

*Helping Clients Sanitize Organically!*

## Winery Ozone Applications Recommendations, Benefits, and Savings

### Summary of Applications

- 1) Barrel Sanitation Program. Ozone when utilized with the correct protocols effectively eliminates Brettanomyces and other spoilage organisms from barrels. The size of McClain Sanitation System required depends on 1) the number of barrels to be sanitized at a time (water flow rate) and 2) the required sanitation time in minutes. The Destroyer 3, 6 or 12 are recommended for single barrel sanitation while the Destroyer 24 and Bugbuster 24 are recommended for single and double barrel sanitation. The Bugbuster 36, 48 and 60 are recommended for up to 6 barrels. Barrel sanitation time (labor) and water usage decreases with system size with the Bugbuster 60 requiring the least amount of time and water.

The implementation of the McClain Barrel Maintenance System will provide additional water and time savings (approximately 50%).

- 2) Facility Gassing. Winery 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. In addition, the use of ozone gas in the barrel storage room allows barrel room humidity levels to be increased (without resulting mold growth) reducing topping losses and improving profits. McClain Sanitation Systems are sized based on the room size in cubic feet.
- 3) Barrel Storage. Protocols for using ozone gas for barrel storage replacing sulfur dioxide (SO<sub>2</sub>) 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.
- 4) Additional ozone sanitation activities recommended to provide complete facility sanitation, water savings and spoilage organism control are as follows:
  - a. Wine contact surfaces sanitation (tanks, hoses, transfer lines, barrels, pumps, barrel bungs, valves, etc.).
  - b. General facility sanitation.
  - c. Atmospheric sanitation.

Application protocols for utilizing McClain systems are available.

- 5) Potential cost savings from utilizing McClain Sanitation Systems for winery sanitation include:

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- a. Reduced water usage in 1) barrel sanitation, 2) tank sanitation, 3) bottling line 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 (SO<sub>2</sub>), and 3) general facility sanitation.
  - d. Reduced energy costs and maintenance in bottling line sanitation.
  - e. Extended barrel life.
- 6) Potential benefits include 1) mold and mildew control, 2) spoilage organism control, 3) improved product quality and 4) improved employee safety.

### **Ozone Sanitation Applications**

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

Spoilage organisms are found throughout the winery and can move by a variety of mechanisms from one part of the winery to another. Their control requires attention to their location and movement mechanisms. As an example, a good barrel sanitation protocol without a tank and 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 wineries 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 winery sanitation protocols.

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

- 1) Wine Contact Surfaces – Any surface which comes into direct contact with the product (i.e. barrels, tanks, bottling lines, transfer lines and hoses, pumps, 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.

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7) Have no negative impact on facilities or the final product.

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

### **Barrel Sanitation Program**

Ozone when utilized with the correct protocols effectively eliminates Brettanomyces and other spoilage organisms from barrels. 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 wine making. A side benefit on good barrel sanitation is that even older barrels can be used as neutral vessels and/or flavor added through oak chips/slats.

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 wine 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 the rinse water ( $CT = \text{Ozone Concentration (ppm)} \times \text{Time (minutes)}$ ). 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 winery for additional cleaning and sanitation activities.

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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 (SO<sub>2</sub>) 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 including the Bugbuster 60.

### **Overview of Facility and Barrel Room Treatment Using Ozone and Recommendations:**

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

The addition of the ozone gas allows the winemaker and/or cellar manager many more sanitation options. Facility gassing, which began in the cork industry, is now being used as a standard operating procedure in wineries. Ozone gassing is extremely affective at both killing existing mold and prohibiting new mold growth in and atmosphere and on facility surfaces. The ability to control mold (and its background odors and health hazards) has allowed many wineries to hold barrel room humidity much higher reducing toping losses (which is money in the pocket).

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 cellar gassing is the control of fruit flies. Many wineries utilize both aqueous ozone surface and drain sanitation combined with cellar gassing to control fruit flies both during and after crush. Not only are fruit flies a nuisance they are also vectors of spoilage organisms within the winery.

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## **Advantages of Facility Treatment with Ozone**

- 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.
- 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.

## **McClain Ozone System Requirements**

McClain Sanitation Systems are sized based on the room size in cubic feet as follows.

Destroyer 6 – up to 42,000 cubic feet

Destroyer 12 – up to 84,000 cubic feet

Destroyer and Bugbuster 24 – up to 168,000 cubic feet

Bugbuster 36 – up to 252,000 cubic feet

Bugbuster 48 – up to 336,000 cubic feet

Bugbuster 60 – up to 420,000 cubic feet

## **Wine Contact Surfaces**

Sanitation of wine contact surfaces (barrels, tanks, bottling lines, filters, hoses/transfer lines, valves and pipe fittings, etc.) is very important in the control of spoilage organisms and their movement in the winery. The barrel sanitation program has been discussed above. Other contact surfaces are discussed below.

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## **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 which saves time (labor), water, chemical usage, and improves employed safety. In addition, the use of McClain Ozone Compatible Tank Cleaner (high pH) can result in further reduced chemical cost and a more biodegradable wastewater.

McClain Ozone Compatible Tank Cleaner Test – McClain cleaners are 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 PAA with ozone as a tank sanitizer:

### **Historic Diageo Process Steps (caustic cleaner and PAA for sanitation 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 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 (OzoKleen (ozone compatible) alkaline 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 degree water.
- 3) Drain tank of cleaning caustic cleaning solution.
- 4) 4 to 5 minute caustic 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**

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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 Line Sanitation**

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

As an example, Domaine Chandon has been using ozone as a bottling line sanitizer on all their bottling lines for over 15 years eliminating **hot water/steam usage resulting in significant savings on sanitation costs (BTU's)** and reduced bottling line maintenance. Another winery with long term use of ozone on bottling lines with similar results is Robert Mondavi.

### **Other Wine Contact Surfaces**

Sanitation of other wine 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 winery. Protocols for the effective use of ozonated water (Bugbuster 60) to quickly sanitize all other wine contact surfaces to control and prevent spoilage organism transfer in the winery are available through McClain.

### **General Winery Sanitation**

The elimination and control of spoilage organisms in the winery involves not only wine contact surface sanitation but also general winery sanitation. Floors, walls, drains, picking bins, presses, 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).

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

**Atmospheric Sanitation Advantages**

Atmospheric sanitation of facilities and barrel storage rooms with ozone gas controls mold and mildew, airborne spoilage organisms, fruit flies (spoilage vectors) and deodorizes the room. Ozone gas is effective at reaching all areas of the barrel room and facility (surfaces and air) destroying microbes on contact.

The use of ozone gassing in the barrel room allows barrel room humidity levels to be increased without resulting mold growth. As can be seen in the table below increasing barrel room humidity level reduces wine topping losses improving profits.

An example of product savings based on 500 barrels is as follows:

Product loss with 500 Barrels stored at 18°C in a relative humidity of 65%  
 500 x 52 gallons/barrel x 4.86% Loss per year = 1,263.6 gallons of product loss per year

Product loss with 500 barrels stored at 18°C in a relative humidity of 85%  
 500 x 52 gallons/barrel x 2.32% loss per year = 603.2 gallons of product loss per year

Total Savings = 660.4 gallons of product annually x 5 bottles/gallon x \$30.00 value per bottle = \$99,060.00

Estimation of Evaporative Loss From Barrels (% per Year)							
Temperature		Relative Humidity					
°C	°F	65	70	75	80	85	90
10.00	50.00	2.90	2.52	2.15	1.77	1.39	1.01
11.00	51.80	3.10	2.70	2.29	1.89	1.48	1.08
12.00	53.60	3.31	2.88	2.45	2.02	1.58	1.15
13.00	55.40	3.53	3.07	2.61	2.15	1.69	1.23
14.00	57.20	3.77	3.28	2.79	2.29	1.80	1.31
15.00	59.00	4.02	3.50	2.97	2.44	1.92	1.39
16.00	60.80	4.28	3.72	3.18	2.60	2.04	1.48
17.00	62.60	4.56	3.97	3.37	2.77	2.18	1.58
18.00	64.40	4.86	4.22	3.59	2.95	2.32	1.68
19.00	66.20	5.17	4.43	3.82	3.14	2.40	1.79
20.00	68.00	5.50	4.78	4.06	3.34	2.52	1.90

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