Ozone vs. Steam as a Winery Sanitizer

In this series Newsletter I am going to talk about steam and ozone as winery sanitizers. I am going to approach the comparison utilizing both studies and empirical evidence.

Purpose of Winery Sanitation

In order to discuss winery sanitation 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.

The ideal winery sanitizer might have the following characteristics:

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) Energy efficient.
6) Have no negative impact on facilities or the final product.

So as I discuss ozone and steam and their sanitation applications in wineries one needs to keep in mind the entire sanitation needs of a winery including the methods and protocols needed.

Ozone, Steam and Barrels

Barrel sanitation has been a long term concern of wineries. Many methods have been attempted to eliminate spoilage organisms from both new and old barrels. Halogenated chemicals (chlorine, iodine, etc.) and heat both have been shown to impact barrel flavors and the efficacy of heat at barrel sanitation has not been shown historically.

I was in the grocery store the other day and ran into one of my first clients from 20 years ago and our discussion turned to steam being promoted again as a barrel sanitizer. His response was simple. “We had steam in Napa Valley wineries 20 years ago and we were using steam on barrels 20 years ago and we still had Brett. When we got ozone we eliminated the Brett.”

Effective barrel sanitation should provide for the following:

1) Elimination of problem microbes from the barrel.
2) No detrimental impact on barrel integrity or oak volatiles (flavors).
3) Deodorize and remove barrel off odors (provide a clean fresh barrel for the product to enter).

Barrel Treatment with Steam

As discussed above, there is little historic empirical evidence that steam is effective in barrel sanitation. Many wineries in Napa Valley, prior to ozone, were searching for ways to eliminate Brettanomyces. Approaches included treating barrels with ProxyClean, steam, and hot water with little success. Although one recent study seems to indicate that barrel steaming may be effective at microbe control it would seem to conflict with the historic empirical data leaving the jury still out.

Although the effectiveness of steam at sanitizing barrels is still being debated, there is certainly evidence on the adverse effect heat has on barrel flavors. Both steam and hot water have a detrimental effect on barrel flavors reducing the effective life of the barrel as a flavor element in wine making.

In addition, steam is not a deodorizer and does not have the ability to remove barrel off orders. Even if we assume steam could sanitize barrels, which is still in question, steam is not a deodorizer so a Brettanomyces or Acetobacter positive barrel steamed will smell like a hot contaminated barrel (which is not what most people would like to put their wine into).

Barrel Treatment with Ozone

In the early 1990's John McClain introduced ozone into the wine industry. Ozone when utilized with the correct protocols was found to work effectively to eliminate Brettanomyces and other spoilage organisms from barrels. Since that time 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).

Ozone, Steam and Wine Contact Surfaces

Sanitation of wine contact surfaces (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.

Steam and/or hot water (heat) applied properly is an effective surface sanitizer. The use of heat to sanitize all wine contact surfaces, however, is problematic. Steaming all tank surfaces, for example, is extremely difficult and dangerous. In addition the use of steam/hot water on bottling lines is expensive and increases bottling line maintenance (due to expansion and contraction of metal components). Filter, hose, transfer line, pump, valve and fitting sanitation with steam is not only difficult, time consuming and dangerous but also can have adverse effects on materials. In short, the use of steam or hot water to control microbes on all wine contact surfaces is not practical.

The use of cold aqueous ozone to sanitize wine contact surfaces is efficacious, safe, cost effective and easy to do. In addition, McClain's established winery sanitation protocols (including water saving protocols) allow the wine maker or cellar manager to accomplish complete facility sanitation using a single source, organic sanitizer. Tank sanitation is quickly and easily done using aqueous ozone. As an example a 10,000 gallon tank is sanitized in 1.5 minutes with no rinse required before refill. In addition, protocols allow for the same sanitation water to be used in the sanitation of several tanks saving a great deal of water.

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. Protocols for the effective use of ozone to quickly sanitize hoses, transfer lines, pumps and fittings to prevent spoilage organism transfer in the winery are also available.

Ozone, Steam and 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 steam and/or hot water for general winery sanitation presents many problems. Steaming all surfaces in the winery is difficult to do safely and many times not possible to do at all. Steaming is hard on many surfaces (plastic, floor coatings, etc.) resulting in increased maintenance and reduced life span of facility components. In addition, steaming produces a large amount of moisture and condensation within the winery which encourages mold and airborne microbes resulting in more detriment than good.

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. 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.

Ozone, Steam for Atmospheric Sanitation and Deodorization

Airborne spoilage organisms, mold, 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 use of steam to sanitize the atmosphere removing airborne spoilage organisms and mold would require steaming the entire facility which is neither safe nor practical. In addition, steam is not a deodorizer and steaming the room or building will not eliminate odors (although it may result in more odors).

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. 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 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.

The use of ozone gas to store barrels (replacing SO_2) is now widely used in the wine industry. Many wineries have now found that they not only remove SO_2 (a toxic and hazardous material) but also find better product quality in ozone stored barrels (improvement in fruit and barrel flavors and reduction in sulfur complexes).

Conclusion

Although steam and/or hot water (heat) have uses as sanitizers in the winery, they cannot do many sanitation applications effectively and are certainly not a single source sanitizer for wineries. I know of no winery using steam as a single source winery sanitizer. It's pretty tough to steam your entire winery!

Ozone is an effective single source organic sanitizer for wineries. Protocols for all winery sanitation applications are available and ozone is being utilized by hundreds of wineries to effectively control spoilage organisms and improve product quality.

In short, steam is limited in its winery sanitation applications and is not a single source winery sanitizer. Aqueous ozone, on the other hand, can be utilized to sanitize the entire winery including barrels, wine contact surfaces, and general facility sanitation. The addition of gaseous ozone for atmospheric sanitation and deodorization make ozone a single source complete winery sanitizer.