

# WORLD BREWING CONGRESS 2016

## IMPROVING SANITATION EFFICIENCY IN BREWERIES WITH OZONE TECHNOLOGY

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Figure 1. Turn-key ozone system including oxygen and ozone generator, control system and contact tank.

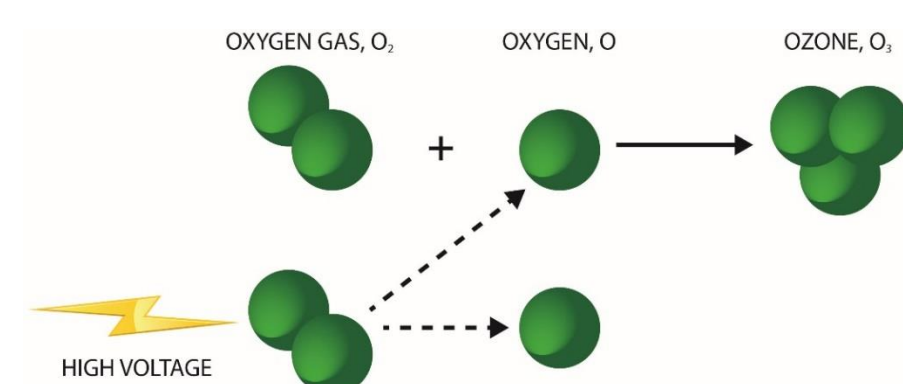


Figure 2. Concepts of in-situ ozone production with Corona Discharge technology.

### WHY OZONE?

Ozone is a proven disinfection agent with multiple advantages compared to traditional disinfection chemicals used in breweries. It enables shorter overall cleaning and sanitation cycles, lower water requirements, no by-products in wastewater. In addition, chemical handling can be eliminated which provides a safer work environment. Ozone can also be used to effectively achieve highest incoming water quality.

Ozone is applied cold, at very low concentration and is very gentle on all materials used in the brewing industry today such as vessels, pipes, valves and seals. This prolongs the overall life time of process equipment.

- Save up to 10% in overall brewery water consumption
- Eliminate all sanitation chemicals
- No chemical handling and storage
- Save power required for hot water if applicable
- No chemical residues
- Reduce overall cleaning and sanitation cycle time
- Quality assurance of process supply water
- An ozone system consumes only 1-2 kW during operation

### HOW IT WORKS

Ozone is produced in-situ in a closed, fully automatic system where the only raw material is readily available oxygen in the ambient air. Ozone is produced in gas phase from at least 93% oxygen gas (produced in the integrated oxygen concentrator) using Corona Discharge technology. See Figures 1 & 2 on the left.

It is then dissolved into water. Residual ozone levels are built up in the integrated contact tank. Typically applied ozone concentrations don't exceed 1 ppm. Ozone is proven to achieve at least 10-20 times lower CT values for microbial inactivation. Ozone naturally breaks down into oxygen.

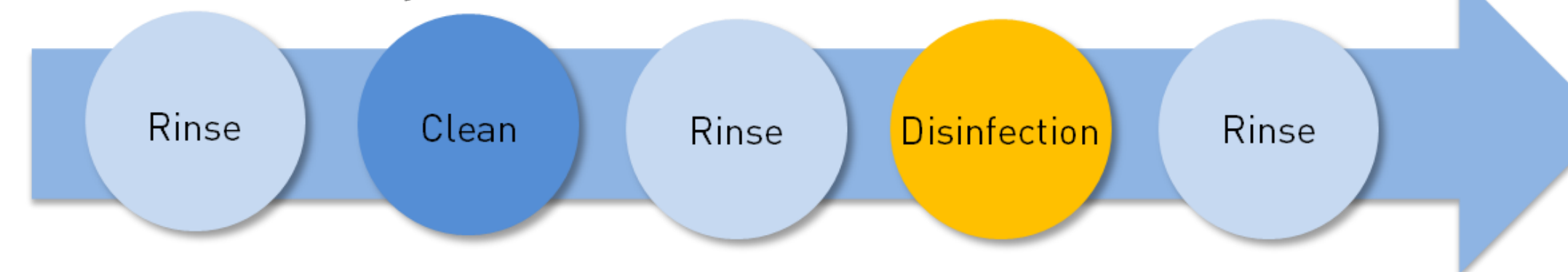
The system can be installed either in-line or using a bypass water stream from an already existing CIP circulation stream, or in the upstream supply water feed.

### APPLICABLE BASE

Major applications for ozone sanitation are summarized below:

- Clean-in-Place systems used both for fermentation tanks and filling machines.
- Effective against *Pectinatus* and *Megasphaera*.
- Bottle rinsing. This ensures efficient sanitation before filling final product.
- Ensure completely sanitized supply of water used for brewing. Ozone application is also an effective way of removing any particles.
- Removal of aroma compounds. For breweries producing beer, flavored bottle water or cider, ozone oxidizes aroma compounds which may cause cross-contamination.

#### Chemical CIP-cycle



#### Ozone CIP-cycle

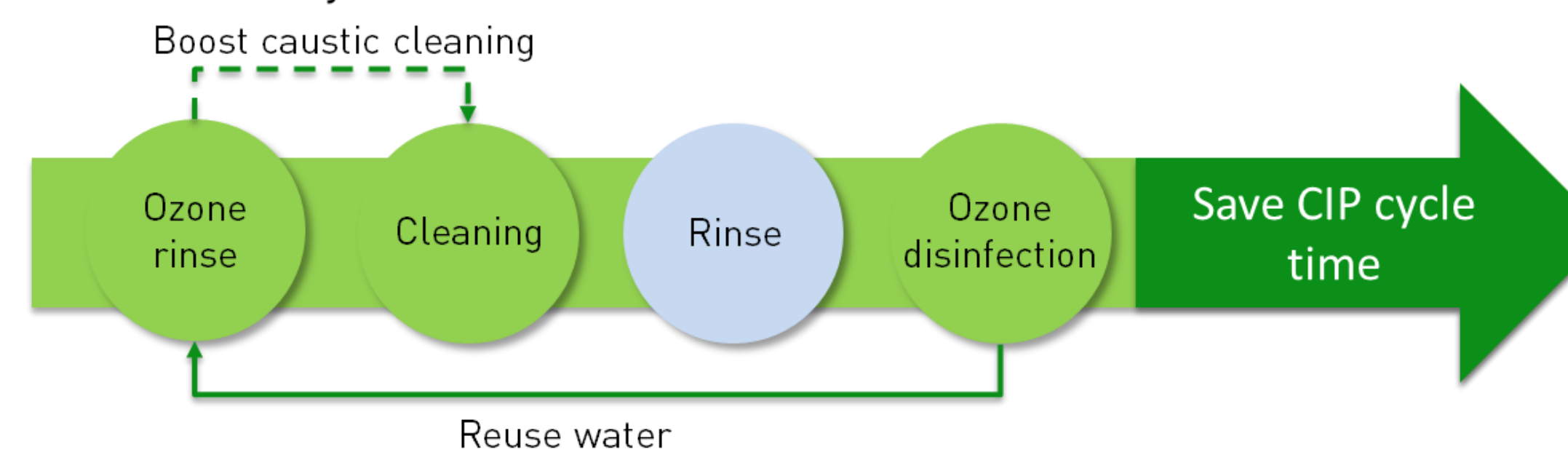
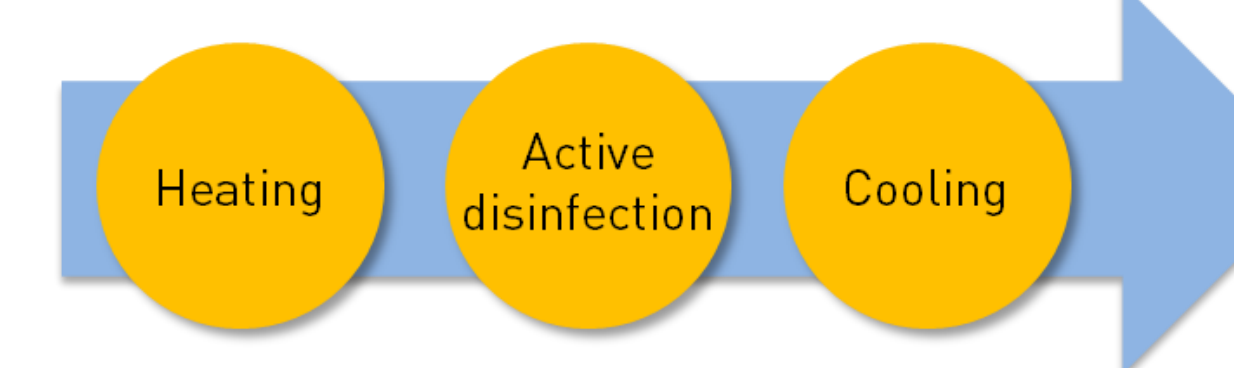


Figure 3. Comparison of chemical based CIP cycle and ozone technology CIP process.

#### Hot water CIP



#### Ozonetech CIP disinfection



Figure 4. Ozone as an alternative to hot water CIP.

### TANGIBLE BENEFITS

In addition to improving the environmental footprint, ozone presents opportunities for brewery operators who want to make cleaning and sanitation operations more effective, pertaining to:

- Shorter CIP cycles. No final rinse. Effective microbial inactivation. **Save 30 minutes in overall CIP cycle time.**
- No handling or storage of chemicals which reduces administration and man-hours.
- Water savings and reuse. **Cut brewery water demand by 10% overall.**
- **Safer work environment.** Ozone is produced on-site on demand in a closed system.
- **Eliminate disinfection chemical costs**
- **Cut energy demand** where hot water disinfection is applied. Up to 200 MWh/year per CIP system in a large brewery. Reduce CIP cycle time by 40 minutes.

The table below shows a brief comparison of ozone to other commonly used sanitation agents.

| Sanitation agent     | Benefits   | Challenge  |
|----------------------|--|--|
| Ozone                | <ul style="list-style-type: none"> <li>• Short sanitation cycle time</li> <li>• No chemical handling or storage</li> <li>• Chemical-free wastewater</li> <li>• Very gentle on all materials</li> </ul> | <ul style="list-style-type: none"> <li>• Mechanical installation</li> </ul>  |
| Hypochlorite         | <ul style="list-style-type: none"> <li>• Requires careful handling</li> <li>• Moderate sanitation efficiency</li> </ul>  | <ul style="list-style-type: none"> <li>• Corrosive, especially at elevated temperatures</li> </ul>                           |
| Peracetic acid (PAA) | <ul style="list-style-type: none"> <li>• Low consumables costs</li> <li>• Small amount of by-products</li> </ul>   | <ul style="list-style-type: none"> <li>• Limited durability</li> </ul>   |
| Hot water            | <ul style="list-style-type: none"> <li>• Effective sanitation</li> </ul>   | <ul style="list-style-type: none"> <li>• Wear on joints and pipes due to heat expansion</li> <li>• Time consuming</li> </ul> |