Electrocoagulation

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Variable Electro Precipitation

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Overview

- What is electro-coagulation ?
- Process Flow & Treatment Results
- Percent (%) Removal
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What is Electrocoagulation ?

Electro coagulation *("**electro**", meaning to apply an electrical charge to water and "**coagulation**", meaning the process of changing the particle surface charge, allowing suspended matter to form an agglomeration*) is an advanced and economical water treatment technology.

The technology removes contaminants that are impossible to remove by filtration or chemical treatment systems, such as emulsified oil, total petroleum hydrocarbons, suspended solids, and heavy metals.

A fully automated modular system has no filters to clean or replace and does not require the use of chemicals.

Water Treatment Systems using EC (Electro-coagulation)

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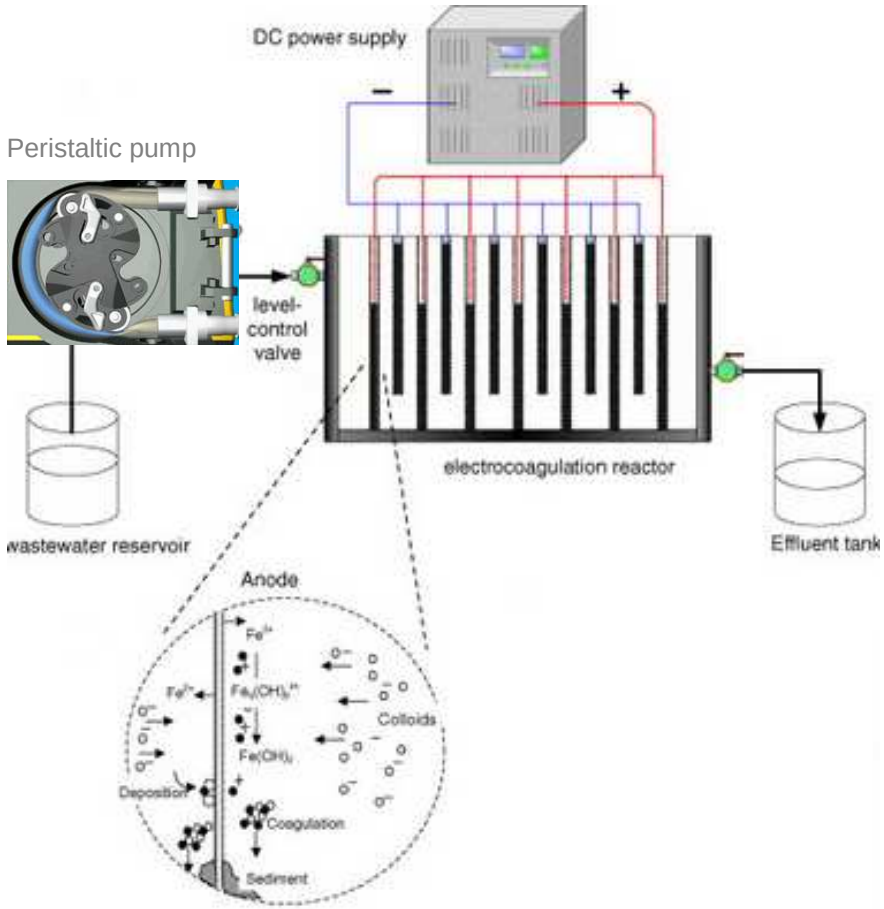
Electrocoagulation: **Process Flow**



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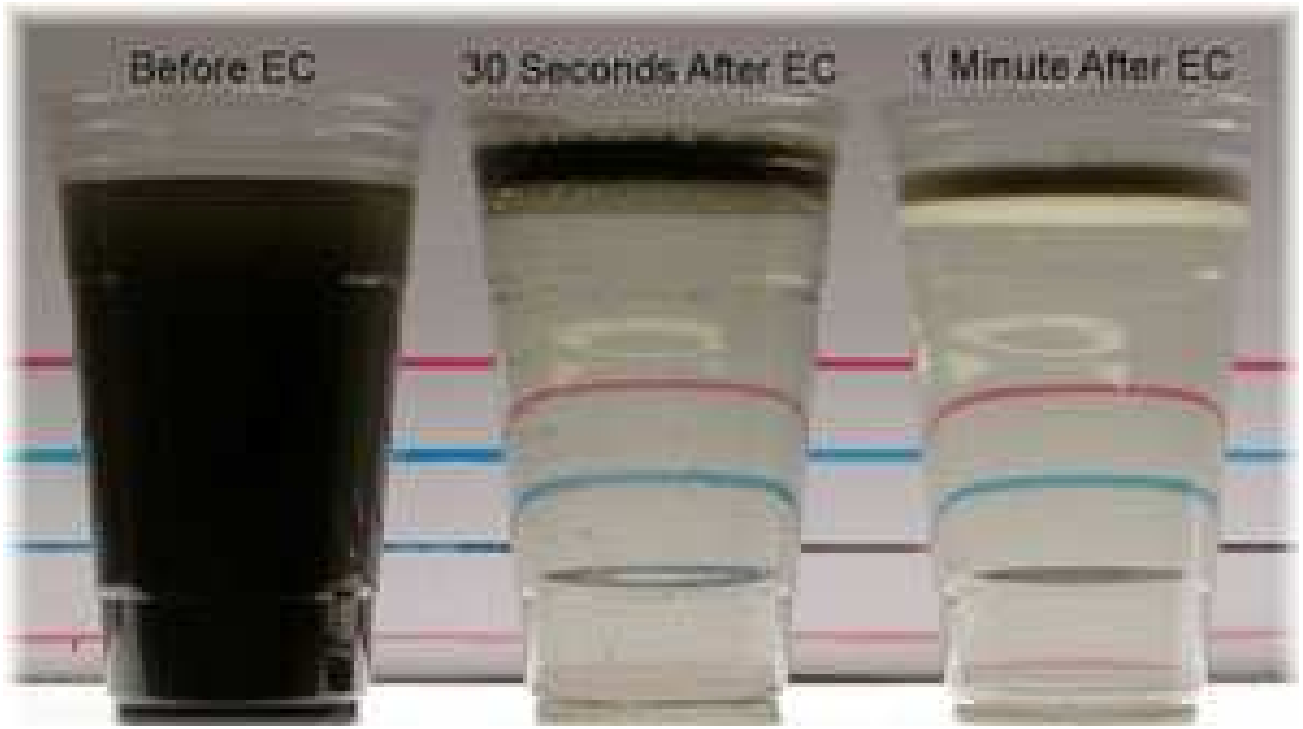
Electrocoagulation: **Treatment Results**



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Electrocoagulation: **Treatment Results**

Water Test Results from a Colorado Energy Company in May 2013

Frac Flowback

Featured Case Study from a Colorado Energy Company in May 2013

Water Test Results From a Southeastern Poultry Plant in May 2013

Food Processing

Results from a Utah Produced Water Treatment Facility in April 2013

Produced Water

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Electrocoagulation: **Percent (%) of removal**

Contaminant	Source	Raw mg/L	Treated	% Removal
Aluminum	Can Mfg.	224.00	0.690	99.70%
Arsenic	Steam Cleaner	0.30	<0.010	96.70%
Barium	Steam Cleaner	8.00	<0.100	98.70%
Calcium	Cooling Tower	1,321.00	21.400	98.40%
Cadmium	Electroplating	31.00	0.340	98.90%
Chromium	Condenser Wash	139.00	<0.100	99.90%
Cobalt	Steam Cleaner	0.13	<0.050	62.00%
Copper	Electroplating	287.00	0.480	99.80%
Iron	Acid Mine	151.00	0.570	99.60%
Lead	Manufacturing	8.21	0.230	97.20%

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Electrocoagulation: **Percent (%) of removal**

Contaminant	Source	Raw mg/L	Treated	% Removal
Magnesium	Ammunition Plt.	6.40	<0.100	98.50%
Magnesium	Ammunition Plt.	0.29	0.050	83.20%
Mercury	Steam Cleaner	0.01	<0.002	66.60%
Molybdenum	Steam Cleaner	0.18	0.040	80.60%
Nickel	Manufacturing	185.00	0.200	99.90%
Silicon	Acid Mine	21.70	0.100	99.50%
Vanadium	Steam Cleaner	0.23	<0.010	96.60%
Zinc	Plating	221.00	0.140	99.90%
BOD	Fish Process	40,500.00	750.000	98.10%
TSS	Municipal POTW	5,620.00	25.000	99.60%
FOG	Food Process	18,165.00	28.000	99.90%
Bacteria	Municipal POTW	110MM	2,200.000	99.99%

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Electrocoagulation: **Applications**

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Electrocoagulation: **Applications**

- **Ground Water Cleanup:** Electrocoagulation is extremely effective in the removal of naturally occurring salts in well water, as well as the separation of iron, magnesium, calcium, metals, nitrates and sulfur. EC is also well suited for the reclamation of ground water that has been contaminated with heavy metals, high molecular weight hydrocarbons and haliginated hydrocarbons.
- **Surface Water Cleanup:** Electrocoagulation is used to remove bacteria, viruses and cysts from surface water, thereby rendering contaminated waste streams into potable water. EC is particularly effective in the removal of life threatening contaminants such as giardia and crypotosporidium.
- **Process Rinse Water and Wash Water:** EC routinely remediates process and rinse water from the electroplating, computer board manufactures, textile industry, paint rinse water, steel production, mining industry, automotive industry, equipment repair industry, stack wash water, and pulp and paper. In most cases, the treated water can be recycled and reused.
- **Sewage Treatment:** Electrocoagulation has proven effective in treating sewage water, sewage sludge concentrations, and sewage sludge metal fixation sufficiently to enable land application.
- **Cooling Towers:** EC is used to pretreat water entering towers as well as blow down water to remove algae, suspended solids, calcium, and magnesium buildup, thereby eliminating costly replacement water.
- **Radioactive Isotope Removal:** Metal ion isotope removal from cooling water at a nuclear power plant site demonstrates another effective application of electrocoagulation.

Electrocoagulation: **Applications**

- **Water Pretreatment:** Water pretreatment with EC has proven effective in removing bacteria, silica and TSS prior to subsequent polishing with reverse osmosis, ultrafiltration, nanofiltration, photocatalytics.
- **Water Reuse Resulting in Zero Discharge:** EC cost effectively treats electroplating rinse water, stream cleaners, pressure washers, mining, food processing, drilling mud, etc.
- **Food Processing Industry:** Meat, poultry, fish, total plant effluent to harvest additional protein and fat for sale, salad oil, beverage, potato processing, vegetable washing, equipment washing.
- **Antifreeze Regeneration:** The removal of metals, oils, and dirt, from the antifreeze. Large fleet users include governments, mining companies, bus companies, trucking companies, service stations, auto dealerships, etc.
- **Gel Fracking Treatment:** Fracking treatment gel is also known as a proppant. A proppant is a solid material, typically treated sand or man-made ceramic materials, designed to keep an induced hydraulic fracture open, during or following a fracturing treatment. It is added to a fracking fluid which may vary in composition depending on the type of fracturing used, and can be gel, foam or slickwater-based. Electrocoagulation has been used as a successful treatment of fracking gels and should be considered in any water treatment management of hydraulic fracturing.
- **Produced Water Treatment:** Produced water is a term used in the oil & gas industry to describe water that is produced when oil and gas are extracted from the ground. Oil and gas reservoirs have a natural water layer (formation water) that lies under the hydrocarbons. Oil reservoirs frequently contain large volumes of water, while gas reservoirs tend to have smaller quantities. To achieve maximum oil recovery additional water is often injected into the reservoirs to help force the oil to the surface. Both the formation water and the injected water are eventually produced along with the oil and therefore as the field becomes depleted the produced water content of the oil increases. Electrocoagulation is used as an extremely cost effective and scalable treatment for the reuse of produced waste water.

Electrocoagulation: **Applications**

- Textile and Dye Industry
- Ground water cleanup
- Process rinse and wash water
- Potable water
- Sewage treatment
- Cooling towers
- Radioactive isotope removal
- Pretreatment for reverse osmosis, ultra filtration, nanofiltration, photocatalytics
- Water reuse resulting in zero discharge
- Metal recovery
- Influent quality water control
- Industrial waster water

Electrocoagulation: **Capabilities**

- Removes heavy metals as oxides that pass TCLP
- Removes suspended and colloidal solids
- Breaks oil emulsions in water
- Removes fats, oil and grease
- Removes complex organics
- Destroys & removes bacteria, virus & cysts
- Processes multiple contaminants

Toxicity characteristic leaching procedure (**TCLP**) is a soil sample extraction method for chemical analysis employed as an analytical method to simulate leaching through a landfill. The testing methodology is used to determine if a waste is characteristically hazardous (D-List). The extract is analyzed for substances appropriate to the protocol.

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Electro coagulation: **Percent (%) of removal**

The following well documented lab and field tested results are routinely attained through electrocoagulation.

Operation	% Removal
BOD	90+ %
TSS (Clay, Coal, Silt, etc.)	99 %
Fats, oil and Grease in Water	93 - 99 %
Water in sludges	50 - 80 %
Heavy Metal Removal	96 - 99 %
Phosphate Removal	93+ %
Bacteria, Viruses & Cysts	99.99+ %

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Electrocoagulation: **Benefits**

Electrocoagulation is the distinct economical and environmental choice for meeting water treatment discharge standards and compliance requirements. Capital and operating costs are generally recovered by eliminating discharge fees and fines, harvesting resources, and significantly reducing water replacement costs.

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Electrocoagulation: **Benefits**

- Available in portable or fixed based units
- Partnered with other water remediation professionals adding pre and posted treatment integrated solutions
- Available in **2**, **10**, **30**, **100**, **500** and **1,000** GPM sizes but can be sequenced to accommodate any flow rate
- Fully automated with remote computer monitoring
- Skid mounted for the smallest possible footprint
- Designed for mobility so they can be redeployed following a rigorous quality control inspection
- Very low cost grid power or can be equipped with a generator reducing maintenance & operating cost
- Mets or exceeds water regulatory quality standards

Electrocoagulation: **Benefits**

- Capital cost significantly less than alternate technologies
- Operating cost significantly less than alternate technologies
- Low power requirements
- Generally no chemicals additions
- Metal oxide formation pass TCLP
- Low maintenance
- Minimal operator attention
- Handles wide variation in the waste stream
- Consistent and reliable results
- Sludge minimization
- Treats multiple contaminants

Electrocoagulation (EC) Systems

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Container EC Systems and Trailer Mounted Systems

We specialize in the treatment of produced, frac flowback, food processing and industrial waste waters !

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500 gal/min Field Unit - Trailer Mounted Systems

EC System can significantly reduce bacteria, suspended solids, heavy metals, fats, oil and grease

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20’ Containerized EC systems

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EC Systems - Small Systems

F&T Commercial Water Treatment Systems

2 GPM Variable Electro Precipitation™
Commercial Test System

2 GPM Variable Electro Precipitation™
Commercial Test System

10 GPM Variable Electro Precipitation™
Commercial Test System

Flow rates: 2 gallons/min to 10 gallons/min

Very portable, can be moved very easily !

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EC System – Large Systems

VARIABLE ELECTRO PRECIPITATOR™

Commercial Production Systems

Flow rates: 500 gallons/minute & Larger Flow Rates Systems

The difference between a standard electro coagulation (EC) unit and a Variable Electro Precipitation unit are in the enhanced flow path and the unit electrode connections.

The Variable Electro Precipitators flow path has been designed to maximize retention time and to increase the turbulence of the water within the unit.

This design greatly aids in increasing the amount of effective treatment per gallon of water.

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Electrocoagulation: **Variable Electro Precipitator** (VEP)

A Variable Electro Precipitator (VEP) is a waste water remediation unit utilizing electro-coagulation.

A major design weakness of the Electro-coagulation units is the method used in connecting the electrode to the power source.

These designs cause overheating resulting in premature failure of the electro-coagulation reaction chamber.

Variable Electro Precipitators reaction chambers are designed to resolve these performance issues by changing all electrode connections from the standard wet connection (inside the chamber) to an external dry connection.

The Variable Electro Precipitator is cooler operating and has a longer chamber life than an Electrocoagulation unit.

Electrodes

- Core component of the VEP is the electrodes
- Design allows electrical connection outside reaction chamber
- Allows selection of physical plates to be adjusted
- Significant differentiator compared to other manufacturers
- Traditional designs will weaken or corrode and cause hot spots or arcing
- This design provides consistent current density & appropriate turbulence
- Reactor will typically use 6 – 13 plates
- Plates may be all metals (Zn, Al, Al) or combination of metals & carbons

Manufacturing Certifications

F&T Water Solutions is proud to partner with IP Automation as our premier Manufacturer. IP Automation provides us with the highest quality products and services that are necessary to meet and exceed our customers expectations through continuous improvements to our processes. IP Automation provides engineering and design, robotics, electromechanical engineering, pneumatics, and automation.

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Sample Collection & Packing Instructions for Water Characterization Test

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Preliminary Information Capture

It is important for our team at F&T Water Solutions to gather as much preliminary and comprehensive information as we can regarding your unique water remediation requirement. We have for your convenience created a PDF download of the questions required for an evaluation of your project. Please use this sample profile as a guide to help us achieve this goal. If you prefer you can use this Water Sample Profile as a guide and contact us directly. We will be happy to put you in contact with one of our trained field representatives who are standing by to serve you. Please use any of the information listed on our website to contact us.

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Water Sample Profile Worksheet

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Sample Collection & Packing Instructions for Water Characterization Test

1. Use two sterile, clean, 250-300 ml plastic bottles with screw tops. Label them using waterproof marker for date, location, time of collection and an ID number or sample number. We are glad to overnight ship a sample collection kit to you, call or email us.
2. Take two samples, filling each bottle with care taken to collect a representative sample of the water to be tested.
3. Place each filled sample bottle in a separate zip lock bag. Then put the sample bags in a separate, additional water tight bag.
4. Put approximately 1 liter of ice in a small, water tight container, if using a plastic bag, please double up the bag as leaking ice water is a big concern to the shipping companies.
5. For shipping, use a small insulated plastic cooler or large wide mouth unbreakable thermos.
6. Put a filled out Southern Research chain of custody form in a zip lock bag and place this inside the cooler. We can fill out the tests to be run once we discuss the sample. Call or email us for the form.
7. Place the ice, samples, and a copy of the filled out Chain of custody form in the cooler.
8. Seal the edges of the cooler lid with duct tape or other waterproof tape. The goal is to make sure there are no leaks. Label the cooler that it contains non potable water samples.
9. Ship overnight FEDX to Southern Research Institute with address information from the Chain of Custody form. On the FEDEX form, please call or email us with the tracking information.

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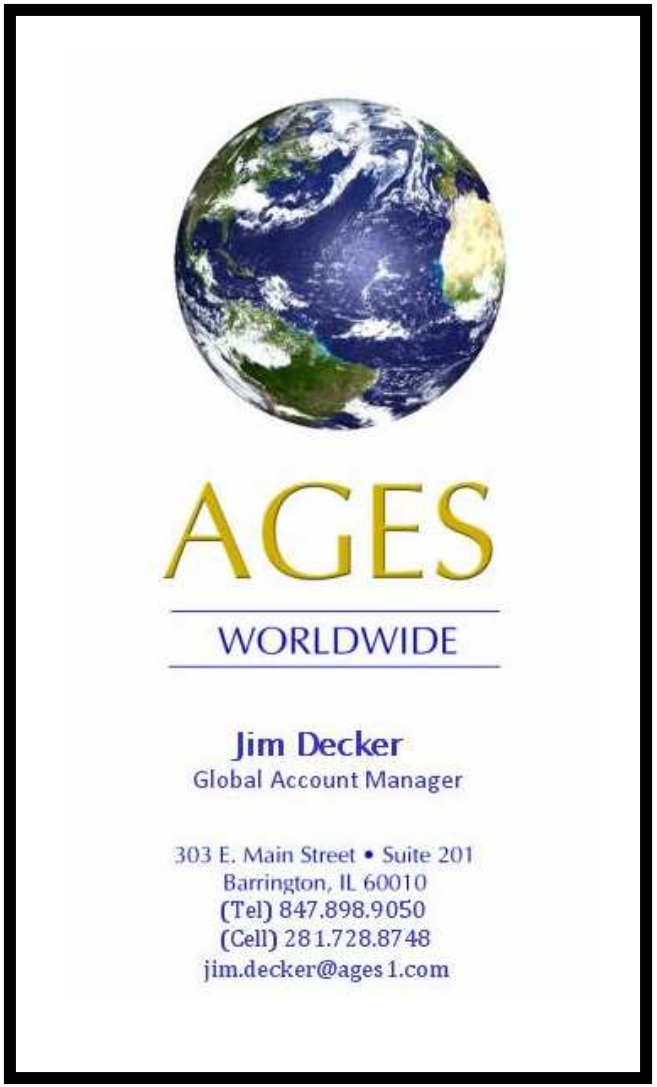
Sales Contact For More Information



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