NANO-ENHANCED ELECTROCHEMICAL GREEN TECHNOLOGY FOR ADVANCED INTEGRATED WATER TREATMENT AND QUALITY CONTROL

Goal of the project:

The main goal of this project is to develop a green electrochemical technology aimed at the use of electrochemical electrode materials based on nanostructured carbon for both destroying priority hazardous organic pollutants from water and to monitor them before / after application of electrochemical processes of destruction, envisaging the exploitation of the dual character of the electrode materials and electrochemical techniques, by creating the right framework for achieving the high research level.

This project aims to explore potential use of nano-enhanced electrochemical dual green technology to improve access to clean water.

Short description of the project

Based on the results obtained in our previous studies for the oxidation of pollutants in aqueous solutions for their degradation and/or their detection on the carbon-based electrodes, specific objectives have been set in this project:

1. Elaboration and manufacturing of some new electrodes types based on nanostructured carbon and Ag/Cu/TiO2 modified zeolite with enhanced electro(photo)-catalytic activity;
2. Manufacturing, design and geometry conditions of electrodes for degradation and monitoring applications;
3. Setting-up the optimal conditions for the degradation and mineralization of priority organic pollutants (POPs) from water;
4. Elaboration of the electrochemical detection scheme;
5. Integration of the electrochemical detection methods within the control of the degradation and mineralization of POPs in aqueous solutions.
6. Development of a new nano-enhanced electrochemical green dual technology for integrated water treatment and control.

Continuous development of nanomaterials and nanotechnology offers more effective and sustainable solutions for the environmental protection.Based on the well-known potential of theelectrochemical processesinenvironmentalremediationand quality monitoring, integration of nanomaterials in chemical composition of the electrode, which represents the key of these processes performances, gives them superior characteristics suitable for the practical applications. Also, the development of pulsed electrochemical techniques was not sufficiently explored and exploited to improve process efficiency.

Project implemented by

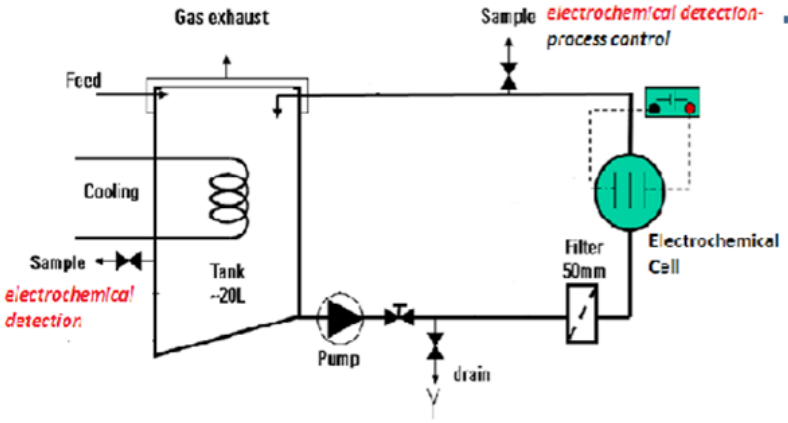
Faculty of Industrial Chemistry and Environmental Engineering

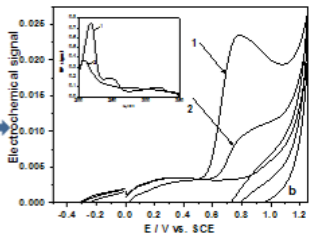
Implementation period

2011 - 2016

Main activities

1. Elaboration of new composite materials based on carbon nanotubes (CNT)/carbon nanofibers (CNF) in epoxy matrix as electrode materials for oxidation of POPs from water;
2. Characterization of new composite materials based on CNT/CNF in epoxy matrix and electrode design;
3. Composite electrode obtaining and selection for application in degradation and/or detection of POPs from water;
4. Assessment of electro(photo)catalytic performance of the selected electrodes in advanced degradation/mineralization of POPs;
5. Assessment of the electroanalytical performance of the electrode in detection of POPs from water. Optimization of the electroanalytical method;
6. Integration and optimization of the electrode materials and electrochemical techniques in advanced wastewater treatment and process control.
7. Dissemination of the project relevant results to the scientific community through publication in peer-reviewed national and international journals, and also to the stakeholders in water treatment technologies (industrial agents, authorities in the field of water, water-sewage operators.





Electrochemical signal in comparison with UV signal (inset) recorded on Ag-TiO2-CNF composite electrode before (1) and after (2) pentachlorophenol degradation

Results

- Comparative monitoring of optimized electrochemical treatment of priority organic pollutants from water using the electrochemical detection and conventional methods.
- Optimization of the composition of the electrode material and the electrochemical technique for integrative electrochemical degradation and process control. Published papers .

Applicability and transferability of the results

The nano-enhanced electrochemical green dual technology which will be elaborated at the end of this project could be scaled and tested for application at pilot level in water treatment.

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