4TH E3 MEDITERRANEAN SYMPOSIUM

ELECTROCHEMISTRY FOR ENVIRONMENT AND ENERGY

2022

ORVIETO

Palazzo del Capitano del Popolo

September 15th - 17th, 2022

Collection of Abstracts

SAPIENZA UNIVERSITÀ DI ROMA

Società Chimica Italiana

Divisione di Elettrochimica

grupo especializado electroquímica

Associazione nano Italy

Solid Polymer Electrolyte-based systems towards real water treatment applications

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In the next future, Electrochemical Advanced Oxidation Processes (EAOPs) will act as a key role in the removal of pollutants from water. Despite the past and current efforts made by the scientific community, some gaps still require to be filled to reach the full EAOPs exploitation. The main issues, which hinder their market, are related to: i) process scale-up from lab to industrial scale, ii) removal of pollutant from real water matrix. This second aspect is not only related to the nature of the pollutant, which can be recalcitrant and hard to remove, but also by the aqueous matrix composition, and then by the electric solution conductivity. A too low value of such parameter would require a too high voltage and energy consumption to run the oxidation process. Recently, the employment of a solid polymer electrolyte (SPE) has been considered as a promising alternative to the addition of a supporting electrolyte [1,2].

To the best of the Authors knowledge, except the recent works by Rodrigo's group based on CabECO cell [3,4], the application of SPE in real water treatment is quite limited [5,6]. In this presentation, the Authors want to investigate the removal of two target pollutants from two different water matrices using SPE sandwiched between a BDD anode and a stainless-steel cathode. The attention has been focused on the removal of Mecoprop herbicide from groundwater, and the treatment of washing wastewater containing Reactive Black 5 dye. The performance of the electrochemical processes has been evaluated as a function of current density, mass transport condition, and water composition (inorganic ions, presence of other pollutants), with particular attention to the chemical oxygen demand removal and the energy consumption. Moreover, a first degradation analysis of the solid polymer electrolyte under operating conditions has been provided performing a series of removal cycles. This is a crucial point for the scale-up of the process and for the development of reliable electrochemical SPE-based systems.

References

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