

Helping Clients Sanitize Organically!

Brewery Ozone Application Recommendations, Benefits, and Savings

Summary of Applications

In general to be effective brewery sanitation protocols should consider the following:

- 1) Beer Contact Surfaces – Any surface, which comes into direct contact with the product (i.e. tanks, bottling lines, bottles, kegs, barrels, transfer lines and hoses, filters, pumps, appurtenances (valves, barrel bungs, fittings, etc.)).
- 2) General Facility Sanitation – All surfaces in the facility, which can harbor microbes (floors, walls, drains, etc.)
- 3) Atmospheric Sanitation – The elimination and control of airborne spoilage organisms, mold spores, odors and fruit flies.

Contact Surface Sanitation

Sanitation of beer contact surfaces utilizing ozonated water and ozone gas (tanks, bottling lines, bottles, kegs, barrels, filters, hoses/transfer lines, valves and pipe fittings, etc.) is very effective in the control of spoilage organisms and their movement in the brewery. McClain protocols for beer contact surface sanitation (both aqueous and gaseous) are well established and continually being updated through existing research and client input.

General Facility Sanitation

The elimination and control of spoilage organisms in the brewery involves not only beer contact surface sanitation but also general brewery sanitation. Floors, walls, drains, etc. can all harbor spoilage organisms allowing for microbe transfer and product contamination or recontamination. General brewery sanitation protocols using ozone are available and are being used extensively not only in breweries but also in wineries and food processing facilities.

Atmospheric Sanitation

Brewery facilities including barrel storage rooms can be effectively treated for mold, mildew, airborne spoilage organisms, fruit flies (spoilage vectors) and odor control using ozone gas. Ozone requirements for room

EPA Establishment # 074150-CA-001

- 1 -



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gassing are based on room volume in ft³. In addition, ozone gas can be effectively used to store empty barrels replacing SO₂. McClain Sanitation Systems are sized based on the room size in cubic feet.

Cost Savings

Potential cost savings from utilizing McClain Sanitation Systems for brewery sanitation include:

- a. Reduced water usage in 1) tank sanitation, 2) bottling line sanitation, 3) barrel sanitation.
- b. Reduces labor costs in 1) tank sanitation, 2) bottling line sanitation, 3) barrel sanitation, and 4) general facility sanitation.
- c. Reduces chemical costs in 1) tank sanitation, 2) barrel storage (SO₂), and 3) general facility sanitation.
- d. Reduced energy costs and maintenance in bottling line sanitation.
- e. Extended barrel life.

Benefits of Ozone Sanitation

Potential benefits include:

- 1) Spoilage organism control.
- 2) Mold and mildew control.
- 3) Enhanced product quality.
- 4) Improved employee safety.

Ozone Sanitation Applications

In order to discuss ozone brewery sanitation applications and methods it is necessary to have a clear picture of what brewery sanitation is intended to accomplish. The purpose of sanitation in breweries is the continual elimination and control of spoilage organisms having an adverse impact on the beer. Sanitation is a continuous process, which is not single faceted, but rather covers all aspects of the brewery operation.

Spoilage organisms are found throughout the brewery and can move by a variety of mechanisms from one part of the brewery to another. Their control requires attention to their location and movement mechanisms. As an example, a good tank sanitation protocol without a good bottling line sanitation protocol will probably not solve the problem. It would be like washing your pants and forgetting about your socks. I often have breweries call and say they wish to purchase an ozone system for their barrels. I then try to explain to them that to be effective barrel sanitation must go hand in hand with total brewery sanitation protocols.

In general to be effective brewery sanitation protocols should consider the following:

EPA Establishment # 074150-CA-001

- 2 -



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- 1) Beer Contact Surfaces – Any surface, which comes into direct contact with the product (i.e. tanks, bottling lines, bottles, kegs, barrels, transfer lines and hoses, filters, pumps, appurtenances (valves, barrel bungs, fittings, etc.)).
- 2) General Facility Sanitation – All surfaces in the facility, which can harbor microbes (floors, walls, drains, etc.)
- 3) Atmospheric Sanitation – The elimination and control of airborne spoilage organisms, mold spores, odors and fruit flies.

The following characteristics of ozone make it an ideal single source sanitizer for these sanitation protocols:

- 1) Effective at killing a broad spectrum of microbes and spoilage organisms.
- 2) Easily used to sanitize a wide variety of locations, applications and processes.
- 3) Environmentally friendly.
- 4) Safe.
- 5) Reduces water usage.
- 6) Energy efficient.
- 7) Have no negative impact on facilities or the final product.

The recommended ozone sanitation applications for breweries, discussed below, encompass the entire sanitation needs of a brewery including the methods, protocols, potential savings and benefits.

Beer Contact Surfaces

Sanitation of beer contact surfaces (tanks, bottling lines, bottles, kegs, filters, hoses/transfer lines, valves and pipe fittings, etc.) is very important in the control of spoilage organisms and their movement in the brewery.

Tank Sanitation

Ozone when utilized with the correct protocols effectively sanitizes both stainless steel and wooden tanks. McClain in cooperation with Diageo has developed a two-step tank cleaning and sanitation protocol utilizing Ozo Kleen Alkaline Tank Cleaner, which is ozone compatible. The Ozo Kleen protocol saves time (labor), water, chemical usage, and improves employed safety. In addition, the use of Ozo Kleen Ozone Compatible Tank Cleaner (high pH) can result in further reduced chemical cost and a more biodegradable wastewater.

The Ozo Kleen Ozone Compatible Tank Cleaner is high pH, biodegradable and compatible with ozone. Cleaner cost is generally less than comparable cleaners on the market. McClain will provide sample cleaner for evaluation against existing product.

The following example based on a Diageo study quantifies the water and labor savings of replacing caustic with Ozo Kleen for cleaning and PAA with ozone for tank sanitation:

Historic Diageo Process Steps (caustic cleaner and PAA for sanitation a 34,000 gallon tank)

EPA Establishment # 074150-CA-001

- 3 -



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- 1) 2 minute burst (pre) rinse.
- 2) 15 minute cleaning cycle with approximately 0.75 to 1 gallon of caustic tank cleaner diluted with 75 gallons of 180 degree water.
- 3) Drain tank of cleaning caustic cleaning solution.
- 4) 3.5 minute cleaner rinse cycle.
- 5) 10 minute set up time for PAA process.
- 6) 15 minute sanitation cycle using PAA diluted with 75 gallons of water.
- 7) 3.5 minute final tank rinse cycle.

TOTAL WATER USAGE = 285 gallons of water (assumes 15 gpm rinse rate)

TOTAL TIME = 50 minutes

Diageo McClain Ozone Process Steps (Ozo Kleen (ozone compatible) Alkaline Tank Cleaner and ozone for sanitizing a 34,000 gallon tank)

- 1) 2 minute burst (pre) rinse.
- 2) 15 minute cleaning cycle with approximately 0.75 to 1 gallon of caustic tank cleaner diluted with 75 gallons of 180° F water.
- 3) Drain tank of Ozo Kleen cleaner solution.
- 4) 4 to 5 minute cleaner rinse cycle utilizing cold ozonated water to remove caustic (pH measurement) and sanitize the tank in one step (Note: CT Values and rinse times for smaller or larger size tanks can be determined by swab test results).

TOTAL WATER USAGE = 172.5 gallons of water (assumes 15 gpm rinse rate)

TOTAL TIME = 21 minutes

Total Saving = Water Savings (112.5 gallons per tank) + Time/Labor Savings (29 minutes per tank + Chemical Cost Savings (chlorine dioxide cost per tank) + Improved Employee Safety

The following is an estimated savings for 100 sanitations per year.

Water Savings = 100 Tanks/year x 112.5 gallons = 11,250 of water and 11,250 gallons of wastewater treatment per month x 12 months = 11,250 gallons of water and wastewater per year.

Labor Savings = 100 tanks/year x 0.5 hours = 50 hours x \$25.00 per hour (estimated hourly salary + benefits) = \$1250.00 per year.

Chemical Saving = 100 tanks/year x PAA cost per tank (unknown) = \$\$\$ per month.

Improve Employee Safety – Invaluable.

Bottling and Can Line Sanitation

EPA Establishment # 074150-CA-001

- 4 -



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Bottling and can line sanitation with ozone is quick and effective. In addition, the use of ozone results in huge energy (BTU) and/or chemical savings and reduced bottling line maintenance. Sanitation can be performed utilizing recirculated ozonated water eliminating sanitation water usage.

Breweries and wineries have been using ozone as a bottling and can line sanitation for over 18 years eliminating **hot water/steam/chemicals resulting in significant savings on sanitation costs** and reduced bottling line maintenance. Protocols for bottling and can line sanitation are well developed and available through McClain.

Bottle, Can and Keg Sanitation

Bottle, can and keg sanitation with ozonated water is easy, fast and effective. McClain has numerous clients using aqueous ozone for these applications. Lake Louie Brewery in Wisconsin has been doing bottle and keg sanitation for almost ten years. Another brewery, Speakeasy in San Francisco, has been sanitizing bottles on their bottling line and kegs on their keg line for over four years. Southern Tier uses ozone to sanitize both cans and bottles. Sanitation system options for this application are available on both McClain Sanitation Systems and protocols are available through McClain.

Barrel Sanitation and Storage

Barrel Sanitation

Ozone when utilized with the correct protocols effectively eliminates Brettanomyces and other spoilage organisms from barrels and wooden tanks. There is extensive empirical evidence (100's of wineries utilizing ozone successfully) as well as university and barrel manufacturer studies which confirm that ozone kills Brettanomyces, Acetobacter and other spoilage organisms in barrels. The kill mechanism is twofold. Ozone gas will penetrate oak pores the same as oxygen. Spoilage organisms in barrels and wooden tanks are aerobic and need oxygen. Since ozone will go anywhere oxygen goes, if you are a spoilage organism and you bump into an ozone molecule your outer membrane is burned and ruptured (this microbe kill mechanism of ozone is called cell lyses). Ozone works in the barrel two ways 1) surface sanitation with aqueous ozone and 2) penetration of the pores with gaseous ozone.

Ozone is not only a good sanitizer but it does not have an adverse impact to barrel flavors. This results in extended barrel life as a flavor element in beer making. A side benefit for brewers making specialty beers is that ozone barrel sanitation can effectively bring the barrel back to neutral. This results in improved product consistency since past products do not impact new products fermented in barrels.

One of the unique attributes of ozone is its ability to deodorize. In barrels it not only sanitizes the barrel but also oxidizes away the metabolic byproducts created by spoilage organisms deodorizing the barrel so that it smells like a new fresh barrel (something you would like to put your beer in).

Time, water usage and safety are three variables to be considered when using ozone for barrel sanitation. The amount of time and water utilized in barrel sanitation is dependent on the concentration of ozone in

EPA Establishment # 074150-CA-001

- 5 -



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the rinse water (CT = Ozone Concentration (ppm) x Time (minutes)). McClain Sanitation Systems provide the highest ozone concentration available in the marketplace reducing both water usage and time.

The McClain Barrel Maintenance System introduced in 2011 (see testimonial below) incorporates an Ozone Sanitation System, Ozone Compatible Pressure Washer and a GamaJet Barrel Blaster to provide one step cleaning and sanitation of barrels.

The advantages of the system include:

- 1) Reduction of water usage (approximately 50%).
- 2) Elimination of cost of heat (hot water/steam) and its negative impact on barrel flavors.
- 3) Extended usable barrel life and flavors.
- 4) Reduction of time and labor used for the barrel treatment process (approximately 50%).

In addition, since the system is componentized the ozone sanitation system and pressure washer can be utilized as multifunctional tools individually throughout the brewery for additional cleaning and sanitation activities.

Testimonial: "I recently replaced my old ozone system and barrel washer system with a new McClain Destroyer mated to an ozone compatible pressure washer and a GamaJet Barrel Blaster. My barrels have never been cleaner. All the tartrates and lees are easily and quickly removed from my barrels after only a few minutes of washing time. We use cold water, and less of it. My water usage is down by at least 50%. Since the ozone machine is separate from the pressure washer, I still have the option to use hot water to clean barrels, but I seldom see the need. In addition, since my ozone machine has the option to generate O3 gas, I can use it to preserve and protect empty barrels."

Cheers,

Craig Jaffurs

Owner/winemaker

Jaffurs Wine Cellars

819 E. Montecito St.

Santa Barbara, CA 93103

Barrel Storage

Protocols for using ozone gas for barrel storage replacing sulfur dioxide (SO₂) are well established and available. **Barrel storage with ozone results in chemical savings, improved product quality, improved employee safety and does not require employee pesticide certification.** Ozone and Oxygen Gas Options are available on all McClain systems.

Other Beer Contact Surfaces

Sanitation of other beer contact surfaces (hoses/transfer lines, valves and pipe fittings, filters, barrel bungs, etc.) is very important in the control of spoilage organisms and their movement in the brewery.

EPA Establishment # 074150-CA-001

- 6 -



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Protocols for the effective use of ozonated water to quickly sanitize all other beer contact surfaces in the brewery to control and prevent spoilage organism transfer are available through McClain.

General Brewery Sanitation

The elimination and control of spoilage organisms in the brewery involves not only beer contact surface sanitation but also general brewery sanitation. Floors, walls, drains, etc. can all harbor spoilage organisms allowing for microbe transfer and product contamination or recontamination.

The use of cold aqueous ozone for general sanitation is not only easy, safe and effective but also can be done quickly with no impact to surfaces. Floors, walls, drains and other surfaces (plastic, floor coatings, etc.) are quickly sanitized (7 to 10 second contact time) leaving no chemical residuals or increased humidity in the facility. An additional benefit to regular treatment of facility floors is control of mold and slime safety hazards (elimination of slipping hazards).

General brewery sanitation protocols using ozone are available and are being used not only in breweries but also in wineries and in food processing facilities.

Atmospheric Sanitation

Airborne spoilage organisms, mold and mildew, odors and fruit flies play a large role in brewery sanitation and product quality. Airborne organisms including mold and spoilage organisms are prevalent in breweries. Eliminating these microbes from beer contact and non-contact surfaces without eliminating them in the atmosphere has little effect and results in recontamination. In addition, beer easily absorbs background odors within the brewery, which can result in reduction of product quality.

The addition of the ozone gas allows the brewer many more sanitation options. Facility gassing, which began in the cork industry, is now being used as a standard operating procedure in breweries. Ozone gassing is extremely affective at both killing existing mold and prohibiting new mold growth in and atmosphere and on facility surfaces.

The elimination of airborne spoilage organisms on a regular basis reduces recontamination and ultimately improving product quality. Removal of microbes and their metabolic by product odors and keeping the facility smelling fresh not only is aesthetically desirable but is also a contributor to better product quality. An additional benefit of gassing is the control of fruit flies. Many breweries utilize both aqueous ozone surface and drain sanitation combined with gassing to control fruit flies. Not only are fruit flies a nuisance they are also vectors of spoilage organisms within the brewery.

Advantages of Facility Treatment with Ozone Gas

- 1) Ozone is organic and leaves no chemical residuals or by products.
- 2) Ozone is effective at killing and controlling mold, mildew, spoilage organisms, and fruit flies.
- 3) Unlike pass through air sanitizing systems ozone is effective at deodorizing the facility.

EPA Establishment # 074150-CA-001

- 7 -



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- 4) Unlike pass through air sanitizing systems ozone gas sanitizes the atmosphere and all contact surfaces throughout the facility.
- 5) In short, ozone gassing controls spoilage organisms, mold, mildew, odors and fruit flies resulting in product improvement.

Facility Recommendations

Initial Facility Treatment for Mold and Mildew Control

- 1) Pressure wash facility to clean surfaces.
- 2) Remove mold stains (if desired) utilizing hydrogen peroxide as the bleaching agent.
- 2) Perform surface sanitation with ozonated water (protocols available).
- 3) Gas the facility to provide an initial kill of mold, mildew and airborne spoilage organisms.

Regularly Scheduled Treatment for Continued Control of Mold, Mildew, Airborne Spoilage Organisms

- 1) Perform regularly scheduled surface sanitation using ozonated water.
- 2) Develop gassing protocols for facility areas (protocol development procedures provided by McClain)
- 3) Gas facility areas on a regularly scheduled basis to kill mold and spores preventing regrowth. Regular gassing will also help control fruit flies, airborne spoilage organisms and provide facility deodorization.

EPA Establishment # 074150-CA-001

- 8 -



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