

Development of multifunctional nanocomposite fibrous electrodes for electro-oxidation filtration

- Z2-4483

- Duration: 1.10.2022 - 30.9.2024

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Organization:

- IOS, Institute for Environmental Protection and Sensors

- Project type: Applied postdoc research project

- Contract value of the project: 137.020,00 €

Financing of the project: Slovenian Research and Innovation Agency (ARIS) in E-SENZOR, development, production and marketing, Ltd.

DESCRIPTION

- Population growth, the emergence of new and more persistent pollutants with the lack of adequate water resources limit the ability of current water treatment and disinfection technologies, making clean and potable water supply a growing problem worldwide. Electro-oxidation filtration is a hybrid technology that is a combination of filtration and electro-oxidation, thus combining the advantages of both technologies. In this technology, the porous filtration material is also electrically conductive and thus also serves as an electrode, which enables electrochemical reactions with the help of an external electrical source. Such an electrode has an extremely increased surface area, which greatly improves its performance, as electrochemical processes occur at the surface of the electrodes. This hybrid technology allows the oxidation of organic pollutants, reduction of anions and halogenated organic compounds, removal of toxic heavy metals, deionization, disinfection of water and reduced fouling which extends the lifespan of filtration material.
- The aim of the research is to prepare durable multifunctional fibrous nanocomposites that can be used as a porous electrode in an electro-oxidation filtration cell for water purification. Nanotechnology enables the improvement of existing and the development of new water treatment technologies. Nanomaterials exhibit excellent antimicrobial properties and microorganisms do not develop resistance to them, which is an exceptional advantage, as bacterial resistance to antibiotics has become one of the major threats to public health. As part of the project, multifunctional nanomaterials will be immobilized on or into fibrous substrates with various methods, in order to prepare multifunctional nanocomposites. Suitable nanocomposites will be used as fibrous electrodes in the electro-oxidation filtration cell for the removal of organic and microbiological substances. In order to use a fibrous electrode in an innovative electro-oxidation filtration cell, it must possess electrical conductivity, porosity, durability, suitable mechanical resistance and anodic or cathodic stability. Successful contaminant removal and long lifespan of the nanocomposite fibrous electrode will have greater potential for its realistic application. Nanocomposites or antimicrobial and electrically conductive fibers have potential applications for use in sensors, smart textiles, textiles with entertainment electronics, and are also extremely interesting for the fields of biomedicine, sport, military, packaging, food, electronics, telecommunications and others.
- Project phases: Study of immobilization of nanomaterials (NMs) on or into the fibers; Synthesis and optimization of multifunctional NMs; Preparation of nanocomposites (NCs); Application of new NCs for electro-oxidation filtration of water; Project management and coordination.



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