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Employment of conducting polymers in electrochemical food testing

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Food quality is an extremely important issue nowadays when abundant additives and preservatives are used in food industry. One of the fast, simple and rather cheap methods for detection of such compounds in food is electroanalysis or in other words analysis using electrochemical (bio)sensors. In order to develop an excellent (bio)sensor, a complicated surface modification of simple materials such as graphite, metals or glass is required. Electrochemical (bio)sensors need a conducting substrate for further sensor development. Furthermore, the surface should be modified with electroactive compounds those accelerate electrochemical process at the (bio)sensor as well as increase its sensitivity. Often these molecules have unsatisfactory adhesion to the substrate surface, therefore, polymers are used to "lock" active molecules on the (bio)sensor. Hence, non-electroactive polymers would decrease sensor sensitivity; therefore, conducting polymers are used in such cases. First conducting polymers were synthesized in the second part of the XXth century and a Nobel Prize was awarded for investigation of the properties of these polymers. Nowadays, many kinds of such polymers are known and have various applications. The most used polymers in the construction of (bio)sensors are polyaniline and polypyrrole. Taking in mind that biosensors have biological molecules in their architecture, conducting polymers should be biocompatible. Such kind of conducting polymers is developed in our group using natural monomers. The monomers are some water soluble vitamins of aromatic nature with heteroatoms and amino groups. Such kind of polymers play a few roles in (bio)sensing: i) accelerate response signal to analyze compound; ii) entrap other active and/or biological molecules on the sensor surface; iii) stabilize the biological part of the sensor due to its biocompatibility. Application of such conducting polymers in the food analysis will be presented and discussed.

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Using electrochemical impedance spectroscopy sinusoidal potential amplitude to assess the efficiency of niobium oxide based organic coating in oil wells produced water

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The oil industry coexists with damages caused by corrosion of materials in almost all areas of activity. Recent discoveries in Brazil of potential oil reserves at deeper waters, commonly named "pre-salt oil layer", may represent severe conditions leading to the need in developing new materials and technologies that meet unfavorable prospection demands. In this context, the corrosion protection characteristic of an organic coating based on niobium oxide immersed in water produced by oil wells was evaluated. The evaluation of the coating was carried out by means of electrochemical impedance spectroscopy technique (EIS). Results showed that only with the application of high voltage amplitudes of 350 mV over the OCP it was possible to decrease dispersion in EIS data, with no degradation or delamination of the coating. Despite this, at high voltage sinusoidal signal and raising the aggressivity of the medium, it was observed an increase in the corrosion mechanisms leading to lower impedance module values at longer exposure time (144 days), indicating the need for optimization of sinusoidal voltage amplitudes according with the nature, thickness and resistivity of the coating applied.

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