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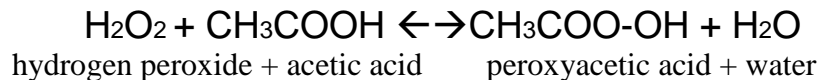
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## **ADVANTAGES OF USING PEROXYACETIC ACID (PAA) IN WINERY SANITATION OPERATIONS**

### **INTRODUCTION**

PAA is a stabilized equilibrium solution that is EPA approved for numerous uses, including circulation cleaning and industrial sanitizing of equipment such as tanks, pipelines, evaporators, fillers, pasteurizers, aseptic equipment, and for sanitizing previously cleaned food contact surfaces of equipment. PAA is an equilibrium mixture of acetic acid and hydrogen peroxide. Although the PAA is the true active ingredient, the hydrogen peroxide fraction aids in stabilizing the PAA and contributes additional oxidation capacity to the over-all formulation.



### **1) REDUCTION IN TRICHLOROANISOLE (TCA) FORMATION**

TCA imparts a “musty” flavor and odor to wine and is detectable by wine drinkers at concentrations as low as 5 – 10 parts per trillion (ppt). TCA is formed by the o-methylation of 2,4,6 – trichlorophenol by molds. Trichlorophenol may be formed by the reaction of chlorine with phenols in wood and wood products. Chlorine based products such as Sani-Bac and chlorinated TSP (trisodium phosphate) are routinely used as disinfectants in wineries. The molds are originally present in cork bark or cooperage or can infect cork / wood in wine cellars.

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## **2) PAA IS A MORE EFFECTIVE SANITIZER THAN CHLORINE BASED PRODUCTS SUCH AS SANI-BAC OR CHLORINATED TSP**

PAA is a powerful oxidizing agent with an oxidation capacity higher than sodium hypochlorite and chlorine dioxide, and is comparable to the oxidative capacity of ozone. PAA at 75 mg / L is reported to successfully kill 100% of a  $10^7$  cell / ml yeast or bacterial population in 30 seconds.

The mode of action of PAA is the aggressive oxidation of lipids, ionic protein bonds, sulfhydryl groups, disruption of cysteine disulfide bonds that are pertinent to secondary and tertiary structures of proteins, and a disruption of chemiosmotic gradient balances used to drive membrane transport and ATP production. Some of the major classes of proteins containing disulfide-rich structures are upstream signaling molecules and lipases responsible for maintaining cellular / environmental response.

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**Oxidation Capacity of Various Oxidizers**

<b>Oxidizer</b>	<b>eV*</b>
Ozone	2.07
Peracetic Acid	1.81
Chlorine Dioxide	1.57
Sodium Hypochlorite	1.36
Hydrogen Peroxide	1.33 (pH 7)
* electron volts	

**3) MAJOR COMPANIES ARE USING PAA FOR SANITATION**

Companies such as Monterey Wine Company, Gallo, Sutter Home, Blossom Hill and Coca Cola currently use PAA for various sanitation procedures.

**4) PAA REDUCES SALT LOADING AND WATER USE**

PAA degrades to acetic acid and water (ultimate biodegradation to oxygen, water and carbon. PAA does not contribute to wastewater TDS or total salt levels. PAA could be used as a substitute for any chlorinated sanitizer, and would eliminate the need to use citric acid for neutralization. One major winery achieved an 89% reduction in salt loading when Sani-Bac was replaced with PAA and the citric acid rinse was eliminated. Eliminating the citric acid rinse saved hundreds of thousands of gallons of water annually.

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### **5) PAA ADDS NO ACETIC ACID TO WINES**

Several major wineries collected samples of a variety of wines before and after it was moved into tanks freshly sterilized with PAA. Acetic acid concentration was determined in the wines before they were moved into the sterilized tanks and after they were in the tanks sterilized with PAA. After laboratory analysis, there was no measurable acetic acid or volatile acidity increase in the wines.

### **FACTS ABOUT THE USE OF PAA FOR SANITATION**

1. Broad spectrum efficacy against gram-negative and gram-positive bacteria, fungi, spores, and slime.
2. Proven efficacy against Escherichia coli 0157:H7, Listeria, Salmonella, Pseudomonas, and other organisms.
3. Effective over wide temperature range, down to 34°F.
4. Effective up to pH 8.5.
5. Low surface tension.
6. Innocuous decomposition products: H<sub>2</sub>O, Oxygen, Acetic Acid, water.
7. No corrosiveness to stainless steel at normal dilutions.
8. More effective than chlorine or quaternary amines for sanitizing contact surfaces.
9. Tolerant to high pH residual rinse water remaining from cleaning solutions.

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10. Very low foaming, high surface contact.
11. No rinse required at levels up to 500 ppm for equipment sanitation, saves time and water.
12. Certified and approved by the National Organic Standards Board (USDA) for use in organic processing facilities (food contact and equipment sanitation).
13. There are no known hazardous or toxic by-products associated with its use.
14. Extremely high LD50 rates: 1540 mg/kg (rat), and 1410 mg/kg (rabbit).
15. Virtually no odor at end-use concentrations.

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**FUNGICIDAL EFFICACY OF PAA IN  
pH 8 SYNTHETIC HARD WATER AT 400C**

Microorganism	Peracetic Acid ppm <u>active</u>	Microorganism Level, cfu/ml		
		1 hour	3 hours	6 hours
<i>Candida albicans</i>	0	6.6 x 10 <sup>4</sup>	4.2 x 10 <sup>4</sup>	4.2 x 10 <sup>4</sup>
	3	1.5 x 10 <sup>3</sup>	7.1 x 10 <sup>2</sup>	<10
	5	2.9 x 10 <sup>2</sup>	<10	<10
<i>Aspergillus niger</i>	0	7.0 x 10 <sup>3</sup>	7.0 x 10 <sup>3</sup>	7.0 x 10 <sup>3</sup>
	5	4.4 x 10 <sup>2</sup>	3.8 x 10 <sup>2</sup>	3.3 x 10 <sup>2</sup>
	10	2.3 x 10 <sup>2</sup>	1.7 x 10 <sup>2</sup>	4.0 x 10 <sup>1</sup>

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**BACTERICIDAL EFFICACY OF PAA IN  
pH 8 SYNTHETIC HARD WATER AT 40°C**

Microorganism	Peracetic Acid ppm active	Microorganism Level, cfu/ml		
		1 hour	3 hours	6 hours
Pseudomonas aeruginosa	0	5.5 x 10 <sup>6</sup>	4.1 x 10 <sup>6</sup>	4.6 x 10 <sup>6</sup>
	1	2.2 x 10 <sup>2</sup>	<10	<10
	3	<10	<10	<10
Bacillus cereus	0	1.0 x 10 <sup>5</sup>	1.3 x 10 <sup>5</sup>	1.2 x 10 <sup>5</sup>
	1	3.0 x 10 <sup>1</sup>	2.0 x 10 <sup>1</sup>	<10
			6	
Legionella pneumophila	0	<sup>66</sup> 8.0 x 10	5.8 x 10 <sup>6</sup>	<sup>66</sup> 6.8 x 10
	1	8.4 x 10 <sup>4</sup>	7.0 x 10 <sup>3</sup>	1.8 x 10 <sup>3</sup>
	3	<10	<10	<10
Desulfovibrio desulfuricans*	0	1.0 x 10 <sup>5</sup>	1.0 x 10 <sup>5</sup>	1.0 x 10 <sup>5</sup>
	5	1.0 x 10 <sup>4</sup>	1.0 x 10 <sup>3</sup>	1.0 x 10 <sup>3</sup>
	10	1.0 x 10 <sup>2</sup>	1.0 x 10 <sup>2</sup>	1.0 x 10 <sup>2</sup>
*Testing done in API RP38 media				

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**ALGICIDAL EFFICACY OF PAA IN  
pH 8 SYNTHETIC HARD WATER AT 40° C**

Microorganism	Peracetic Acid, ppm active	Microorganism Level, cfu/ml		
		1 hours	3 hours	6 hours
Phormidium inundatum	0	1.0 x 10 <sup>3</sup>	1.0 x 10 <sup>3</sup>	1.0 x 10 <sup>3</sup>
	3	1.0 x 10 <sup>3</sup>	1.2 x 10 <sup>2</sup>	1.1 x 10 <sup>2</sup>
	5	0	0	0
Chlorella vulgaris	0	1.0 x 10 <sup>5</sup>	1.0 x 10 <sup>5</sup>	1.0 x 10 <sup>5</sup>
	3	1.2 x 10 <sup>4</sup>	1.5 x 10 <sup>2</sup>	1.1 x 10 <sup>2</sup>
	5	1.0 x 10 <sup>2</sup>	0	0