Advanced
Waste Water Treatment Corp.

Electrocoagulation

Achieving clean, clear, treated and reusable water:
The process, technology and benefits.

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SEWAGE WASTE

Clean water is vital to virtually all living things on this planet. While nature has the remarkable ability to cope with small amounts of water wastes and pollution, it would be overwhelmed if we didn't treat the billions of gallons of wastewater and sewage produced every day before releasing it back to the environment. Water treatment facilities serve to reduce the level of pollutants in wastewater. Further, with the capacity and abundance of clean water shrinking on a global scale due to various factors such as drought and pollution, the importance of advancing new techniques and methodologies in water treatment has never been more critical than it is today.

According to the USGS (the U.S. Geological Survey), the major aim of sewage treatment is to remove as much of the suspended solids as possible before the remaining water, called effluent, is discharged back to the environment.

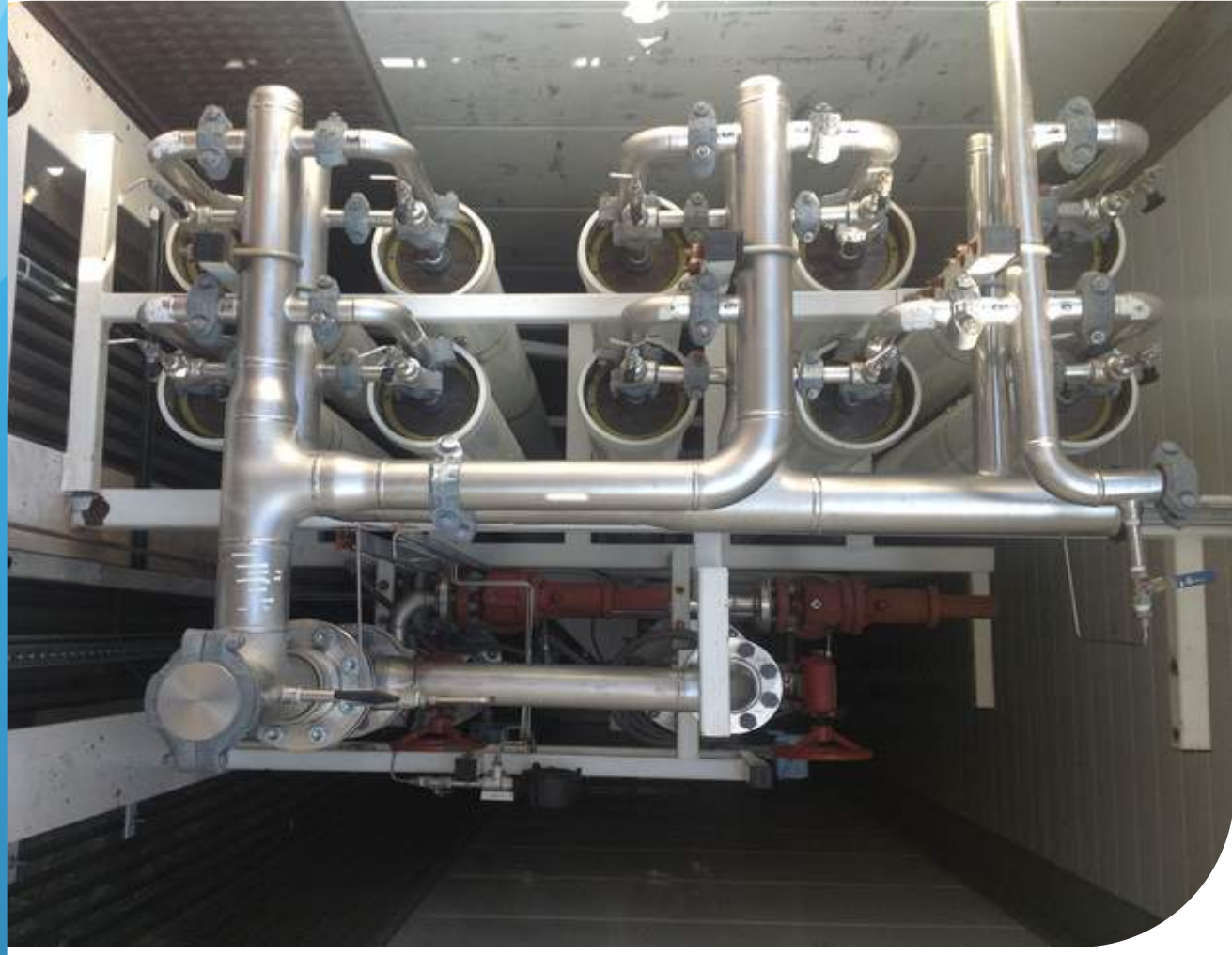
The method for treating sewage water involves a "primary treatment," which removes about 60 percent of suspended solids from wastewater, as well as a "secondary treatment," which removes more than 90 percent of suspended solids[1].

Aerating, or stirring up the wastewater to put oxygen back in is also necessary for the proper treatment of wastewater.

A more detailed process of this method includes screening, pumping, aerating, removal of sludge, and the killing of bacteria **2**. The most common means of killing bacteria in wastewater quite often involves using chemicals, which are sometimes toxic. While this represents the primary method in treating wastewater, new technological advancements in this field have made the process more cost effective and more efficient than ever before.

This white paper will provide a discussion about what Electrocoagulation is, the process of how it works and the technology behind it. Additionally, this paper will discuss the various benefits in utilizing this form of water treatment option.

1 *http://water.usgs.gov/edu/wuww.html* **2** See primary wastewater treatment process at: *http://water.usgs.gov/edu/wwvisit.html*



WHAT IS ELECTROCOAGULATION?

Electrocoagulation ("EC") is an electrochemical water treatment technology to remove contaminants from aqueous streams. Broken down, "electro", meaning to apply an electrical charge to water, and "coagulation", meaning the process of changing the particle surface charge by allowing suspended matter to form an agglomeration. EC removes suspended solids to sub-micrometer levels, breaks emulsion such as oil and grease, and oxidizes and eradicates heavy metals from an aqueous waste stream by utilizing an electrical current to cause a chemical reaction. This result is achieved without the use of filters or the addition of separation chemicals.

Our EC process forces a reaction in the various compounds which produces a number of effects, but generally contaminants are reacted to their most stable state and then are removed from the wastewater by a number of secondary solids separation techniques.

Our EC technology uses a proprietary treatment chamber and electricity to treat a wide range of differing waste streams containing heavy metals, virus, bacteria, biochemical oxygen demand (BOD), Total Dissolved Solids (TDS), and Total Suspended Solids (TSS).

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SEWAGE WASTE

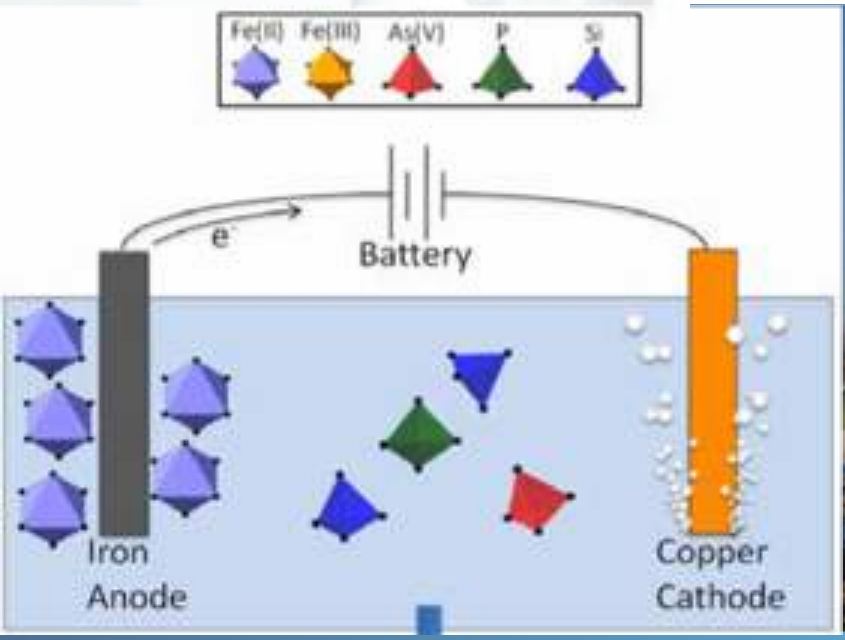
An EC reactor is made up of an electrolytic cell with one anode and one cathode. When connected to an external power source, the anode material will electrochemically corrode due to oxidation, while the cathode will be subjected to passivation.

An EC system essentially consists of pairs of conductive metal plates in parallel, which act as monopolar electrodes. It furthermore requires a direct current power source, a resistance box to regulate the current density and a multimeter to read the current values. The conductive metal plates are commonly known as “sacrificial electrodes.” The sacrificial anode lowers the dissolution potential of the anode and minimizes the passivation of the cathode. The sacrificial anodes and cathodes can be of the same or of different materials.

These metal plates, such as Iron (Fe) and Aluminum (Al), are usually used as sacrificial electrodes to continuously produce ions in the water. When the ions are released they neutralize the charges of the particles initiating the coagulation process. The released ions then remove undesirable contaminants and pollutants either by chemical reaction and precipitation, or by causing the colloidal materials to merge, which can then be removed by floatation. In addition, as water containing colloidal particulates, oils, or other contaminants move through the applied electric field, there may be ionization, electrolysis, hydrolysis, and free-radical formation which can alter the physical and chemical properties of water and contaminants. As a result, the reactive and excited state of the materials causes contaminants to be released from the water and destroyed or dissolved.

Careful selection of the reaction tank material is essential along with control of the electrical current, flow rate, pH and cost. While electrodes can be made of iron, aluminum, titanium, graphite or other materials, depending upon the wastewater to be treated and the contaminants to be removed, Iron (Fe) and Aluminum (Al) are frequently used because of their effectiveness and cost efficiency when used in this process.

During the EC process, the water-contaminant mixture separates into a floating layer, a mineral-rich sediment, and the resulting clear water. The floating layer is removed by way of an overflow/removal method, and is then moved to a sludge collection tank. The aggregated mass settles down due to gravitational force, and is consequently removed via a drainage valve at the bottom of the EC reaction tank. The mass is then moved to a sludge collection tank. Finally, the clear, treated water is pumped to a buffer tank for later disposal and/or reuse in the designated process.



INDUSTRIES SERVED

In North America, EC has been used primarily to treat wastewater derived from the pulp and paper industries, as well as the mining and metal-processing industries. EC has been applied to treat wastewater from the following industries:

- **Drilling/Hydraulic**
- **Fracturing**
- **Municipal and Domestic**
- **Nuclear**
- **Pulp and Paper**
- **Animal and Dairy**
- **Laundries vii. Cooling Towers**
- **Wash Pad/Truck Wash**

More recent uses of EC have been in the treatment of water used in connection with drilling and hydraulic fracturing operations utilized in the production of oil and natural gas.

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THE BENEFITS OF EC:

AWWT's proven technology is an efficient and low cost solution to clean polluted water. AWWT is committed to being the leader in water reclamation. Our firm has an aggressive business plan that reaches out to the water problems of the world. AWWT brings a low cost and efficient reclamation process, which purifies all types of contaminated water.

- Green and Sustainable Technology - Eliminate Chemicals
- Treat Complex Waste Streams
- Reclaim & Harvest Metals & Oils
- Remove & Destroy Bacteria and Viruses
- Water Recycling
- Meet Discharge Requirements
- Reduce or Eliminate Testing and Monitoring of Wastewater
- Remove & Process Waste Streams With Multiple Contaminants
- Ease of Integration
- Customizable Units For Any Size Treatment System and Configuration

Advanced Waste **Water Treatment**™'s EC systems are available and are the best method of allowing wastewater to be recovered. AWWT is able to provide an analysis of your current systems in place and provide a frank assessment of constraints and will assist you with the development of a plan of action. Our EC systems are the first step to an effective waste minimization and water-recycling program.

LEARN MORE

Advanced Waste Water Treatment, Corp. ("AWWT") is an industry leader in EC technology. The company is dedicated to "Green" and "Sustainable" initiatives. It uses the latest and most technologically advanced water treatment techniques in an effort to solve the world's clean water shortage. To learn more about AWWT and this patented process go to

http://www.awwtcorp.com.