**Electrocoagulation?**

Electrocoagulation is an electrochemical water treatment process that uses an electrical current to remove contaminants from water. It's about the use of electrodes, which are usually metallic materials like aluminium or iron and release ions in water when electricity is used. These ions of metal are destabilizing and neutralizing the contaminants causing them to coagulate, which results in larger particles that can easily be removed.

**Is it Suitable for Jigalong?**

Electrocoagulation is a promising solution for managing water pollution in Jigalong, Australia, due to its flexibility and effectiveness in removing pollutants like heavy metals, organic compounds, bacteria, and suspended solids. Its relative energy efficiency makes it compatible with sustainable practices and long-term water treatment solutions. The size of electrocoagulation systems allows for adaptability to fluctuating water flow rates and the changing nature of domestic water sources. Additionally, electrocoagulation has a reduced environmental impact compared to traditional coagulation and flocculation procedures due to minimal chemical use.

*Basic theory of Electrocoagulation*

Anode electrons Cathode

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Iron (II)

Iron (II)

Iron(II) + 2 Oxidation state

Iron (II) + 3 Oxidate state

sludge

Suspended

solids

Hydrogen ion

Hydrogen gas

Oxygen

**Requirements**

Other than settling tanks, floating devices and filters we need combination of hardware and software to control and monitor the process effectively.

Hardware requirement

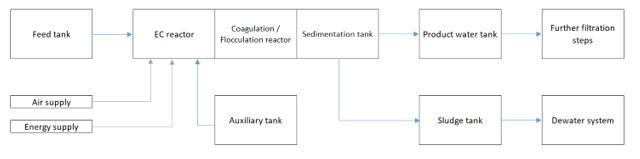
* **Electrocoagulation cells**: The electrodes (often constructed of aluminium or iron) in these cells are where the electrochemical processes take place. According to the projected water flow rates and pollution levels, the number and size of cells will vary.
* **Power supply**: For the electrocoagulation process, a reliable source of energy is essential. Transformers and power distribution systems, among other electrical tools, are required to supply the electrodes with the appropriate electrical current.
* **Control system**: The electrical current provided to the electrodes is controlled by programmable logic controllers (PLCs) or microcontrollers in a control system. These controls make sure the electrocoagulation procedure runs according to its ideal conditions.
* **Sensors and Instrumentation**: During the treatment process, sensors and equipment are crucial for keeping track of important water quality indices. Depending on the pollutants of concern, this may also incorporate sensors for pH, turbidity, conductivity, and maybe other parameters.
* **Pumps and equipment**: Pumps are required to move water through the electrocoagulation cells, and mixing apparatus is required to guarantee that pollutants and treatment chemicals are distributed equally.

Software requirements

* **Control software**: To program and manage the system, control software is required. You may improve the electrocoagulation process by setting and adjusting parameters including voltage, current, and time.
* **Data Acquisition and SCADA (Supervisory Control and Data Acquisition) Software**: The electrocoagulation system will be monitored and controlled via a graphical interface. SCADA software, which assists in gathering real-time data from sensors and devices. It enables operators to decide wisely based on information about the quality of the water.
* **Communication software**: For remote monitoring and control, especially in bigger or geographically distributed systems, communication software may be needed. It makes it possible to send and receive control orders and data across the internet.

**How it works/functions?**

1. Pumped into electrocoagulation cells created specifically for this procedure is water from the source. These cells have precisely selected electrodes that are frequently constructed of aluminium or iron and submerged in the water. The electrocoagulation process is then started by connecting these electrodes to a power source. The electrodes start to release aluminium or iron ions into the water when an electrical current passes over them.
2. A critical phase of the process is started when metal ions are added to the water. These metal ions function as coagulants, efficiently neutralizing and destabilizing charged pollutants and particles in the water. The pollutants are made to coagulate, or cluster together, by this chemical process. They then flocculate or create bigger flocs or particles in the water.
3. A mixing component is used to make sure the coagulated particles and flocs are uniformly distributed throughout the water. The even distribution made possible by this apparatus maximizes interaction between the metal ions and the pollutants. To maximize the effectiveness of the electrocoagulation process, the reaction time is also carefully managed to allow for enough contact and reactivity between the metal ions and pollutants.
4. The treated water still includes these bigger particles in it even after the electrocoagulation procedure has successfully coagulated and flocculated the pollutants. The system uses a range of separation and filtering techniques, including the use of settling tanks, flotation units, and filtration units, to remove them.



**Benefits of the design**

* Reduce chemical usage
* Energy efficiency
* Effective Removal of Diverse Contaminants

**Impact to the society**

* Access to clean and safe drinking water
* Gain health benefits
* Environmental preservation

**How the design is culturally appropriate for the environment?**

The electrocoagulation system's environmental impact should be evaluated, considering Indigenous communities' deep connections to their land and natural surroundings. Design considerations should protect ecosystems, wildlife habitats, and waterways, while aligning materials, disposal, and potential impacts with community values.

**How does the design idea benefit the community in accordance with the guidelines?**

* Access & Equity: Everyone has access to safe drinking water.
* Health & Safety: Water is free from continent so health diseases will be reduced.
* Appropriateness: the design is culturally appropriate and respects the community values.
* Affordability: It minimize operational costs to chemicals and optimize energy usage.
* Environmental Health: Low impact to environment because low usage of chemicals.
* Sustainable livelihoods: The availability of clean water supports sustainable livelihoods within the community.

**Potential challenges**

* Maintenance: Electrodes may require maintenance and replacement over time.
* Treatment Efficiency: Depending on the pollutants and water chemistry, electrocoagulation's efficacy might vary.
* Residuals Disposal: The created sludge or residuals need to be handled for proper disposal.