Waterpower Systems

Sample obtained directly from a Waterpower cell (bottle-left) shows high separation efficiency on a multiple component sample (bottle-right).

… advanced water treatment & recycling technology.

The implementation of increasingly stringent environmental legislation is a trend shown in the government policies of nearly all Countries. This has resulted in the world-wide search for wastewater treatment systems that provide higher efficiency, more versatility and also lower cost of operation in removal of water-based contaminants, than treatment systems presently available in the marketplace.

A fully configured skid-mounted electrocoagulation system ready for delivery to site.

The technology, by virtue of the excellent removal efficiencies obtained in removal of contaminants and the broad spectrum of industries in which the technology is applicable, is well positioned as a solution provider to water quality concerns on a global basis.

Wide Ranging Applications

Aquenox Pty. Ltd., a division of Cardia Technologies Ltd. has designed, developed, manufactured, patented and field tested fully-automated Electrocoagulation systems that provide superior performance in comparison to presently available water treatment methods. The systems are manufactured to comply to the rigorous operation and safety requirements at mine-sites, food-processing, industrial and municipal locations.

Suitable for High Volume Effluent Applications.

Systems are designed for a large range of flow rates- ranging from 10 litres per minute to 500 litres per minute treatment capacity.

Each system includes sophisticated valving that operates automatically for incoming sample feed, level compliance, discharge to a development tank and outlet.

Aquenox has demonstrated *Waterpower Systems* technology to over fifty organisations with independent laboratory results confirming the high efficiency and broad range of applications in which the technology applies. Based on comparisons of cost per kilolitre, the Aquenox system is very competitive, with excellent margins and return on capital invested.

A large-capacity system has operated at the Queensland site of one of Australia's largest mining companies for a continuous operation appraisal period of twelve weeks. The Waterpower System treated ore-loading facility wash-down pits for the removal of ten or more metals together with the simultaneous removal of oils, greases and surfactant products from the wash-down bays.

Global Perspective.

Whilst Aquenox has to date focused on proving the technology within Australian markets, the high back-log of overseas interest in the technology underpins its universal scope on a world-wide basis. This international interest has lead Aquenox to establishing *Waterpower Systems* manufacturing facilities and sales offices in China and Hong Kong.

Industry Applications.

Mining

Process Waters	Effluent discharge compliance.
Tailings	Suspended solids removal, metals harvesting
Refining	Metals removal, pH treatment -discharge compliance
Ore Wash Down	Water re-use or recycling by metals removal
Ore Loading Facilities	Metals, greases and detergent removal
Source Waters	Bore and dam water - suspended solids and metals.
Leachates	Treatment for rehabilitation areas
Acid Mine Drainage	Metals removal and pH adjustment
Kaolinites/Bentonites	Improved rate of settling and compaction
Coal Fines	Suspended solids removals for water re-use
Radio-Nucleotides	Removal of radio-actives for compliance and re-use

An integrated control system maintains all run parameters, valve conditions and includes safety interlocks for completely unattended operations.

Industrial

Metals Processors	Dissolved metals removal
Food and Beverage	Fats, oils, greases, BOD, nutrients
Paints, Pigments, Dyes	Organic separation
Petrochemical	Emulsified oil removal
Pulp and Paper	BOD, nutrients, suspended solids removal
Abattoirs	BOD, fats, oils, greases, nutrients, suspended solids
Tanneries	Chromates, pH adjustment
Chemical Producers	Catalyst and other contaminant removal
Vegetable Oils	Emulsified oils and fats removal
Electroplaters	Metals removal, pH adjustment
Textiles and Laundries	Dirt and phosphate removal, water re-cycling
Dairy	BOD and fats removal

Municipal

Sewerage	Phosphate removal, fats, oils, greases, choliforms
Potable	Metals removal, e.g. iron, manganese, silicates
Waste Services / Landfills	Leachate and run-off treatment for metals, solids.
Waste Services / Organics	Water/Oil separation
Waste Services / Hazardous	Quarantine wastes - destruction of bacteria, viruses, cysts

Agricultural/Primary

Pesticides, Herbicides	Removal of organic species
Bore Waters	Metals and suspended solids removal
Nurseries	Water reticulation through removal of bacteria.
Animal Wastes/Wash-Down	Phosphates, bacteria, viruses and cysts

Other

Acid Sulphate Waters	Neutralisation, suspended solids
Cooling Towers	Algae destruction, water hardness removal
Marine-Bilge Water,	Microbes, metals, oils and greases
Marine - Ports	Loading facilities catchment pits
Transport	Vehicle, aircraft, train: wash-down bays – metals.
Wood Treatment	CCA removal
De-salination	Silicate removal prior to reverse osmosis

The Aquenox Waterpower Systems EC Cell can be designed for flows in the range of 10-500 litres per minute. Image at left shows the modular AQ30-005 design, having capacity 30LPM

Regulatory Trends.

With reference to all the above applications, there is a trend towards more stringent compliance requirements, increased financial penalties for polluters and increased policing that compliance is continuously maintained. Aquenox is committed to continuous products and applications development, thus providing the most efficient wastewater treatment technologies possible

Control system constantly checks system integrity and provides alarms and automatic shut-down logistics.

Few chemical inputs reduce sludge disposal requirements.

It is envisaged that a significant growth area will be in implementation of water re-use and water re-cycling strategies in the next decade, both as a water conservation measure and for the economic benefits in reducing water supply volumes (hence costs).

As Electrocoagulation does not require the addition of chemicals (which often eliminates water re-use as an option) the technology is ideally suited to serve the growing interest in recycling strategies.

Key advantages.

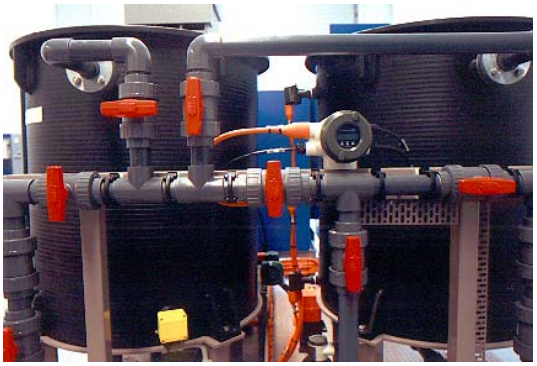
- Electrocoagulation is a single and compact technology that processes multiple contaminants, simultaneously.
- Removes metals at very high removal efficiencies across a broad range of concentrations, across a wide variation in concentrations from one day to the next and across a broad range of pH. The process forms a low volume; inert sludge of lower volume than chemically treated waters. The sludge de-waters more efficiently than chemically formed sludges.
- Removes suspended and colloidal solids - down to micron level particle sizes and in loading up to many grams per litre loading levels.
- Breaks oil emulsion in water, removes fats, oils and greases.
- Destroys bacteria, viruses and cysts.
- High removal efficiencies for BOD and COD. Removes nutrients, particularly Phosphates at very high efficiencies.
- System operates across a broad pH range - does not require the addition of pH modifying chemicals - saves supply and transport costs.
- Forms large, uniform particle sized sludges that can be easily separated. Inert sludges do not require special handling and cartage as exists with most chemically formed sludges.
- Does not require coagulant chemicals - reduces sludge volumes considerably.

- An option is that discharged water can be recycled back to the source - there is a synergistic effect on contaminant removal in receiving waters by passing Electrocoagulated waters to the source.

- System designs permit the operation of very large scale or very small capacity systems. Results achieved on small-scale systems can be achieved on large-scale units through proven process-modelling algorithms.

- Low maintenance system that is purpose designed for minimal operator attention.

- Systems built in Australia have locally supplied, readily available components.



System records flow and power usage thereby providing operational costs on a $ per kilolitre of effluent treated basis.

International and local water quality managers viewing rapid separation of contaminants in a treated waste stream.

Background to the technology.

Electrocoagulation is based on the principle of introducing an electric current to various types of electrode/s, generating positive ions in an energetic environment that reacts with negative charged species in the water. Correspondingly, positive charged contaminants are destabilised and react with negative charged ions in the reaction chamber (Electrocoagulation cell).

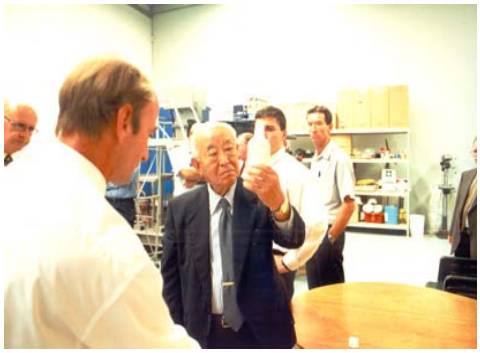
Low cost locally available electrode plates are easily removed and replaced on a periodic basis.

The products of reaction are discharged as a stable and inert floc, that coagulates, then precipitates in solution. The coagulated material de-waters easily and can be separated from solution by a variety of secondary separation techniques – in particular a centrifugal process or dynamic sand filter.

Electrocoagulation is applicable in the removal of a diverse range of contaminants. The technology is largely interference free and operates across a broad range of pH (4-9) and conductivity (salinity) of solutions.

Regular and low cost scheduled service procedures ensure continuous operation is maintained. It is expected that such maintenance be budgeted for quarterly (of 2 days duration), with 2 special visits for emergencies.

History of the technology.



Electrocoagulation, which is the removal of contaminants in a waste stream by an electrically induced chemical reaction, is a technology based on fundamental scientific principles. These basic scientific principles date back to experiments conducted in Electro-Chemistry in the early 1900's.
In the last decade or so, advanced research (primarily conducted in USA) has resulted in a better understanding and characterisation of the various types of on-site chemical reaction processes that take place in an Electrocoagulation system.

Basic principles of operation.

The Electrochemical reactions that have been characterised in an Electrocoagulation process are as follows:

Seeding:	Metal ions generated by applying current to the Electrodes at controlled dissipation rates become centres for reactions whereby larger, stable and insoluble complexes form, usually as the metal oxide form/s.
Emulsion breaking:	Results from Oxygen and Hydrogen bonding into induced dipoles at molecular sites of oils, fats, greases and other Organics.
Halogens:	As the metal ions bind themselves to halogenated Hydrocarbons, resulting in large insoluble complexes that separates water from pesticides, herbicides and Halogenated organics.
Bleaching:	By the Oxygen ions produced in the reaction chamber, that in turn oxidises dyes, inks, cyanides, bacteria, viruses and biohazards.

Electron Flooding: Induces Van Der Waal (electrical attraction between ions with different charges) type interactions that results in the removal of suspended solids in water and also creates an osmotic pressure that ruptures bacteria, viruses and cysts.

Oxidation and Reduction That results in the most stable species formed by dissipation of energy through the reaction kinetics.

Induced pH shifts: A by-product of other in-situ processes that results in acid and alkali influent solutions being discharged with shifts of solution pH toward the neutral range.

Benchtop Demonstration

Above image shows "live" demonstration of the effectiveness of the Aquenox Waterpower process. This example shows dye effluent (collected in tank at left) treated through the Waterpower process, resulting in clean water discharged into fish-tank (shown at right).