Very effective copper cleaner	Rinse water should be applied to avoid oxide deposits which may promote bacterial growth
Hypochlorite (sanitizer)	<p>Effective at breaking up organic compounds</p> <p>Low cost sanitizer</p> <p>Sanitation effect favoured by elevated temperatures</p>	<p>Corrosion may occur, even for stainless steel vessels (SS304 and SS316), especially with hot water</p> <p>Copper vessels are easily oxidized, leaving copper in the beer/spirits/wines</p> <p>May affect the taste of the following brew unless boiled water is used for rinsing</p> <p>If system is not cleaned properly, it will lose its sanitizing ability</p>
Ozone (sanitizer)	<p>Can be applied cold, thus reducing energy costs</p> <p>Leaves no harmful by-products</p> <p>Produced on-site (in-situ) which eliminates chemical handling</p> <p>Negligible consumables (power) cost</p> <p>Gentle on materials</p>	<p>Mechanical installation</p> <p>Should not be mixed with other organic chemicals in order to achieve maximum effects</p>

No rinsing required

Sodium/Potassium Hydroxide, Caustic (cleaner)	Very effective detergent and removes organic residues Removes scorched surfaces	Extreme handling caution must be taken to avoid skin and eye damage Very corrosive to aluminium and brass
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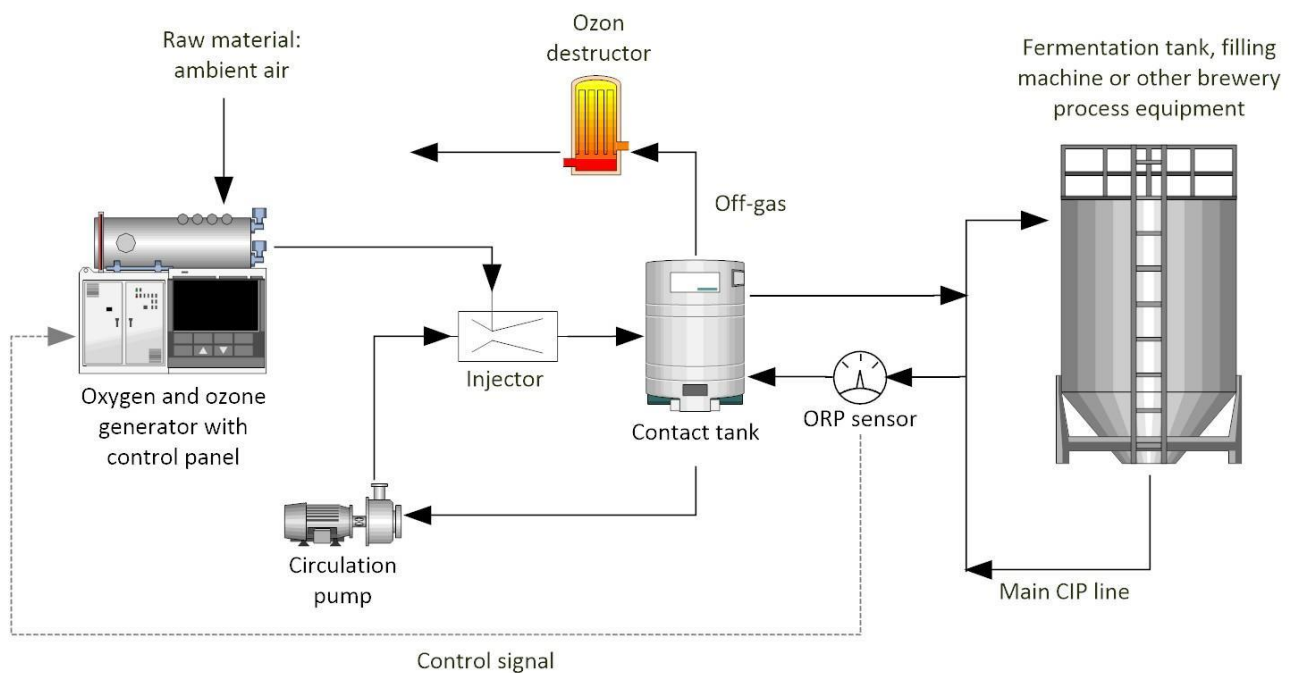
Peracetic Acid, PAA (sanitizer)	Readily available sanitizer agent with minimal by-products Relatively low application temperature	Shelf-life of beer is reduced unless thoroughly rinsed Relatively expensive at required applied concentrations Smell
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Iodophor (sanitizer)	Effective sanitizer Not very common the industry anymore	Handling precautions must be taken due to its skin and eye irritating characteristics Stains upon exposure May affect flavour
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Heat (sanitizer)	Potentially effective but requires a prolonged exposure at high temperature	High operational costs Time consuming due to heat up and cool down periods
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The Ozonotech solution for brewery/distillery sanitation

Ozonotech's Corona Discharge (CD) ozone generators—combined with an oxygen generator—are highly effective and low in power consumption. Ozone is produced in closed system described in the figure below. Any ozone left in the reaction tank off-gas is effectively destroyed, leaving no residual ozone in the work environment. The system has a small footprint and is delivered on a EUR-pallet (120 x 80 cm, 47" x 31").

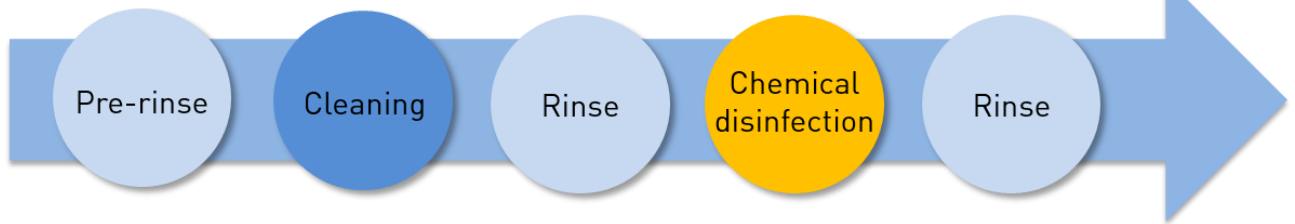


Ozone or ORP (Oxidation-Reduction Potential) sensors are used to monitor the degree of treatment and determine the active ozone concentration during the complete sanitation phase.

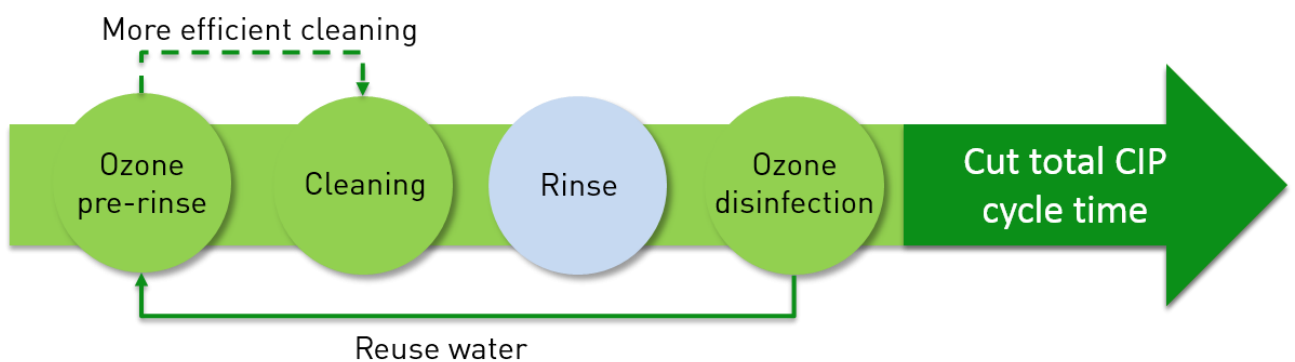
Eliminate sanitation chemicals

Ozone can be used as the sanitation agent to reduce total CIP time, realize water savings and reduce chemical handling and consumption. The figure below conceptualizes the benefits of upgrading your current CIP system with an integrated solution from Ozonotech.

Typical CIP cycle



Ozonetech CIP cycle

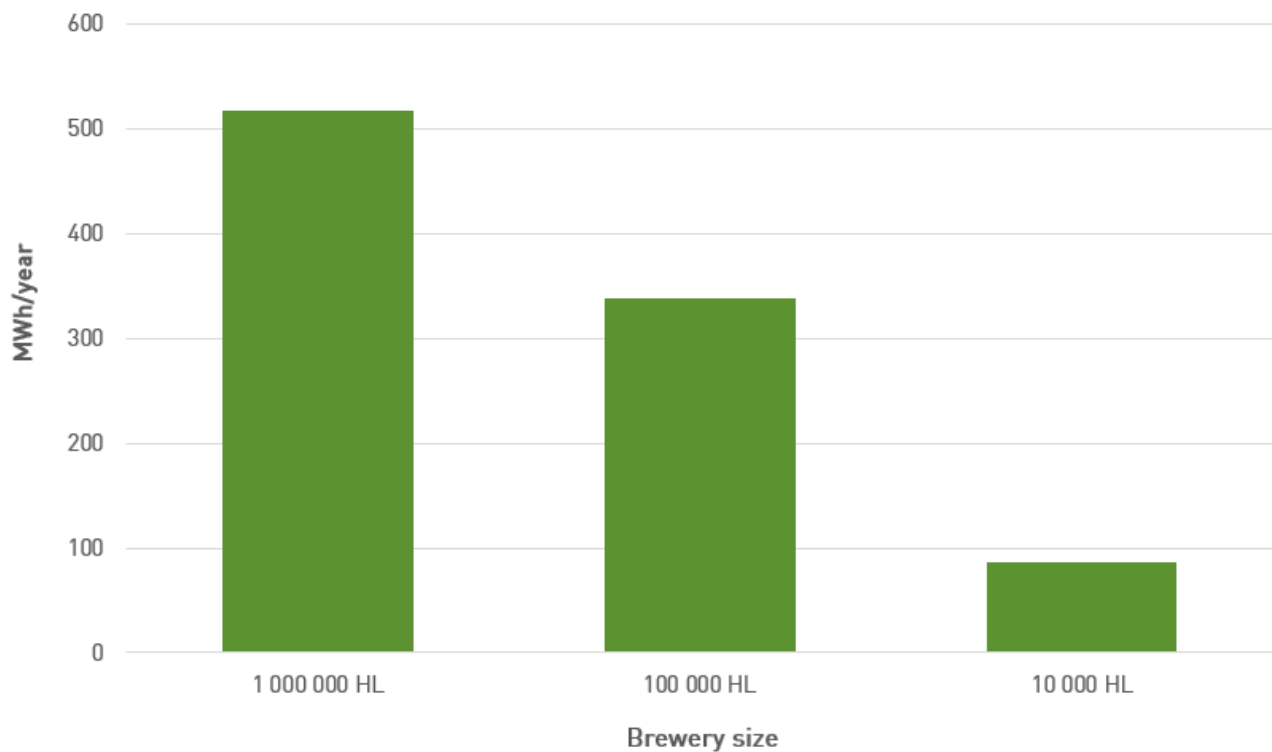


Not only can disinfection chemical use be avoided, by applying ozone in the pre-rinse phase, caustic cleaning can be enhanced which may further reduce chemical consumption.

Replace hot water sanitation with ozone

Many breweries/distilleries apply hot water to sanitize tanks, filling machines and other process equipment. For hygienically designed systems, ozone presents large energy savings opportunities and achieves 3-log reduction of unwanted bacteria in 10-15 minutes.

Potential annual savings with ozone in lieu of hot water sanitation



Estimated annual savings for large scale, middle size and craft breweries/distilleries by replacing hot water sanitation with ozone. Calculations are based on 85 deg C hot water sanitation once per day.

Not only can substantial energy savings be realized, equipment life time and maintenance issues are also improved by avoiding frequent mechanical tensions during heating and cooling between CIP-cycles. Annual operational down time can be avoided by up to 300 hrs which increases production capacity.

