Comparative table of Anolyte of Biocidal Efficacy

Organism Type Bacteria	Classification	Resistance	Reduction	Dilution
Gram Negatives	Acinetobacter baumanii	ESBL, AME	Log 6	Conc
	Acinetobacter calcoaceticus	Na	Log 8	1:10
	Pseudomonas aeruginosa	Na	Log 6	1:10
	P. aeruginosa SATCC – Pse 16	Na	Log 5	Conc
	P. syringae	Na	Log 8	1:10
	P. flourescens	Na	Log 8	1:10
	P. alcaligences	Na	Log 8	1:10
	P. medocina	Na	Log 8	1:10
	P. putida	Na	Log 8	1:10
	P. stutzeri	Na	Log 8	1:10
	Escherichia coli	ESBL	Log 6	Conc
	E.coli SATCC – Esc 25	Na	Log 5	Conc
	E.coli 0157:H7	Na	Log 6	1:10
	Enterobacter spp	ESBL	Log 6	Conc
	Klebsiella pneumoniae	ESBL	Log 6	Conc
	Legionella pneumoniae	Na	Log 6	Conc
	Salmonella isangi	ESBL	Log 6	Conc
	Salmonella spp	ESBL	Log 6	Conc
	Salmonella typhi SATCC Sal 10	Na	Log 5	Conc
	Bacillus Subtilis	Na	Log 8	1:10
	Bacillus cereus	Na	Log 8	1:10
Gram Positive	Enterococcus Faecalis	VRE	Log 6	Conc
	Enterococcus faecium	VRE	Log 6	Conc
	Staphylococcus aureus	MRSA	Log 6	Conc
	Staph aureus SATCC Sta 53	Na	Log 5	Conc
	Staph zooepidermidus	Na	Log 5	Conc
	Streptococcus faecalis	Na	Log 8	Conc
	Labtobacillus brevis	Na	Log 8	1:10
	Listeria monocytogenes	Na	Log 7	Conc
	Micrococcus luteus	Na	Log 8	1:10
	Micrococcus roseus	Na	Log 8	1:10
	Vibrio cholerae	Na	Log 6	1:10
Mycobacteria	M. tuberculosis (H7Rv)	Na	Log 6	Conc
	M.smegmatis	Na	Log 6	Conc
Viruses	Polio virus	Na	Log 8	1:10
	Hepatitis A	Na	Log 8	1:10
	Herpes simplex	Na	Log 4	1:10
Fungi	Candida albicans	Na	Log 4	Conc

Organism Type	Classification	Resistance	Reduction	Dilution
Coliphages	F-RNA Coliphages	Na	Log 6	1:10
Fungi: Ascomyctes	Fusarium oxysporum f.sp. Cubense	Na	Log 4	1:100
Ascomycetes	F. circinatum	Na	Log 4	1:100
	Phyllosticta citricarpa	Na	Log 3	1:20
	Geotrichium candidum	Na	Log 6	1:10
	Penecillium digitatum	Na	-	1:20
Oömycetes	Pythium ultimum	Na	Log 6	Conc
	Trichophyton mentagraphytes	Na	Log 4	Conc
	Aspergillus niger	Na	Log 4	Conc
Ascomycetes	Botrytis cinerea	Na	Log 4	Conc
Basidiomycetes	Rhizoctonia solani	Na	Log 4	Conc
Deuteromycetes	Vericillium dahliae	Na	Log 4	Conc
Deuteromycetes	Botrysphaeria dothidea	Na	Log 4	Conc
Deuteromycetes	Sclerotium rolfsi	Na	Log 4	Conc
Bacteria	Erwinia carotovora	Na	Log 4	Conc
	Agrobacterium tumefaciens	Na	Log 4	Conc
	Ralstonia solanacearum	Na	Log 6	Conc
	Xanthomonas campestris	Na	Log 4	Conc
	Clavibacteria michiganense	Na	Log 4	Conc
	Pseudomonas syringae	Na	Log 4	Conc

Competing Technologies
Comparison between ECA and Chlorine Gas

	ECA	Chlorine Gas
Disinfection	▪ Two to ten times more effective than Cl2 ▪ More rapid disinfection ▪ Broader inactivation range	▪ Effective kill on certain micro-organisms ▪ Slower disinfection (more CT time required) ▪ Cannot kill some resistant organisms
Residual	▪ More stable ▪ Last longer ▪ Less disinfectant required to maintain residual ▪ No need for ammonia	▪ Can vary widely throughout system ▪ Must often be boosted or combined with ammonia to last throughout distribution system ▪ A higher dosage is required to maintain equal residual
Safety	▪ Uses only salt water and 24VCD ▪ Reduction in liability exposure ▪ Avoids special equipment and training for worker safety ▪ Avoids equipment corrosion problems ▪ Avoids fire/explosion hazards from chlorine concentrates	▪ Packaged Cl_2 gas is under pressure – potential for explosion or fire ▪ Liability exposure ▪ Poses hazard to surrounding community and to system operator ▪ Potential for chlorine burns ▪ Safety equipment and training is necessary ▪ Creates corrosion problem
Generation of Oxidant	▪ Oxidants generated onsite – fresh chemicals with constant potency ▪ No hazardous materials to transport or store	▪ Transportation of hazardous materials requires permits, EISs, etc. ▪ Storage of hazardous material often requires scrubber
Cost Considerations	▪ Higher capital cost is offset by lower lifecycle cost when compared to chlorine gas	▪ Lower installation cost when gas scrubber is not considered, but higher lifecycle costs

	ECA	Chlorine Gas
Simplicity & Reliability	▪ Fully automated unit requires minimal training and maintenance – periodically add salt and check system ▪ Safety gear is unnecessary ▪ Cell is easily replaced and only requires replacement every few years	▪ Regular change-out of cylinders requires complicated safety training and gear ▪ A system using about 10 pounds per day must change a 150 pound cylinder twice each month ▪ Requires periodic cleaning and change-out of gas venture injection system
Taste & Odor	▪ Excellent taste – does not react with ammonia and phenols to produce compounds that normally impart chemical taste and odors ▪ Removes H_2S to improve water quality	▪ Often imparts a chlorine taste and odor, especially when combined with ammonia ▪ Cannot eliminate H_2S taste or odor problems
Multiple uses	▪ Can be used for a wider range of disinfection purposes than Cl_2 ▪ Can be used for iron and manganese removal ▪ Can be used for H2S removal, both in drinking water and sewage odor applications ▪ Can be used to improve filter runs when installed prior to the filter ▪ Improves turbidity by enhancing prefilter flocculation	▪ Can only be used for disinfection purposes

COMPARISION OF UV AND ECA DISINFECTION TECHNOLOGY

Application Areas	UV	ECA
Disinfection of water-based liquids in food, Beverage, pharmaceutical, chemical, manufacturing, agriculture, aquaculture, medical and dental industries	✓	✓
Water treatment and treatment of potable water for individual houses and remote sites.	✓	✓
Disinfection of liquids, such as syrup		
Effluent and waste water treatment	✓	✓
Oxidation	✓	✓
Flocculation enhancement		✓
Modes of Application		
Washing/soaking	None	High
Fogging	None	High
In-Line	High	High
IRRADIATION	High	None
PHYSICAL LIMITATIONS		
MULTI-DIMENSIONAL EXPOSURE	Low	High
RY APPLICATIONS	High	None
SENSITIVITY TO BIO-LOAD	High	High
SENSITIVITY TO TURBIDITY	High	Low
OPERATING COSTS	High	Low
DURABILITY	Medium	High
CAPITAL COSTS	High	Medium to High
DISINFECTION EFFICIENCY	High	High

MODE OF DISINFECTION	Disruption of DNA	Non-discriminate disruption of biological chemical groups
SPEED OF DISINFECTION	High	Medium
RESIDUAL DISINFECTION PROPERTIES	None	Medium
RESISTANCE BUILDUP	None	Medium
RESIDUALS ON TREATED MATTER		None
Taste	None	None
Odour	None	None
pH	None	None
Chemical	None	Low
Colour	None	None
CORROSIVENESS	None	Low to Medium
TOXICITY	Low	Low
HANDLING AND STORAGE OF CHEMICALS	None	Medium
HANDLING AND STORAGE OF HAZARDOUS CHEMICALS	None	None
SIZE OF APPLICATIONS	Small to Large	Small to Large
COMPACTNESS OF UNITS	Small	Small
PERIPHERAL EQUIPMENT REQUIRED	Low	Medium

EAW Mixed Oxidant Advantages

	Effective	Safe	Economical	Easy to Use	Residuals	Low DBP's
GAS CHLORINE						
Ca Hypochlorite						
Sodium Hypochlorite						
Chlorine Dioxide						
Ozone						
Ultraviolet						
ECA mixed Oxidants						

Unsatisfactory Good

Comparison Chart of Water Disinfection Methods in a Hospital Environment										
Item	**Disinfection System**							**Combination of Disinfection Systems**		
	Super Heating & Flushing	Auto-Chlorinating / Inhibitor System	Auto-Chloramines System (Mono-Chloramine)	Chlorine Dioxide	Copper-Silver Ionization System	Ozoniation	Ultraviolet	Ultraviolet & Auto-Chlorinating/ Inhibitor	Ultraviolet & Auto-Chloramine System (mono-chloramine)	Ultraviolet & Chlorine Dioxide
USED ON DOMESTIC COLD WATER SYSTEM	No	Yes	Yes	Yes	FEASIBLE – RETURN LOOP WITH FIXTURE/ EQUIPMENT BACK FLOW PREVENTION REQUIRED	Yes	Yes	Yes	Yes	Yes
USED ON DOMESTIC HOT WATER SYSTEM	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CHEMICAL USED	None	SODIUM HYPOCHLORITE	CHLORAMINE (CHLORAMINE & AMMONIA)	CHLORINE DIOXIDE (SODIUM CHLORITE)	COPPER & SILVER (MINERALS)	NONE	NONE	SODIUM HYPOCHLORITE	CHLORAMINE (CHLORINE & AMMONIA)	CHLORINE DIOXIDE (SODIUM CHLORITE)
BY-PRODUCT	None	TRIHALOMETHANES (THM'S)	TRIHALOMETHANE (THM'S (FAR LESS THAN CHLORINE)	SOME CHEMICAL DECOMPOSITION IN THE FORM OF CHLORITE AND CHLORATE	NONE	BROMATE	OZONE	TRIHALOMETHANES (THM'S)	TRIHALOMETHANES (THM'S) (FAR LESS THAN CHLORINE	SOME CHEMICAL DECOMPOSTION IN FOR OF CHLORITE AND CHLORATE
EFFECTIVE MAX. pH	None	7.8 pH	9 pH	10 pH	8 pH	NA	NA	7.8 pH	9 pH	10 pH
TASTE & ODOUR	None	YES-CAN CAUSE TASTE AND ODOUR PROBLEMS	YES-CAN CAUSE TASTE AND ODOUR PROBLEMS	NONE (BELOW .8 PPM) – REMOVES MOST TASTE AND ODOR PROBLEMS	NONE	YES – WILL ADD ODOUR	NONE PROVIDED HIGH INTENSITY OZONE LAMPS ARE NOT USED	YES-CAN CAUSE TASTE & ODOUR PROBLEMS/ ONLY IF HIGH INTENSITY OZONE LAMPS ARE USED	YES-CAN CAUSE TASTE & ODOUR PROBLEMS/ ONLY IF HIGHT INTENSITY OZONE LAMPS ARE USED	NONE (BELOW .8 PPM)- REMOVES MOST TASTE AND ODOUR PROBLEMS/ ONLY IF HIGH INTENSITY OZONE LAMPS ARE USED
IMPACT ON EQUIPMENT	Potential	POTENTIAL CORROSION	MINIMAL POTENTIAL	MINIMAL POTENTIAL	MINIMAL POTENTIAL	POTENTIAL CORROSION	POTENTIAL CORROSION	POTENTIAL CORROSION	MINIMAL POTENTIAL	MINIMAL POTENTIAL

Item	Disinfection System							Combination of Disinfection Systems		
	Super Heating & Flushing	Auto-Chlorinating / Inhibitor System	Auto-Chloramines System (Mono-Chloramine)	Chlorine Dioxide	Copper-Silver Ionization System	Ozoniation	Ultraviolet	Ultraviolet & Auto-Chlorinating/ Inhibitor	Ultraviolet & Auto-Chloramine System (mono-chloramine)	Ultraviolet & Chlorine Dioxide
SYSTEMS		PROBLEMS	CORROSION PROBLEMS	CORROSION PROBLEMS	DEPOSITION OF COPPER ON MILD STEEL/ LOCALIZED CORROSION – NONE REPORTED	PROBLEMS	PROBLEMS IF HIGH INTENSITY OZONE LAMPS ARE USED	PROBLEMS/ CORROSION IF HIGH INTENISTY OZONE LAMPS USED	PROBLEMS CORROSION IF HIGH INTENISTY OZONE LAMPS USED	PROBLEMS CORROSION IF HIGH INTENISTY OZONE LAMPS USED
IMPACT ON DIALYSIS EQUIPMENT	NONE	NONE(BELOW 4 PPM)- CARBON FILTERS AND RO EQUIP. EFFECTIVELY REMOVES CHLORINE AND BY-PRODUCTS	SIGNIFICANTLY DIFFICULT TO REMOVE CHLORAMINES (MONO-CHLORMAINES AND BY-PRODUCT AT 4 PPM AND BELOW – CARBON FILTERS EFFECTIVE, RO MEMBRANDE NOT EFFECTIVE, MEMBRANE DAMAGE	NONE (BELOW .8 PPM) – CARBON FILTERS AND RO EQUPMENT EFFECTIVELY REMOVES CHLORINE DIOXIDE AND BY-PRODUCTS	INFORMATION CURRENTLY NOT AVAILABLE	INFORMATION CURRENTLY NOT AVAILABLE	NONE	NONE (BELOW 4 PPM) – CARBON FILTERS AND RO EQUIPMENT EFFECTIVELY REMOVES CHLORINE AND BY-PRODUCTS	SIGNIFICANTLY DIFFICULT TO REMOVE CHLORAMINES (MONO-CHLORMAINES AND BY-PRODUCT AT 4 PPM AND BELOW – CARBON FILTERS EFFECTIVE, RO MEMBRANDE NOT EFFECTIVE, MEMBRANE DAMAGE	NONE (BELOW .8 PPM) – CARBON FILTERS AND RO EQUPMENT EFFECTIVELY REMOVES CHLORINE DIOXIDE AND BY-PRODUCTS
ENVIRONMENTAL & HEALTH EFFECTS	WATER IS AT SCALDING TEMP	PRODUCES CARCINGOGE-NIC THM'S	PRODUCES CARCINGOGE-NIC THM'S (less than chlorine)	NONE – DOES NOT PRODUCE THM'S AND CAN DESTROY SOME THM'S	COOPER IS ACUTELY TOXIC TO MANY AQUATIC SPECIES AT LEVELS LOW AS 50 PPB. SYSTEM OPERATES BETWEEN 200 – 600 PPB COPPER, 10 TO 60 PPB SILVER	NONE – BROMITE IDENTIFIED AS AN ANIMAL CARCINOGEN – EFFECTS ON HUMANS UNKNOWN	NONE	PRODUCES CARCINOGENIC THM'S	PRODUCTES CARCINOGENIC THM'S (less than chlorine)	NONE – DOES NOT PRODUCE THM'S AND CAN DESTROY SOME THM'S
EPA APPROVED PRIMARY DRINKING WATER DISINFECTANT		YES (BELOW 4 ppm)	YES (BELOW 4 ppm)	YES (BELOW .8 PPM	NO	NO	NO	YES (BELOW 4 PPM)	YES (BELOW 4 PPM)	YES (BELOW .8 PPM)
BREAKS DOWN BIOFILM		NO @ BELOW 50 PPM MINIMAL	NO – (SYSTEM OPERATES AT 2-3	YES	YES/ NO DEPENDING	NO	NO	NO @ BELOW 50 PPM MIN	NO – (SYSTEM OPERATES AT 2-3	YES

Item	Disinfection System							Combination of Disinfection Systems		
	Super Heating & Flushing	Auto-Chlorinating / Inhibitor System	Auto-Chloramines System (Mono-Chloramine)	Chlorine Dioxide	Copper-Silver Ionization System	Ozoniation	Ultraviolet	Ultraviolet & Auto-Chlorinating/ Inhibitor	Ultraviolet & Auto-Chloramine System (mono-chloramine)	Ultraviolet & Chlorine Dioxide
NOMINAL OPERATING CONDITIONS		ABOVE 50 PPM SYSTEM OP-ERATES BET-WEEN 2-3 PPM	PPM		ON PPM			ABOVE 50 PMM SYTEM OPER. BETW. 2-3	PPM	
INHIBITS BIOFILM AT NOMINAL OPERATING CONDITIONS	NO	MINIMAL	MINIMAL	YES	YES/ NO DEPENDING ON PPM	NO	NO	MINIMAL	MINIMAL	YES
SHORT TERM RESIDIUAL EFFECTIVEN ESS AGAINST LEGIONELLA(SYTEM NOT OPERATING)	YES – APPROX. ONE WEEK	YES	YES – FAR LESS EFFECTIVE AS CHLORINE NONE	YES	YES	NO	NO	YES	YES – FAR LESS EFFECTIVE AS CHLORINE	YES
LONG TERM RESIDUAL EFFECT. AGAINST LEGIONELLA (SYSTEM NOT OPERATING)	NONE	NONE	NONE	MINIMAL – SOME RESIDUAL PROTECT. UNTIL BIOFILM IS RE-EST. NONE FOR BULK WATER	YES FOR HOT WATER SYST. ONLY – (LONG TERM STUDIES INDICATE LEGIONELLA MAY DEVEL. A TOLERANCE TO SILVER)	NONE	NONE	NONE	NONE	MINIMAL – SOME RESIDUAL PROTECT. UNTIL BIOFILM IS RE-EST. NONE FOR BULK WATER
FLUSHING REQUIRED AT ALL FIXTURES AT START UP ON PERIODIC BASES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
CHLORINE SHOCKING OF WATER SYSTEM REQUIRED PRIOR TO SYSTEM OPERATING	NA	YES	YES	NOT REQUIRED	NOT REQUIRED	YES	YES	YES	YES	NOT REQUIRED

Item	Disinfection System							Combination of Disinfection Systems		
	Super Heating & Flushing	Auto-Chlorinating / Inhibitor System	Auto-Chloramines System (Mono-Chloramine)	Chlorine Dioxide	Copper-Silver Ionization System	Ozoniation	Ultraviolet	Ultraviolet & Auto-Chlorinating/ Inhibitor	Ultraviolet & Auto-Chloramine System (mono-chloramine)	Ultraviolet & Chlorine Dioxide
ESTIMATED COST FOR A 600 GPM SYSTEM (NOT INSTALLED)	NA	$9,000 (APPROX)	$9,000 (APPROX)	$12,000	$36,000	NOT AVAILABLE	$27,000	$36,000 (APPROX)	$42,000 (APPROX)	$39,000
ESTIMATED INSTALL. COST	NA	$5,000 (APPROX)	$5,000 (APPROX)	$3,000	$5,000	NOT AVAILABLE	$10,000	$15,000 (APPROX)	$15,000 (APPROX)	$13,000
ESTIMATED ANNUAL MAINT. COST	$12,500 (PER EVENT)	$8,000	$8,000	$16,650 @ 1 LB CIO2 OR $28,250 @ 2 LBS CIO2	$25,250	NOT AVAILABLE	$12,600	$20.600	$20,600	$20,000 @ 1 LB Cl02 OR $32,000 @ 2 LBS Cl02

Industrial Market Competitor Analysis

Market	Description of Application	Competing Technologies	Competitors	RW Competitive Edge	RW Marketing Strategy	
					Local	International
Water Treatment (food industry)	Disinfection of process water	Chlorine Chlorine Dioxide Ozone UV Food Grade biocides	Nalco BDH Buckman/ laboratories Bets Dearborne Niche Companies	Low running cost On site generation Regulated Ph Low maintenance Low toxicity Low residue	License	Licensing
Potable	Disinfection of potable water	Chlorine Chlorine Dioxide Ozone UV Non oxidizing/ and oxidizing biocides	Nalco BDH Buckman laboratories Bets Dearborne Niche companies	No resistance Optimal activity No-hazardous Versatile application	Licensing	Licensing
Cooling Towers	Biological control	Chlorine Chlorine Dioxide Ozone UV Non oxidizing/ and oxidizing biocides	Nalco BDH Buckman - laboratories Bets Dearborne Niche Companies		Licensing	Licensing
Abattoirs	Meat product bio-security, Surface disinfection,	Chlorine Chlorine Dioxide UV	Antec Int Niche Companies		Own then license	Licensing
Macadamia Nuts	Disinfection of nuts	None	None		Own then license	Licensing
Mushrooms	Control of bacterial blotch	Chlorine Chlorine Dioxide Biological control	Niche Companies		Own then license	Licensing
Animal husbandry	Control of veterinary deseases and meat bio-security	Antibiotic Iodine	Niche Companies		Own then licenses	Licensing
Potatoes	Control of bactarial blight, shelf-life extension	Chlorine Chlorine Dioxide	Niche Companies		License	Licensing
Hide preservation	Preservation	Salt	Salt suppliers		Own then license	Licensing
Mining	Mineral Extraction	Cyanide/carbon Electro-chemincal	Niche Companies		Licensing	Licensing
Hospital Hotel-Disinfection	General disinfection and cleaning	Gluteraldehyde Peracetic acid QAC's Chlorine Chlorine Dioxide Iodine compounds Hydrogen peroxide	Pharmaceutical and detergent companies		Licensing	Licensing
Food Processing	CIP/COP disinfection Acidurin bactatial control shelf life extension	QAC's Chlorine Chlorine Dioxide Iodine compounds	Niche Companies		Licensing	Licensing

Medical & Dental Competitor Analysis

Market	Description of Application	Competing Technologies	Competitors	RW Competitive Edge	RW Marketing Strategy	
					Local	International
Dental	Dental unit water line disinfection	Filters Na Hypochlorite Sterile water supplies	Niche Filtration unit suppliers Non focused Pharmaceutical and chemical suppliers Dental supply companies	Low running cost On site generation Regulated Ph Low maintenance Low toxicity Low residue No resistance Optimal activity Non-hazardous	Own	Licensing
Dental	Root canal irrigation	Na hypochlorite	Pharmaceutical companies	Versatile	Licensing	Licensing
Tissue Culture Lab Research	Disinfection of tissue culture growth medium Investigation of new applications for medical use	Micro-filtration N/A	Niche suppliers Sterilox		Own	Licensing
Hospitals/ clinics	Treatment of TB topical wounds skin infections bedsores etc	Antibiotics QAC'S Iodated compounds etc	Pharmaceutical companies		Licensing	Licensing
Veterinary clinics	Treatment of topical wounds skin infections etc	Antibiotics QAC's Iodated compounds Antifungal compounds etc	Pharmaceutical companies		Licensing	Licensing