Commentary

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Electrochemistry for Soft Nanoparticle Detection: Gradients Prepared Using Bipolar Electrodeposition

Paul A Engelberg*

Department of Chemical and Biological Engineering, University of New Mexico, Albuquerque, NM, United States

***Corresponding author:** Paul A. Engelberg, Electrochemistry for Soft Nanoparticle Detection: Gradients Prepared Using Bipolar Electrodeposition, Email: engelbergpa@gmail.com

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Description

This review charts recent progress in the development of electrochemical methods for treating and, in many cases, recycling harmful chemicals. The viability of such methods for sterilization, disinfection, deodorization and similar microbiological applications is also considered. Environmental applications of electrochemistry have been the topic of several recent books and reviews. Specific commercial processes and systems are not discussed; the interested reader may find such material elsewhere and in patent literature. Similarly, radioactive materials warrant special techniques for their handling and disposal, and are not discussed here. The literature cited is representative rather than comprehensive. Economic aspects, while undoubtedly important, are beyond the scope of this article. A second area where electrochemistry is playing an increasingly key role is in sensor technology. Electrochemical sensors for environmental applications have been reviewed by previous authors. Accordingly, only selected examples of, and approaches to, trace level detection of microorganisms and air, water, and soil-borne pollutants are given below. In both the instances involving treatment (or recycling) and sensing, we have adopted a (generic) concept-driven format for the review; caseby-case description of past and present work on the myriad of pollutant chemicals and microorganisms would have been prohibitive. Finally, future opportunities and emerging materials in electrochemical environmental science and technology are discussed. A companion review will treat the applicability of photoelectrochemical methods for pollutant sensing and treatment.

Lignin comprises polymerized phenolic and aliphatic-hydroxyl groups, being the most abundant renewable source of aromatic polymers in nature. Historically, the degradation of lignin represented a major target in the pulp industry. In order for the pulp to reach an acceptable brightness level, the residual lignin after the Kraft process was bleached either to remove it from the pulp or, alternatively, to decrease absorption by the residual chromophoric groups as much as possible of all the processes involved in the manufacturing of pulp for the paper industry, the bleaching stage to degrade lignin is the step which contributes most to environmental pollution. Several alternative bleaching processes have been developed to date including those using chlorine-free oxidants to make this challenging process more environmentally friendly **[1]**. A general problem with bleaching the small percentages of lignin and colored chromophores in a bulk matrix of cellulose is the lack of selectivity of the oxidation reaction. Therefore, the driving force in the development of new bleaching technologies is to produce pulps with the best brightness.

Perkin Condensation of Differently Substituted Ortho-Hydroxybenzaldehydes

Lowest lignin and chromophore contents, while preserving the yield and strength of the fibers by minimizing cellulose degradation. Different sites in the cellulose matrix are susceptible to attack by oxidative agents: the damage may occur within the polysaccharide chains (oxidizing carbon positions of the monomeric sugar units to carbonyl groups which give rise to alkali-labile glycosidic bonds), or alternatively the end groups (oxidizing aldehyde groups that are formed after each cleavage of the glycosidic linkage) can be targeted **[2]**.

The coumarin derivatives were efficiently synthesized according to the protocol outlined in Scheme the general conditions and the compounds characterization were described in the experimental section. Perkin condensation of differently substituted ortho-hydroxybenzaldehydes with the corresponding arylacetic acids, using N,N'-dicyclohexylcarbodiimide (DCC) as dehydrating agent, in DMSO, afforded the 3-arylcoumarins 1-5. Compounds 6-10 were synthesized starting from the respective methoxy/ethoxy derivatives 1-5 by hydrolysis reaction using hydriodic acid 57%.

Multi Electrode Arrays

Multi Electrode Arrays (MEA) are well established for manipulating cells and for recording their electrical potentials. From first MEAs with 30 microelectrodes to record potentials from chicken heart cells to arrays based on CMOS (Complementary Metal-Oxide-Semiconductor) technology, which have bidirectional functionality for recording and stimulation with 26,400 electrodes, considerable research efforts were dedicated to those electrodes. The incentive for developing new kinds of electrodes are the existing challenges **[3]**. Wiring of single, fixed-positioned metal electrodes led to a limited density of electrodes with the consequence that cells

lying between electrodes, or barely covering them, could only be monitored with a low signal-to-noise ratio. The high electrode density and spatial resolution, together with the good signal-to-noise ratio of nowadays CMOS technology, goes, however, along with very sophisticated fabrication and signal processing. The high costs for these MEA chips, fabricated in small numbers, make them not attractive for many potential applications. Especially, cell-culture-based applications, which need steril environments, prefer disposable systems.

The EPS uses two kits as it from Cypress Semiconductors: CY8CKIT-059 and CY8CKIT-042-BLE, the CY8CKIT-059 kit has the chip CY8C5888LTI-LP097; the CY8CKIT-042-BLE kit has four devices but the prototype just needs the PRoC and the USB dongle. The measurements of the EPS are compared to a commercial potentiostat system (CH Instruments, model 700E). The EPS was operated to recording 2000 data per second which is the maximum samples that the equipment can measure. The three cables on the bottom right part of the protoboard were connected to the three electrodes of the electrochemical cell on **[4]**.

The electrochemical conditions in which the response signal of the prototype is congruent with the commercial potentiostat. Summary of the experiments to appreciate the capacity of the EPS. The concentration used provides information about the voltage and the current range of the electrochemical techniques studied. In addition, the study provides a guide to test the scan rate and the range of the sample per second on the EPS **[5]**.

In addition, this work contributes to providing information about the architecture (digital peripherals and analog front end devices) required to construct a potentiostat since this information is scarce, due to the main providers being companies who protect their circuit design. Finally, an integral methodology that includes the characterization and calibration of the potentiostat has been presented, thus an analysis of errors on the measurements in this device were tested and three electrochemical techniques were performed.

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