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New approach of flexible electrodes coated with carbon nanotubes/poly(3,4-ethylenedioxythiophene (PEDOT) for mancozeb analysis in waterRoy Zamora¹, Federico Masís Meléndez², Hayden Phillips¹ and Ricardo Starbird¹¹Costa Rica Institute of Technology, Costa Rica²CEQIATEC - Costa Rica Institute of Technology, Costa Rica

The extensive use of pesticides in crops generates a negative environmental impact affecting water quality and organisms. The intensive use of mancozeb pesticide (MCZ), in developing countries such as Costa Rica can cause severe chronic diseases in people. Therefore, it is paramount to access the residual amount of this agrochemical in water bodies. The purpose of this work is to develop a novel and economical electrode to detect mancozeb in water by electrochemical techniques. The electrodes of poly(3,4-ethylenedioxythiophene) (PEDOT) mixed with CNTs were characterized using thermogravimetric analysis (TGA), atomic force microscopy (AFM) techniques and its recovery after leaching through a sand column. Cyclic voltammetry was applied to characterize the electrochemical behavior of MCZ and its quantification in commercial formulations. The PEDOT/MWCNT electrode provides a robust electrochemical response in the linear range in addition to a faster procedure that can be conducted with fewer solvents and is more environmentally friendly compared to other techniques used to measure MCZ. Measures of this signal intensity as a function of concentration were used to quantify MCZ. Linearity yields a value over $R > 0.99$ in the range from 25 to 150 $\mu\text{mol/L}$. The recovery value obtained for the tap water was 51.2 $\mu\text{mol/L}$ equivalent to 102%. Speed on signal outputs and the feasible procedure make this new approach a candidate to undertake monitoring programs for ecological, agricultural and hydrological applications.

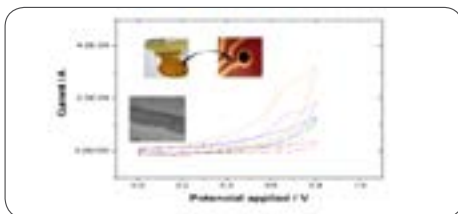


Figure 1: Voltammograms obtained for different mancozeb concentrations in at pH 7 using PCNT electrode. Inset: flexible electrodes and SEM image.

Recent Publications

1. Mora Barrantes J, Zamora Sequeira R, Benavides Ramírez D and Haug T (2014) Tübingen University radioactive material and waste management. *Revista Tecnología en Marcha* 27(2):22-31.
2. Starbird R, García González C A, Smirnova I, Krautschneider W H and Bauhofer W (2014) Synthesis of an organic conductive porous material using starch aerogels as template for chronic invasive electrodes. *Materials Science and Engineering C* 37:177-183.
3. Zamora R, Masís Meléndez F, Phillips H, Alvarado Marchena L and Starbird R (2018) Development of poly(3,4-ethylenedioxythiophene)(PEDOT)/carbon nanotube electrodes for electrochemical detection of mancozeb in water. *Int. J. Electrochem. Sci.* 13:1931–1944.
4. Zamora R, Ardao I, Starbird R and García González C A (2018) Conductive nanostructured materials based on poly(3,4-ethylenedioxythiophene) (PEDOT) and starch/ κ -carrageenan for biomedical applications. *Carbohydrate Polymers* DOI: 10.1016/j.carbpol.2018.02.040.

Biography

He has experience in polymers, by profession he is an Industrial Chemist, he has a Master's degree in Industrial Engineering, he is currently a PhD student and works at the Technological University of Costa Rica (TEC), as a Professor at the Materials School and works with the laboratory's chemical regent of polymers of the National Institute of Learning. His research area focuses on standardization of procedures, validation of methods and conducting and nano-structured polymers.

rzamorasequeira@ina.ac.cr