

USES AND BASIC CHEMISTRY

Perasan® and BioSide™ HS (Peroxyacetic Acid Solutions)

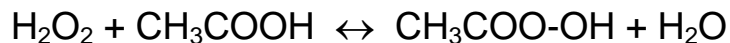
Perasan® and BioSide™ HS are stabilized equilibrium solution concentrates that are EPA approved for numerous uses, including circulation cleaning and industrial sanitizing of equipment such as tanks, pipelines, evaporators, fillers, pasteurizers, aseptic equipment, and for sanitizing previously cleaned food contact surfaces of equipment.

The equilibrium peracetic acid is a 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.

USES

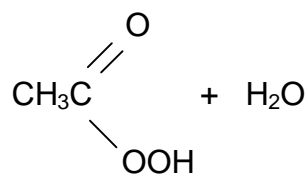
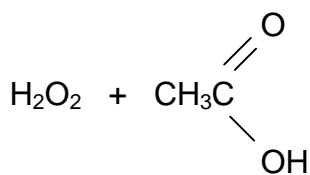
- Milk and dairy products processing and packaging plants, including farm equipment.
- Wineries, vineyards, breweries, and beverage plants.
- Meat, poultry, seafood and vegetable processing and packaging plants.
- Rendering, spray drying, and further processing plants.
- Use as a fogging adjunct for critical disinfection in packaging rooms.
- Cleaning, sanitizing, and continuous disinfection of UF and RO membranes.
- Industrial circulating cooling water for both open, closed, and semi closed loops (including food contact).
- Wastewater treatment (as an outstanding sulfide oxidizer and inhibitor, odor control agent, disinfectant, and cleaner.)
- Other non-porous food or non-food contact surfaces such as conveyors and doorway foamer systems.
- Pulp and paper process water slime and deposit control and specialty bleaching.
- Hospital and health care facilities, veterinary clinics.
- Drip irrigation tape line cleaner and algicide.
- Beverage plant high level sanitation/disinfection of filler machines and bottles.
- Broad spectrum efficacy against gram-negative and gram-positive bacteria, E. coli #0157:H7, Listeria, Salmonella, Pseudomonas, and many other organisms.

- Not subject to residual tolerances by the FDA or EPA at normal use rates.
- Certified and approved by the National Organic Standards Board (USDA) for use in organic processing facilities (food contact and equipment sanitation, 7 CFR 205.605). No rinse needed.
- There are no known hazardous or toxic by-products associated with its use.
- More effective than chlorine, chlorine dioxide, or quaternary products for sanitizing food contact surfaces.
- Efficacy is unaffected at temps as low as 36° F (for most species).
- Effective and stable at pH values between 1-9. (pH values above 8.3 increase the rate of hydrolysis).
- Non-foaming, and exhibits very low surface tension.
- Initial degradation products are acetate and water. Final biodegradation is carbon dioxide, oxygen, and water.
- Extremely high LD50 rates: 1540 mg/kg (rat), and 1410 mg/kg (rabbit).
- Completely disintegrates into water and oxygen at temperatures above 165 °F.
- Virtually no odor at end-use concentrations.
- No rinse required at levels up to 100 ppm for many fruits and vegetables, and up to 500 ppm for equipment sanitation uses.



hydrogen peroxide + acetic acid

peroxyacetic acid + water



Oxidation Capacity of Various Oxidizers

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

COOLING WATER:

PAA solutions find particular advantageous use in cooling water systems because it is a very powerful oxidizer (second only to ozone). PAA is lipid soluble making it an effective on-line and off-line cleaner. Higher doses can be used to remove slime mass accumulation. It does not create halogenated by-products or THM's, does NOT react with ammonia and many other nitrogen-based chemistries, and does not contribute to the conductivity or TDS of the blow-down or bleed off stream. PAA consumes alkalinity, allowing higher cycles of concentration compared to hypochlorite. For most surface discharges, quenching is not required. PAA is compatible with organic scale and corrosion inhibitors. The threshold level for most algae and slime forming organisms is 1-2 ppm active PAA. Effective pH ranges are as high as 9.5, but the optimum pH is below 8.6. Testing is accomplished using the DPD Total Chlorine method. The results are multiplied by 1.07 for a PAA equivalence. Detection limit with this method is 0.05 ppm. Typical micro results for various organisms exposed to PAA solutions are as follows.

FUNGICIDAL EFFICACY OF PERASAN® IN pH 8 SYNTHETIC HARD WATER AT 40°C

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 ⁴	4.2 x 10 ⁴	4.2 x 10 ⁴
	3	1.5 x 10 ³	7.1 x 10 ²	<10
	5	2.9 x 10 ²	<10	<10
<i>Aspergillus niger</i>	0	7.0 x 10 ³	7.0 x 10 ³	7.0 x 10 ³
	5	4.4 x 10 ²	3.8 x 10 ²	3.3 x 10 ²
	10	2.3 x 10 ²	1.7 x 10 ²	4.0 x 10 ¹

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

Microorganism	Peracetic Acid, ppm <u>active</u>	Microorganism Level, cfu/ml		
		1 hour	3 hours	6 hours

Pseudomonas aeruginosa	0	5.5×10^6	4.1×10^6	4.6×10^6
	1	2.2×10^2	<10	<10
	3	<10	<10	<10
Bacillus cereus	0	1.0×10^5	1.3×10^5	1.2×10^5
	1	3.0×10^1	2.0×10^1	<10
	3	<10	<10	<10
Legionella pneumophila	0	8.0×10^6	5.8×10^6	6.8×10^6
	1	8.4×10^4	7.0×10^3	1.8×10^3
	3	<10	<10	<10
Desulfovibrio desulfuricans*	0	1.0×10^5	1.0×10^5	1.0×10^5
	5	1.0×10^4	1.0×10^3	1.0×10^3
	10	1.0×10^2	1.0×10^2	1.0×10^2
*Testing done in API RP38 media				

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

Microorganism	Peracetic Acid, ppm <u>active</u>	Microorganism Level, cfu/ml		
		1 hours	3 hours	6 hours

Phormidium inundatum	0	1.0×10^3	1.0×10^3	1.0×10^3
	3	1.0×10^3	1.2×10^2	1.1×10^2
	5	0	0	0
Chlorella vulgaris	0	1.0×10^5	1.0×10^5	1.0×10^5
	3	1.2×10^4	1.5×10^2	1.1×10^2
	5	1.0×10^2	0	0

SANITATION:

When used as the primary sanitizer in processing facilities, the PAA formula does not contribute to wastewater TDS or total salt levels, and does not interfere with most wastewater chemical treatment programs or systems. There are no known microbial mutation or resistance responses to PAA. It can be used at concentrations up to 200 ppm active PAA without requiring a water rinse. Normal use rates are 80 ppm with contact times of 1 minute to achieve a 99.999% microbial kill. PERASAN 'A' may be used as a continuous conveyor sanitizer (with direct food contact) for meat, poultry, seafood, and fruit and vegetable plants in accordance with 21 CFR 173.315 and 21 CFR 173.370

AGRICULTURE:

PAA solutions are finding specialty use as a fungicide for daffodil and flower bulbs, a biodispersant and slime inhibitor for flume systems, and as a drip irrigation line cleaner and algaecide. When used as a drip line cleaner, the PAA breaks down in soil within minutes, releases (adds) active oxygen, and does not contribute a salt or conductivity (EC) loading in the root zone. At levels above 10 ppm, the product will dissolve calcium and add mild acidity to the soil. When compared to chlorine, PAA will NOT depress crop yields.

WASTEWATER:

Although not yet approved by the EPA specifically as a wastewater disinfectant, PAA has, nonetheless, been used successfully as an additive for sludge debulking, algae control, chemical enhancement for sulfide removal and prevention, as a supplement to UV disinfection, and odor eliminator. PAA use costs are lower than chlorine for treating raw and physiochemically treated effluents. For biologically treated effluents, use cost are higher (but with similar efficacy results), yet PAA does not create THM precursors or most of the DBP's (disinfection by-products) associated with the use of chlorine. When neutralization is required, sulfite reduction may be used (the same as for chlorine).

In November 2006, Enviro Tech is scheduled to receive an EUP (Experimental Use Permit) from the EPA which will allow it to be used as the single disinfectant in Combined Sewer Overflow (CSO) applications in New Jersey. Since PAA has a very friendly environmental profile, it may have a dramatic effect on the bacterial decontamination of overflow wastewater that is released during periods of high influx to wastewater treatment plants in the Midwest or East Coast. It will be the first trial of its kind in the United States.

Many More to Come in 2007