



### Abstract

**A Spanish research group has a high experience and know-how to develop and carry out the treatment of waste water (containing salts, cyanides, heavy metals, fats, organic compounds, etc.) by electrochemical technology in order to decrease its polluting effect. The technology has been already tested at laboratory and pre-industrial levels. The research group seeks to transfer the technology and know-how on electrochemical field to companies by mean of patent licence or know-how agreements.**

### Description

Applied Electrochemistry is the employment of electrochemical processes in any type of industrial application (synthesis of pharmaceutical products, nanotechnologies,



waste treatment, heavy metals recovering, metallic depositions, etc). This research group is focused on the investigation of new electrochemical processes and transfer of the knowledge and the technology to the industry.

#### ELECTROCHEMICAL DEGRADATION

One of the main industrial applications of the electrochemical technology is the effective treatment of waste water with high concentration of organic compounds:

Traditionally, waste water with organic compounds coming from chemical industries have been treated: (i) by biological treatment; (ii) by incineration treatment; or (iii) by the burial after a chemical pre-treatment. Electrochemical degradation and electrocatalysis of hazardous wastewater has several advantages compared with incineration and biological treatment since:

- is able to treat very toxic wastes
- can operate at room temperature and atmospheric pressure
- is an environmentally friendly technology
- the energy consumption depends on COD
- can be stopped simply by switching off the power
- is cost and safety effective

This research group is also able to develop new highly effective purification and treatment methods of industrial interest accordingly with the type of toxic charge when effluents contain:

- hazardous compounds and these are degraded inoffensively to less polluting products without arriving to the complete destruction
- either amounts of highly toxic compounds or not biodegradable materials
- salts, PCBs, cyanides, nitrites, phenols or tensioactives
- toxic, organic materials combined with heavy metals which have to be removed and/or to be recovered. In this case, the organic compounds can be degraded on the anode and the metals recovered on the cathode in the same electrochemical reactor.

Actually, the electrochemical technology is used at the present time in:

- the PCBs degradation
- in-situ chlorine production
- ozone generation
- destruction of cyanides and nitrites
- purification of waste water using oxidising agents and in general as a method for the reduction of COD from any effluent
- Elimination of Phenol
- Elimination of tensioactives compounds and dyes.

#### DESALINATION

Moreover, the research group is able to develop new highly effective purification and treatment methods to:

- Removing of salinity in valuable aqueous effluents.
- Recovering of acids and alcalis from salt solutions.

#### ELECTRODEPOSITION/ HEAVY METAL REMOVING & RECOVERING



The activity of the group in the research line of metal electrodeposition is mainly focused in two objectives:

1. Development of electrochemical processes for the recycling and recovery of metals (Pb, Zn, Ni...) from their secondaries.
2. Removal of heavy metals in waste waters.

Thus, the research group is able to develop highly effective treatment to:

- Metal finishing processes (electroplating,...).
- Recovery of precious metals (silver from photographic material,...).
- Recovery of non precious metals (lead coming from batteries,...).
- Elimination of impurities in chemical reagents.

The recovery of the metal is carried out by means of its deposition in metallic form on the cathode in an electrochemical reactor. The recovery of metals by electrodeposition is usually carried out from concentrated solutions, using an open reactor. This geometry facilitates the extraction of the recovered massive metal. Owing to the low concentration of the metal in solution, it is important the development of electrochemical reactors able to remove the metals in these experimental conditions. There are two main strategies for this point:

1. Use of three-dimensional electrodes.
2. Increase the mass transport conditions by means of generating turbulence.

#### DESIGN AND PILOT PLANT CAPABILITY

The research group also has a pilot plant fully equipped with the necessary infrastructure in order to develop the pre-industrial phase and scaling-up of the processes. The pilot plant has developed several electrochemical reactors to produce

chemicals at pre-industrial and industrial level.

#### Innovations and advantages of the offer

- The electrochemical treatment is able to treat toxic effluents with high concentration of organic compounds
- The use of electrochemical processes allows to obtain metals of a bigger purity and in consequence much less polluting than the traditional treatments
- Suitable when traditional treatment methods are not effective due to: not biodegradable materials, heavy metals, hazardous compounds are not completely degraded
- It is an environmentally friendly technology since it avoids the emission of gases, sulphur and metal particles
- It avoids the problem of dropping of the bacterial count on the biological treatments
- It is a cost and safety effective technology

#### Current and Potential Domain of Application

The electrochemical technology has been already tested at laboratory and pre-industrial level and the research team has several years of experience in this field. The installations of the pilot plant are already being working and some projects for Spanish and European clients have been carried out successfully. All the technicians and management staff are experienced enough to guarantee the success of the projects.

This treatment method could be of interest to:

- Industries with waste waters with high concentration as described above. Potential clients could be textile industry, metal - processing industry, chemical industry, etc.
- Consultancy companies from the environmental sector with activities in the effluents treatment which



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Waste water treatment by electrochemical technology

(09 ES 23D2 3CR9)



would like to add new effective methods to their capability.



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