

PHOTOVOLTAIC ELECTRODIALYSIS SYSTEM FOR BRACKISH WATER DESALINATION

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RESUMEN

The Applied Electrochemical and Electrocatalysis Group (Institute of Electrochemistry) at the University of Alicante was created in 1983. From its creation, the aim of this research group has been the development of electrochemical processes for industrial application. Our twenty years of research have provided us with a wide experience in diverse fields of the Applied Electrochemistry, which include principally the development of new accumulators and batteries, synthesis and purification of pharmaceutical compounds and the treatment of waste water.

In agreement with increasingly important social demand during last years, one of the priority research lines of the group is the ENVIRONMENTAL ELECTROCHEMISTRY. Among the opportunities that the Electrochemistry Technology offers in the treatment of waste water, in our department we put special emphasis on the desalination of saline water from underground reservoirs for human consumption or irrigation by means of systems of electrodialysis powered by photovoltaic solar energy.

The advantages of the use of the photovoltaic power are that is non-polluting; it is also silent; the fuel-sunlight- is free, abundant and a renewable resource, decentralized; long-life and the low maintenance cost due to the fact that it includes neither accumulation batteries, nor regulators/inverter.

These systems are interesting for remote areas with access to saline underground reservoirs, where the supply of electricity is particularly expensive or even non-existent, or for coastal zones where there are saline aquifers and the water resources are scarce.

Therefore, the desalination method developed by the Applied Electrochemical and Electrocatalysis Group (LEQA) at the University of Alicante is a process free of CO₂-emissions and, consequently, a sustainable way of producing drinkable water for human consumption respectful with the environment, not contributing to the climatic change, and with a minimum environmental impact.





Figure 2. Pilot Plant of Department of Physical - Chemistry (Applied Electrochemical Group LEQA) of the University of Alicante .

The Applied Electrochemical and Electrocatalysis Group (LEQA) at the the University of Alicante has a great experience and knowledge in the evelopment and operation of the electrodialysis applications. Also it has a laboratory with the most modern technologies of analysis to carry out experiments in pre-industrial scale systems, water and substances/pollutants analysis, as well as one Plant Pilot of 160 m² in the University of Alicante, ready to carry out studies of industrial scale process. Besides, the University of Alicante has a solar photovoltaic plant of recent installation (38.4 kW) located in the north zone of the University, close to the Pilot Plant of the Applied Electrochemical and Electrocatalysis Group (LEQA). This photovoltaic solar plant has 1000 panels of 38.4 W of peak power each one and it supplies of electrical energy to the Pilots Plants and is used with research purposes.



Figure 3. General view of the Photovoltaic Solar Plant of the University of Alicante.

1 Generally, systems of accumulation are used when the requirement of electrical energy and the availability of solar hours are not simultaneous. For example, a domestic home with a photovoltaic solar power system, where the main electrical consumption is during the night time due to lighting, heating, etc. In this case, the use of batteries is inevitable.

2 The Green Chemistry can be defined as the product designs and chemical processes that reduce or eliminate the use and generation of dangerous substances and contribute to the sustainable development.

The aim of sustainable development will have to be achieved with new technologies, which provide the society with the products that we need in a way esponsible to the environment.

3 The rejection (water that there is returned to the sea) produced by Reverse Osmosis Plants contains approximately twice the concentration of the sea water. (Sea Water=35 g/l of NaCl, Rejection R.O. =70- 75 g/l of NaCl).

VENTAJASY ASPECTOS INNOVADORES

innovative aspects

Desalination system using renewable energy, respectful with the environment, ot contributing to the climatic change.

Desalination system for remote areas with access to saline reservoirs, where he supply of electricity is particularly expensive or even non-existent, or for oastal zones where there are saline aquifers and the water resources are carce.

main advantages of the technology

The system electrodialysis-photovoltaic generator is reliable, versatile and has low maintenance costs.

The advantages of the use of the photovoltaic power are that it is non-polluting; it is also silent; the fuel-sunlight- is free, abundant and a renewable resource, includes neither accumulation batteries, nor regulators/inverter. Electrodialysis process is more competitive than reverse osmosis process for desalination of brackish water

ESTADO ACTUAL

The technology developed has been tested with success at lab scale and at the pilot plant.

Some technical data from the installation which the research team works with:

- PV generator area: 4 m² (0.5 m² per PV module, 8 PV modules)
- PV peak power: 272 W (34.8 W of peak power per PV module)
- Production: 1.32 m³/day production of drinking water from brackish water (2000 ppm NaCl, January).
- Electrodialyzer: 4.4 m² of total membrane area, 550 cm² unit cell area

APLICACIONES DE LA OFERTA

The developed technologies could be of interest of companies, public bodies and organisations dealing with water supply problems. Companies or institutions interested in profiting water resources which come from brackish water. Users from engineering and industrial companies, waste water management firms, agricultural related companies, etc., could use this technology.

COLABORACIÓN BUSCADA

The Applied Electrochemical and Electrocatalysis Group (LEQA) is seeking for:

- Partners willing to introduce the electrodialysis - photovoltaic system in its facilities.
- R&D departments of any company interested in carrying out feasibility studies on the use, industrial or not, of this technology.

DERECHOS DE PROPIEDAD INTELECTUAL

Secret Know-How. The Applied Electrochemical and Electrocatalysis Group (LEQA) at the the University of Alicante has the experience and a deep expertise in the electrodialysis and applied electrochemistry field.

PERFIL DEL GRUPO DE INVESTIGACIÓN

In the following link you will find a description of the nature and activities of the Research Group:
<https://cvnet.cpd.ua.es/curriculum-breve/grp/en/electroquimica-aplicada-y-electrocatalisis/356>

SECTORES DE APLICACIÓN (4)

Pollution and Environmental Impact
Marine Studies
Water Resources
Chemical Technology