OmniLyte™

Innovation for a safer tomorrow.

Technical Brochure
ELECTRO-CHEMICALLY ACTIVATED WATER

Experience *Knowledge* *Flexibility*

Water savings of up to 60%

What is ECA

What is Electro Chemical Activation (ECA Technology)

OmniLyte is the market leader in Electro Chemical Activation ECA Technology. We manufacture, produce and install ElectroChemical Activation hygiene management systems for many applications. ECA Technology is a replacement for traditional chemical cleaning processes.

The Electro Chemical Activation of water, better known as ECA solutions are created by mixing readily available food grade salt with water, and feeding it through our reactors which are the core of the ECA device. Once inside the reactor, the brine is activated by way of an electrical charge and two distinct solutions are produced:

- Anolyte which is used as a disinfectant (replacing chlorine based chemicals)
- Catholyte which is used as a detergent (replacing caustic based chemicals)

ECA technology has secured FDA, EPA, and EU approval for use as an advanced disinfectant in the food and beverage processing industries, as well as accreditation for full profile safety and antimicrobial efficacy. The OmniLyte devices are also CSA certified.

Reduction of Toxic Effluent

ECA does NOT affect the taste, colour and appearance of the products

How does it work

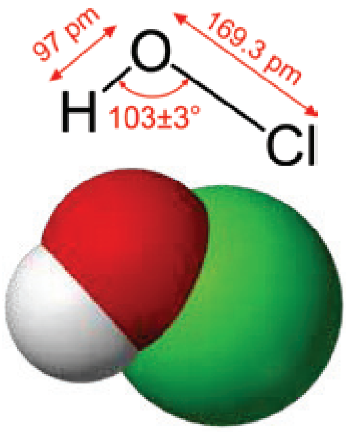
ECA is a scientific process that mimics the body's own natural defense process.

When the body comes under attack from invading bacteria and viruses, the body's immune system immediately responds by sending increased numbers of a specific white blood cell called a Neutrophil to the invasion site. Once activated, these cells produce substantial quantities of a mixed oxidant solution which is highly effective in eliminating all invading microbes and pathogens. The oxidant that the white blood cells produce is acknowledged to be amongst the most potent natural disinfectants, yet it remains non-toxic to humans, and is highly effective as an antimicrobial agent with rapid action. It is called Hypochlorous acid or HOCl.

HOCl is generated under highly specific electrochemical conditions using a combination of water, salt (NaCl) and electricity. By utilizing the specially designed and highly controlled production systems OmniLyte is able to consistently and repeatedly produce HOCl of the highest quality and efficacy, litre after litre.

HOCl is extremely effective at eliminating all pathogens and food spoilage microbes including spores.

Hypochlorous acid – chemical structure



HOCL in 100% Anolyte = 170mg/litre

↓

HOCl molecular mass = 52.4g/mol

HO = 17g/mol — **32.4%**

Cl = 35.4g/mol — **67.6%**

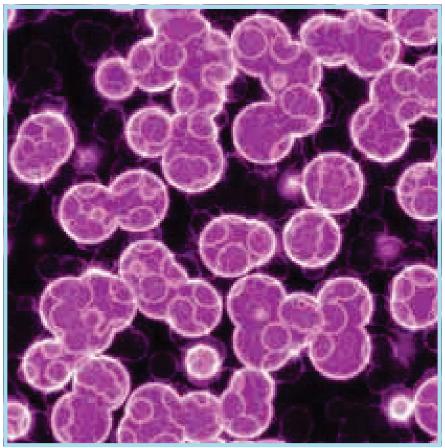
↓

67.6% Cl (Chlorine) in 170mg/l HOCl = 115mg/l elemental Chlorine in HOCl

safe • fast • effective

ECA Anti-Microbial efficacy

Table 1: Percentage kill of bacterial strains at different Anolyte (produced using 3 % NaCl) concentrations



		Anolyte concentration		
Bacterial strain	Gram stain	100%	1:10	1:20
Bacillus subtilis	+	100	100	78
Pseudomonas aeruginosa	-	100	100	87
Acinetobacter calcoaceticus	-	100	100	100
Lactobacillus brevis	+	100	100	100
Micrococcus luteus	+	100	100	100
Streptococcus feacalis	+	100	100	31
Pseudomonas fluorescens	-	100	100	66
Staphylococcus aureus	+	100	100	100
Pseudomonas alcaligenes	-	100	100	52
Pseudomonas medocina	-	100	100	88
Pseudomonas putida	-	100	100	90
Bacillus cereus	+	100	100	92
Micrococcus roseus	+	100	100	100
Pseudomonas stutzeri	_	100	100	57
Pseudomonas syringae	_	100	100	87

Anolyte gave a 100 % kill of all the test isolates at a concentration of 100% and 10% (Table 1). At a 1:20 dilution (5%), variable kill percentages were obtained, ranging from 100% - 31%. This indicated variable susceptibility of different bacteria to Anolyte. This is not an uncommon phenomenon. Many organisms are intrinsically more tolerant of antimicrobial substances, than others.

The cell concentration of microorganisms will also play a role in determining the efficacy of the Anolyte. The antimicrobial effect of different Anolyte dilutions (2g/l NaCl) on various test organisms at different cell concentrations are shown in table 2.

“The System is automated to ensure CIP integrity and requires little manual intervention.”

RW customer quote

Table 2. Effect of Anolyte on the growth of the test microorganisms.

Bacillus Subtilis					
Anolyte Concentration	Cell concentration (cfu/ml)				
	106	105	104	103	102
1:10	Growth	Growth	Growth	No Growth	No Growth
1:50	Growth	Growth	Growth	No Growth	No Growth
1:100	Growth	Growth	Growth	No Growth	No Growth
Staphylococcus Aureus					
Anolyte Concentration	Cell concentration (cfu/ml)				
	106	105	104	103	102
1:10	No Growth	No Growth	No Growth	No Growth	No Growth
1:50	No Growth	No Growth	No Growth	No Growth	No Growth
1:100	Growth	No Growth	No Growth	No Growth	No Growth
Escherichia Coli					
Anolyte Concentration	Cell concentration (cfu/ml)				
	106	105	104	103	102
1:10	No Growth	No Growth	No Growth	No Growth	No Growth
1:50	Growth	No Growth	No Growth	No Growth	No Growth
1:100	Growth	Growth	Growth	No Growth	No Growth
Pseudomonas Aeruginosa					
Anolyte Concentration	Cell concentration (cfu/ml)				
	106	105	104	103	102
1:10	Growth	No Growth	No Growth	No Growth	No Growth
1:50	Growth	No Growth	No Growth	No Growth	No Growth
1:100	Growth	No Growth	No Growth	No Growth	No Growth

CIP time savings of up to 70%

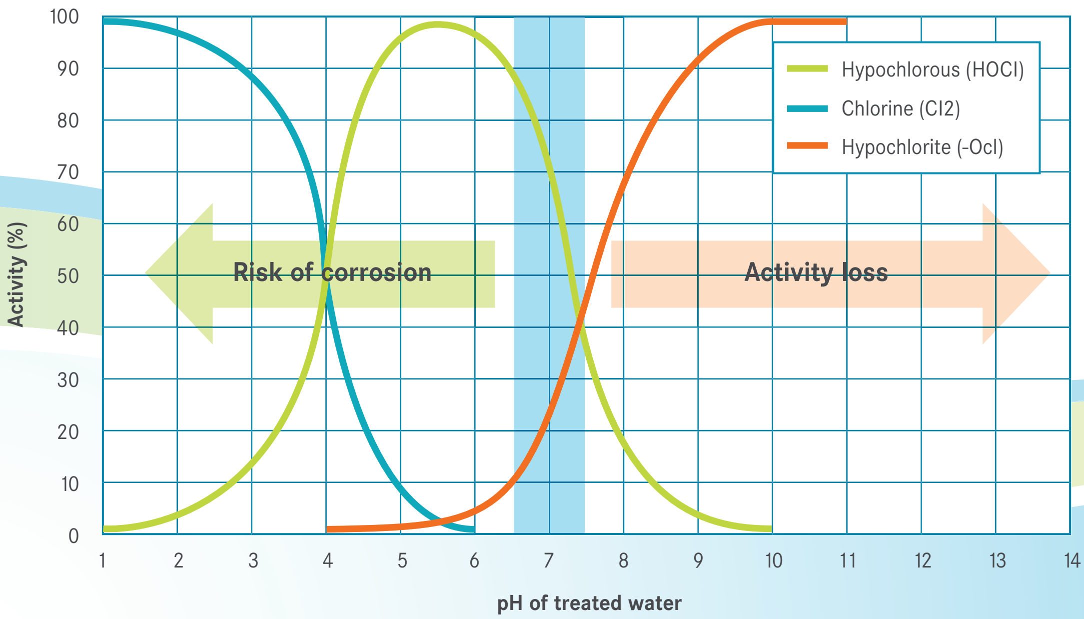
Chemical Cost Saving up to 90%

Water savings of up to 60%

Energy Savings

ECA as a function of pH

Figure 1. Graph demonstrating the different chlorine component formed at different pH levels.



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Alkaline Anolyte:

There are ECA manufacturers that use plate reactors without a membrane, and thus produce an alkaline Anolyte with a pH of ±9. In this instance, the predominant active ingredient of this type of Anolyte is sodium hypochlorite (bleach). Although hypochlorite is relatively safe during storage and use when diluted, it is less effective in eliminating certain microbial species and might require longer contact times or higher concentrations in order to achieve the equivalent antimicrobial activity as TRUE ECA solutions.

Table 3. Effect of pH on Hypochlorous and Hypochlorite concentration.

pH	HC1O(%)	C1O (%)
6.5	92	8
7.0	79	21
7.5	55	45
8.0	28	73
8.5	11	90
9.0	4	96

Hypochlorous acid is a weak acid (pKa of about 7.5), meaning it dissociates slightly into hydrogen and hypochlorite ions as noted in the below equation:

$$HOCl \longleftrightarrow H^+ + OCl^-$$

Between a pH of 6.5 and 8.5 this dissociation is incomplete and both HOCl and OCl^- species are present to some extent. Below a pH of 6.5, no dissociation of HOCl occurs, while above a pH of 8.5, complete dissociation to OCl^- occurs. As the germicidal effects of HOCl is much higher than that of OCl^-, chlorination at a lower pH is preferred.

Acidic Anolyte

Other suppliers of on-site chlorine generators use coaxial (cylindrical) type reactors to produce a gaseous mixture of oxidants with a low pH of ±2.0. Therefore, gaseous chlorine is the predominant specie in this type of Anolyte and it has to be dissolved into water to create an aqueous chlorine solution.

Chlorine gas is extremely harmful when inhaled, therefore strict requirements for handling and storage need to be adhered to. Although this type of Anolyte is an efficient oxidant and disinfectant, the possible formation of THM's (trihalomethanes) when organic material is present, and the hazard aspect, pose a risk to both the manufacturer and end user of this Anolyte. Anolyte produced at such a low pH is also much more corrosive.

Neutral Anolyte

OmniLyte uses a co-axial reactor and produces Anolyte with a pH of 6.8 – 7.2. The neutral pH makes the solutions safe and effective because hypochlorous acid is the predominant oxidant in Anolyte with a near neutral pH. It is scientifically proven that hypochlorous acid is much more effective against a wider range of microorganisms that the standard sodium hypochlorite solution produced at an alkaline pH. As a consequence, hypochlorous acid requires shorter contact time compared to hypochlorite and other equivalent conventional chemicals.

This pH neutral Anolyte is also highly effective as a sporicidal agent and it has a superior ability to remove biofilm when compared to other ECA or chlorine solution types. Additionally there is a significantly reduced risk for the formation of toxic by-products such as THM's due to the presence of both hydroperoxy- as well as chloroxy- radicals which is the distinctive feature of the mixed oxidant anolyte solutions produced by OmniLyte Technology.

Comparison between ECA and other traditional chemicals used

	ECA	Chlorine Gas
Disinfection	300x more effective than Hypochlorite. More rapid disinfection. Broader inactivation range. Oxidants generated on-site - fresh solutions with constant potency.	Effective kill on certain organisms. Slower disinfection. Cannot kill some resistant organisms.
Residual and stability	More stable – Solution shelf life up to 9 months under optimal conditions. Residual effect without affecting taste and odour. Less disinfectant required to maintain residual. No need for Ammonia. Low levels of THM formation. Doesn't produce chlorites/chlorates.	Can vary widely throughout system. Must often be boosted or combined with ammonia to last throughout the system. A higher dosage is required to maintain equal residual. Production of THM's is much greater.
Safety	Uses only salt, water and electricity. Reduction in liability exposure. Avoids special equipment and training for worker safety. Reduced equipment corrosion problems. Avoids fire hazards from chlorine concentrates.	Packed Cl_2 gas is under pressure - potential for explosion or fire. Liability exposure. Poses hazards to surrounding community and to system operator. Potential for chlorine burns and highly corrosive to equipment. Safety equipment and training is necessary.
Generation	Oxidants generated on-site - fresh solutions with constant potency. No hazardous materials to transport or store.	Transportation of hazardous materials requires permits, EISs, etc. Storage of hazardous materials often requires gas scrubber to remove fumes.
Cost Considerations	Higher capital cost is offset by lower lifecycle cost when compare to other chemicals.	Lower installation cost when gas scrubber is not considered but higher lifecycle cost.
Simplicity & Reliability	Fully automated unit requires minimal training and maintenance - periodically add salt and check system. Safety gear is unnecessary. Reactor is easily replaced and only requires replacement once/year.	Regular change-out of cylinders requires complicated safety training and gear. Periodic cleaning required. Cylinders is changed frequently - up to 2x per month.
Taste & Odour	Excellent taste - does not react with ammonia and phenols to produce compounds that normally impart chemical taste and odours. Removes H_2S to improve water quality.	Often imparts a chlorine taste and odour especially when combined with ammonia. Cannot eliminate H_2S taste or odour.
Multiple Uses	Can be used for a wider range of disinfection purposes than Cl_2. Can be used for heavy metal removal - iron and manganese. Used for H_2s removal. Improve filter runs. Improves turbidity - enhancing prefilter flocculation.	Mainly used for disinfection purposes.

Chlorine Dioxide	Ozone	Sodium Hypochlorite
Inactivates most microorganisms. More effective than chlorine less than ozone. Biocidal properties not influenced by pH. Effective against *Cryptosporidium* and *Giardia*.	Strong disinfectant and oxidation agent. More effective than chlorine and chlorine dioxide. Requires very short contact time. Very effective against *Cryptosporidium* and *Giardia*. Biocidal activity not influenced by pH.	At high pH, OCl- dominates, which causes a decrease in disinfection efficiency. Requires higher concentrations. Requires longer contact times. Not effective against *Cryptosporidium* and *Giardia*.
Reacts with many organic and inorganics. Chlorites and chlorates are produced - cause of health effects. Does not produce THM's - ClO_2 aids in reducing the formation of THM's. Residual in system can cause taste/odour problems. It decomposes in sunlight.	Ozone provides no residual. Ozone decays rapidly at high pH and temperatures. Forms DBP's including aldehydes, ketones, organic acids, bromine containing THM's and bromates. Upon decomposition the only residual is dissolved oxygen.	Formation of THM's and other DBP's as well as chlorites and chlorates. The stability of sodium hypochlorite solution depends on the hypochlorite concentration, the storage temperature, the length of storage (time), the impurities of the solution and exposure to light. Sodium hypochlorite solutions degrade over time. Sodium hypochlorite solution is typically not diluted prior to mixing to reduce scaling problems.
ClO_2 gas is explosive at levels >10% in air. CLO_2 dosage cannot exceed 1.4mg/L to limit formations of Chlorites and Chlorates. Measuring ClO_2 gas is explosive. Chlorine dioxide also highly corrosive.	High levels of ozone is toxic when inhaled. Ozone, when correctly applied, has been proven to maintain uniformly low corrosion rates, similar to and frequently better than systems treated with traditional chemicals.	Sodium hypochlorite solution is a corrosive liquid with an approximate pH of 12. Therefore, typical precautions for handling corrosive materials such as avoiding contact with metals, including stainless steel, should be used. Chlorates may be formed, avoid by limiting storage time, high temp and reduce light exposure. Spill containment must be provided for. Safety equipment and training is essential.
Must be generated on-site, easy to do this. Generated as needed and directly injected into diluting stream. Variety of feedstock used like sodium chlorite, Cl_2 gas, NaOCl, HCL or H_2SO_4. Only small samples up to 1% can be stored if solutions are protected from light, chilled, has no unventilated head space.	Generation of Ozone requires high energy and should be generated on-site.	Sodium hypochlorite is produced when chlorine gas is dissolved in a sodium hydroxide solution. Alkaline solution produced with lower biocidal effect. Dilute sodium hypochlorite solutions can be generated electrochemically on-site from salt brine solution.
Equipment is typically rented and costs of sodium chlorite are high. Costs associated with training, sampling and testing for chlorates/chlorites are high.	Initial cost of ozonation equipment is very high. Considerable expenses for operators' training and installation support.	Least expensive when bought in containers, But can be expensive when on-site generators are used. Typically, sodium and calcium hypochlorite are more expensive than chlorine gas.
Oxidant demand study should be completed to determine approx ClO_2 dosage to obtain required CT value for disinfection. Decomposes in sunlight. Generator efficiency and optimization difficulty can cause excess chlorine to be fed into system - can potentially form halogen based DBP's.	Biologically activated filters are needed for removing organic carbon biodegradable DBP's. Maintenance on generators requires skilled technicians. The process is highly automated and very reliable, requiring only a modest degree of operator skill and time to operate an ozone system.	Easiest and least expensive disinfection method. No maintenance required. Easier to use, are safer, and need less equipment compared to chlorine gas.
Concerns about possible taste and odour complaints have limited the use of ClO2 to provide a residual in the system.	Ozone controls colour, taste and odours.	Finished water could have taste and odour problems, depending on the water quality and dosage.
Primary and secondary disinfectant, for taste and odour control. TTHM/HAA reduction, Fe and Mn control, colour removal. Sulphide and phenol destruction. Zebra mussel control. Enhance clarification process.	Ozone can sometimes enhance the clarification process and turbidity removal. Ozone oxidises iron, Manganese and sulphides.	Oxidises iron, Manganese and sulphides.

Material Compatibility

One concern is that use of ECA water will oxidize equipment and facilities, and this can happen if the materials are incompatible with ECA water. Most materials used in food processing are compatible with ECA water at the concentrations normally used. Stainless Steel (e.g. 316L) is corroded less and common plastics used in food processing are generally resistant, including ECTFE (Halar®), PTFE (Teflon®), PVDF (Kynar®), PVC (rigid, schedule 80 or 40), and silicon tubing and gaskets. Natural rubber will readily degrade; however FPM (Viton®) and Teflon gaskets are very stable.

We have not challenged this technology enough to know its limitations.

RW beverage customer quote

Table 4. Material compatibility with ECA water.

NOTE: The highlighted materials will perform satisfactorily under most ECA water uses
NOTE: Some materials rated as excellent in contact with ECA perform poorly in heat treatment (e.g. PVDF or Kynar ®)

Material	Compatibility
304 Stainless Steel	B – Good
316 Stainless Steel	**A – Excellent**
ABS Plastic	B – Good
Acetal (Delrin ®)	C – Fair
Buna N (Nitrile ®)	D – Severe Effect
Carbon Steel	C – Fair
ChemRaz (FFKM)	B – Good
CPVC	A – Excellent
EPDM	A – Excellent
Fluorocarbon (FKM)	A – Excellent
Hypalon ®	A – Excellent
Hytrel ®	C – Fair
Kalrez	A – Excellent
Kel-F ®	A – Excellent
LDPE	C – Fair
Natural Rubber	D – Severe Effect
Neoprene	C – Fair
Nylon	D – Severe Effect
Polycarbonate	A – Excellent
Polyether ether Ketone (PEEK)	A – Excellent
Polypropylene	B – Good
Polyurethane	A – Excellent
PTFE (Teflon ®)	**A – Excellent**
PVC	B – Good
PVDF (Kynar ®)	A – Excellent
Silicone	**A – Excellent**
Viton ®	**A - Excellent**

Ratings: A – Excellent
B – Good: Minor effect, slight corrosion or discoloration.
C – Fair: Moderate effect, not recommended for continuous use. Softening, loss of strength, swelling may occur.
D – Severe effect: Not recommended for ANY use.