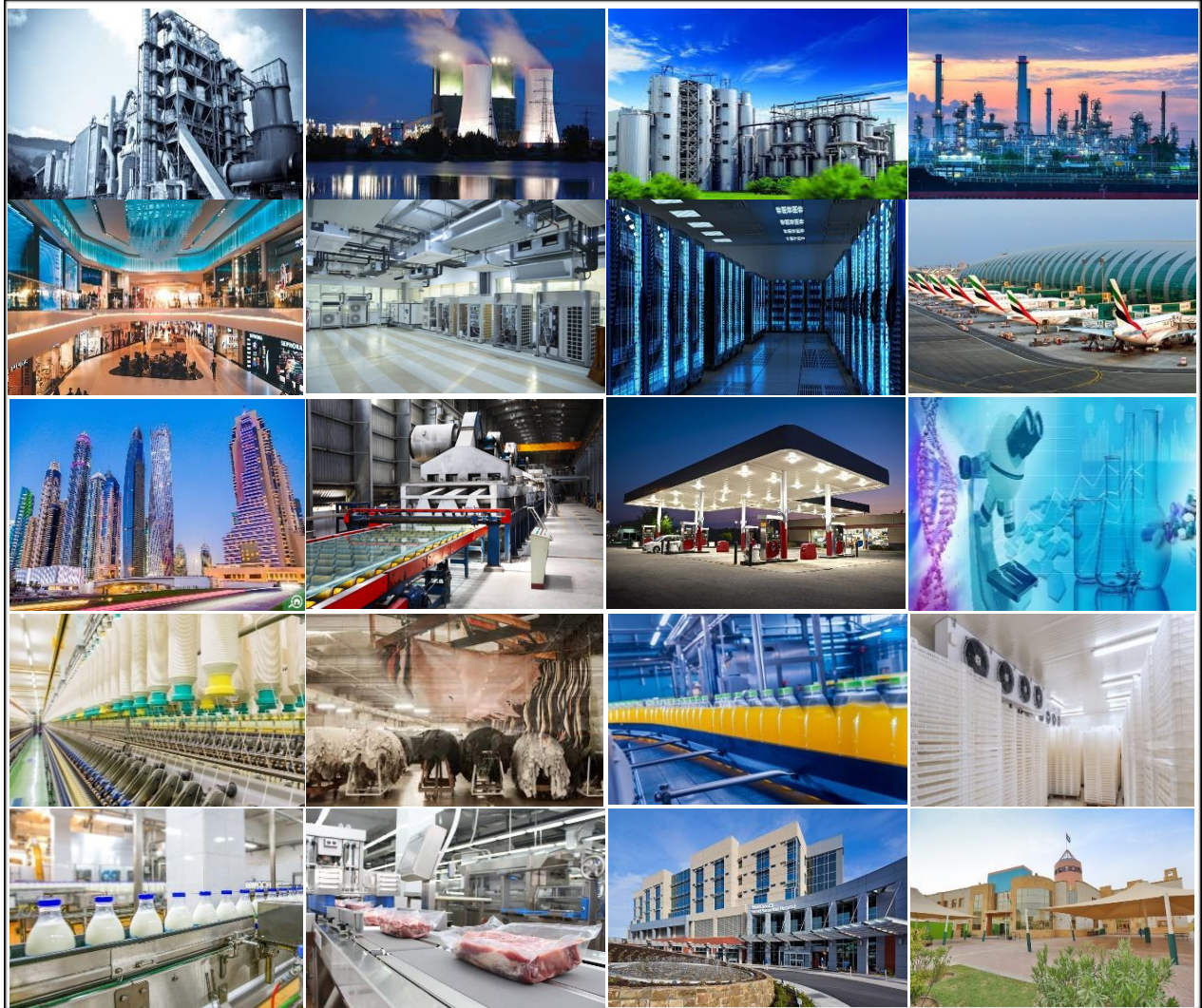


aquagroup

Aktiengesellschaft

Cooling Tower Water Treatment



"ECA Solutions combats innovatively and efficiently."
We are providing the best quality products and technical solutions.
www.aquagroup.com



Controlling of Biofilm, Biofouling, Legionella, and other Microorganisms in Cooling Tower Water of the Industry by ECA Technology, ECA System and ECA Disinfectants of Aquagroup AG, Germany.

The ECA System and ECA Disinfectants Effects and Benefits:

- Germ free and Safe cooling tower water.
- Eliminating of Biofilm, Biofouling, Legionella, Algae and other Microorganisms in cooling tower water and cooling tower water system.
- Just-in-time production of Disinfectant.
- Guaranteed high water quality at all time.
- No storage, no transportation nor handling of dangerous and unstable disinfectants or biocides.
- Simple operation of component.
- Automatic process, reduction of human error.
- Increase heat transfer of cooling tower, lower energy cost.
- Increase working time of the cooling systems.

The Company

Aquagroup Swiss GmbH Dubai Branch is a branch of German Company (Aquagroup AG). It is a technology-based company established with the aim to significantly improve water quality and general hygiene conditions. We are specialized in water treatment and disinfection. Our concepts save water and time, reduce energy costs and reduce the use of very hazardous chemicals. Our main goal is to show the customers as many fields of application and savings potentials as possible while offering customized solutions to tackle wide variety of germ issues. With the Aquagroup's competence team, a staff of highly trained food engineers, hygienists, chemists, biologists, microbiologists and field application engineers provide the customers with just the right expert for any task throughout the entire process.

Neglecting the issue of water risk management can have a severe impact on the water system health and well-being of guests and personnel. Our company guarantees reliable standards of your water wherever it is used.

In recent years, the public has become increasingly aware of the water contamination, water quality, water safety and potential risk of biofilm harbouring pathogenic microbes. Management of superior hotels and good buildings dedicated to upholding the highest quality standards cannot afford the massive media exposure, subsequent image loss and drastic financial repercussions that occur after an outbreak of Legionella and other microorganisms.

Our company provide technical support to the organization or industry. This starts with intensive pre-surveys identifying areas of weakness in the current system, covering not only the technical engineering aspects but also the analysis of the source of potential risks. The provision of a concept integrates our solution into an existing functional system to increase safety. We always guarantee risk mitigation through the permanent elimination of biofilm ensuring high water quality, according to WHO, GSO and other International Water Standards for both globally and locally.

What is ECA?

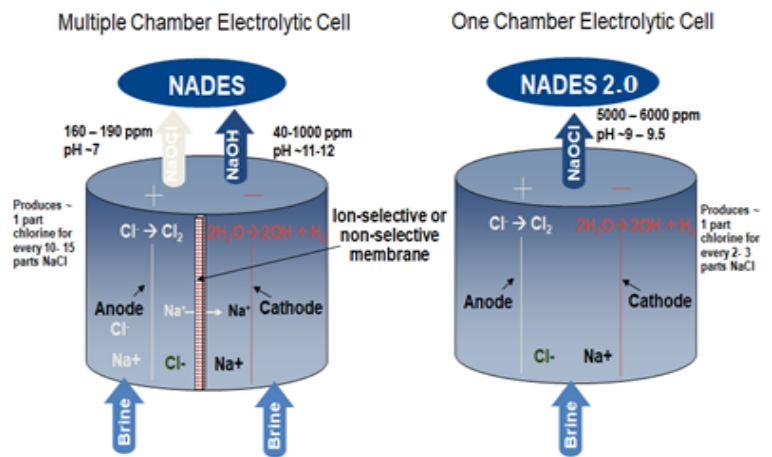
ECA Technology means Electro Chemical Activation Technology. Our ECA disinfectant product NADES or NADES 2.0 are Electrochemically Activated (ECA) solutions which are produced through our specially designed devices. A saturated brine solution is passed through a cell and the NaCl is split into chemical streams via electrolysis.

The active agents in our products are electrolysed water with high ORP value (Oxidation Reduction Potential) and chemically active agent NaOCl.

ECA advantages

The ECA Generator offers the advantages of producing active chlorine out of a harmless Sodium Chloride salt solution and electricity. Both are **easy to handle** and **available worldwide**. This process substantially reduces the risks involved in the distribution, transport, storage and handling of the hazardous active chlorine treatment of process water. Conventionally manufactured NaOCl can produce harmful chlorates during storage.

The **just-in-time** concept of NADES or NADES2.0 production leaves no time for chlorates building. There is less handling of hazardous goods through the automated processes; this also results in simple operation of the generator's components. The ECA solutions NADES or NADES 2.0 are effective against Biofilm and have a high anti-microbiological (all kinds of bacteria specially legionella, algae, and anti-viral efficacy).



Health & Safety

The health and safety for people is of paramount importance. Continuous investments in the design and security of water treatment are made to ensure optimal results. One of the highest risks in water management is that of biofilm.

Biofilm Formation



Free swimming cells alight on a surface and attach

New genes are expressed to synthesize matrix polymers

Cells coordinate by ex-changing molecules

Cooling water systems and cooling tower used in Power plants, Petroleum (Oil and Gas) refineries, Petrochemical plants, Natural gas processing plants, Food processing and Beverage plants, District Cooling Systems, Nuclear power stations, HVAC systems for cooling buildings, Sugar industry, Distilleries, Chemical Industries, Pharmaceutical industries, Industries canning and juice, Glassworks, Ironworks, Plastics industry, Rolling mills and wire mills, Iron foundries, Steel Mills, Aluminium Plant Non-ferrous metals manufacture industries, Pulp & Paper Mills, Manufacture of wood, Disposal Waste, Cold Storage, Cement Plant and Data Centres, Ethanol Production Plant, Mining industry and Leather industry.

Due to high temperatures and permanent scrubbing of nutrients, cooling towers and evaporative condensers shape a perfect environment in which microorganisms can thrive. Controlling and preventing the growth of microorganisms in a cooling tower system is extremely important for health reasons and required to keep the tower running under optimal operating conditions.

Microorganisms may cause serious problems in the system through which the cooling water circulates:

- Build-up of odor and slimes. Slime formation requires frequent mechanical cleaning of the fills.
- Loss of heat transfer due to the low thermal conductivity of the biofilm and inorganic deposits which further impede the heat exchange.
- Increased corrosion rates due to acidic by-products secreted by anaerobic bacteria present in the biofilm and blocking of contact of corrosion inhibitors with the metal by the biofilm layer.
- Increased pumping energy required to circulate the cooling water in the presence of biofilm which has a high friction factor.
- Formation of mineral scale. All scaling begins at a site where nucleation can occur. Biofilm may provide a site, and its existence can contribute to scaling problems.
- Unacceptable health risks, such as the formation of Legionella species, which in turn may lead to an outbreak of Legionnaires' disease, a possibly fatal form of pneumonia. The costs of remedial action to correct these problems, maintenance costs and downtime (lost production) must be added.

Many different microbes have demonstrated the ability to survive in cooling tower water system with some possessing the ability to grow and/or produce biofilm. Primary pathogens survive and protect themselves.

Our ECA Solutions NADES and NADES 2.0 are;

- Environmentally Friendly
- Non-Irritating
- Germ Free
- Quick Acting
- Non-Hazardous
- Non-Toxic

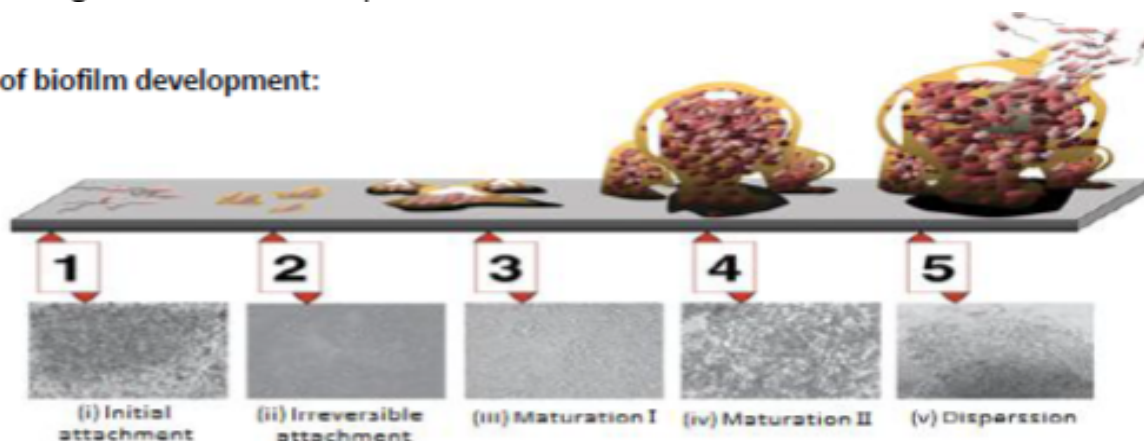
Why to Choose Aquagroup;

- Flexible Financing
- Pre-Survey
- Installation
- Training
- Commissioning
- Service and

Maintenance

- 24/7 Hotline

Five stages of biofilm development:



Fighting the biofilm — a hopeless battle?

In cold water < 20 °C *Legionella pneumophila* does not multiply but remains dormant. In countries with hot climates the cold water inlet temperature often exceeds 25 °C, ideal for microbiological growth and biofilm formation. It is a widely known fact that conventional free active chlorine solutions are relatively ineffective in eliminating biofilm.

Fighting Microbiological Fouling Cooling water systems are constantly inoculated with microbes from the makeup water, process contamination and the air. Controlling microbiological fouling depends upon effective control of all these parameters: Water quality—organic contaminants, such as oil and grease, fertilizers, food products and by-products, dust and silt from the air, leaves, and suspended solids have a major effect on the potential for microbial growth. pH—changes in pH, in the range of 6.5–9.5, do not significantly affect microbial growth rates in cooling water treatments. Water velocity—the flow rate of cooling water is a critical factor, particularly in areas of low velocity such as in shell-side heat exchangers, where debris can settle out and provide favourable conditions for microbial activity. Biocide treatment—The application of biocides, by either slug or continuous addition, is used to control the level of microbes, depending on a specific plant’s requirements. Underfeeding a biocide can rapidly lead to rebounds in the population of microorganisms or may not provide sufficient kill to ensure adequate control. Biofilm control—Removal or control of the biofilm on system surfaces is critical. While bulk water concentration of microorganisms raises the potential for re-inoculation and health hazards, biofilm raises the potential for corrosion.

Microbiological deposits

Biofilms severely restrict heat transfer. Slime masses bind inorganic and organic foulants and plug systems. Algae and fungi cause extensive plugging and fouling of heat exchanger tubes, water lines, tower spray nozzles, distribution pans, screens and fill. Microbiological fouling also contributes to under-deposit corrosion as well as the growth of corrosion-causing bacteria.

Possible types of micro-organisms that exist in cooling water.

Micro-organisms	Impact on cooling tower system
Algae	<ul style="list-style-type: none"> • Provide a nutrient source for bacterial growth • Deposit on surface contributes to localized corrosion process • Loosened deposits can block and foul pipe work and other heat exchange surfaces.
Fungi	<ul style="list-style-type: none"> • Proliferate to high number and foul heat exchanger surfaces
Bacteria	<ul style="list-style-type: none"> • Some types of pathogenic bacteria such as Legionella may cause health hazards • Sulphate reducing bacteria can reduce sulphate to corrosive hydrogen sulphide • Cathodic depolarization by removal of hydrogen from the cathodic portion of corrosion cell

A Legionella water management program consists of:

1. Establishing a water management program team.
2. Describing the building water systems using words and diagrams.
3. Identifying areas where *Legionella* could grow and spread.
4. Deciding where control measures should be applied and how to monitor them.
5. Establishing ways to intervene when control limits are not met.
6. Making sure the program is running as designed and is effective.
7. Documenting and communicating all the activities.

www.cdc.gov/legionella/WMPtoolkit

SOURCE: ASHRAE 188: Legionellosis: Risk Management for Building Water Systems June 26, 2015.

Legionella bacteria in Cooling Tower Water:

Hazards and risks

Cooling towers, because of their mode of operation, can create ideal conditions for microbial growth and they also deliberately require the creation of sprays and aerosols, which can be dispersed over a wide area if not controlled properly. Those at risk of exposure, include not only those who work in the premises but also others in the vicinity including members of the public. Employees involved in cleaning or maintenance may be at increased risk.

Cooling towers operate at temperatures which can provide an environment for the growth of microorganisms in the water (20-45°C), including *Legionella*. A specific strain of legionella bacteria (*L. pneumophila*) can cause a Legionellosis infection in susceptible individuals and presents the most serious hazard. If the water is allowed to become heavily contaminated and to escape from the unit in aerosol form and is then inhaled by susceptible persons in the vicinity, cases of Legionellosis may result.

The presence of *Legionella spp.* alone should not be regarded as a cause for alarm, the bacteria are commonly found in both natural water sources and artificial water systems. It is only when levels proliferate in favourable conditions (nutrients are available and the water is stagnant), that problems arise.

Legionella Control In Water Cooling Towers:

The ideal conditions for growth of *Legionella spp.* in water include:

- ☒ A high microbial concentration, including algae, amoebae, slime and other bacteria
- ☒ Presence of biofilm, scale, sediment, sludge, rust or other organic matter
- ☒ Presence of degraded plumbing materials, such as rubber fittings, which may provide nutrients to enhance

bacterial growth *Legionella spp.* and *L. pneumophila* are listed among biological agents *which can cause human disease and might be a hazard to employees, although it is unlikely to spread to the community and in respect of which there is usually effective prophylaxis or treatment available*

Problems associated with cooling systems before treatment:

- Scaling and corrosion of pipes caused by biological activity (biofilm and algae growth)
- Fouling of filling material caused by algae in cooling tower
- Frequent emptying of basins from sludge and bioactive material
- Poor heat transfer due to biofilm formation - loss of energy / money
- Usage of dangerous chemicals in case of algae growth prevention
- Generally high operating and maintenance costs
- No effective on-line biological activity control

What preventive measures should be taken with water cooling towers in the workplace?

Exposure can be avoided completely by paying close attention to the mechanical design of the equipment, by using chemical treatment to maintain good water quality and system cleanliness. An important element of the design is the need for high efficiency *drift eliminators* to minimize the water droplets and aerosols discharged into the atmosphere.

The routine microbiological monitoring of the general aerobic heterotrophic bacterial count (total viable count (TVC)) is an important indicator of whether microbiological control is being achieved. This should be routinely undertaken for cooling towers.





ECA Solution is non-irritating

ECA Solution is non-irritating and is authorized for use as a disinfectant for drinking water or water carrying systems; and at the same time it is completely safe to use and compatible with all materials and its corrosion level in the application concentrations is as low as that of drinking water.



ECA Solution frees from germs

ECA solution reliably destroys any microorganisms and its spores even in the weakest concentration levels. The reason is the unique working mechanism, which takes full effect and does not allow any resistance to build up.



ECA Solution is quick acting

ECA Solution effect in seconds even in the weakest concentration levels and quickly destroys microorganisms.

We remain at your disposal at any time.

Please contact us if you wish to evaluate your specific saving potentials and applications scenarios!

Aquagroup Device:

- Risk management tool: all parameters are continuously monitored before, during and after the production process.
- User-friendly Touch Screen. (Optional)
- Integrated data logger for recording all parameters.
- Solenoid valve with time control for water and product.
- Service-friendly.
- Economical and environmentally friendly.



Expert Competency:

- Interface between hardware provider and Expert knowledge.
- Highly qualified team of chemists, microbiologists and food scientists.
- Field experience & support through validation.
- Fully equipped laboratory for internal analysis.



AQUAGROUP SWISS GMBH DUBAI BRANCH

Address: Jebel Ali Industrial Area - 1, P.O Box: 37925, Dubai, UAE.

Phone: +971 4 8857934 **Fax:** +971 4 8829934

Mobile: +971 50 7082327 **Email:** m.javaidd@aquagroup.com

www.aquagroup.com