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Carbon-Based Electrodes for Parabens Detection

Authors : Aniela Pop, Ianina Birsan, Corina Orha, Rodica Pode, Florica Manea

Abstract : Carbon nanofiber-epoxy composite electrode has been investigated through voltammetric and amperometric techniques in order to detect parabens from aqueous solutions. The occurrence into environment as emerging pollutants of these preservative compounds has been extensively studied in the last decades, and consequently, a rapid and reliable method for their quantitative quantification is required. In this study, methylparaben (MP) and propylparaben (PP) were chosen as representatives for paraben class. The individual electrochemical detection of each paraben has been successfully performed. Their electrochemical oxidation occurred at the same potential value. Their simultaneous quantification should be assessed electrochemically only as general index of paraben class as a cumulative signal corresponding to both MP and PP from solution. The influence of pH on the electrochemical signal was studied. pH ranged between 1.3 and 9.0 allowed shifting the detection potential value to smaller value, which is very desired for the electroanalysis. Also, the signal is better-defined and higher sensitivity is achieved. Differential-pulsed voltammetry and square-wave voltammetry were exploited under the optimum pH conditions to improve the electroanalytical performance for the paraben detection. Also, the operation conditions were selected, i.e., the step potential, modulation amplitude and the frequency. Chronomaprometry application as the easiest electrochemical detection method led to worse sensitivity, probably due to a possible fouling effect of the electrode surface. The best electroanalytical performance was achieved by pulsed voltammetric technique but the selection of the electrochemical technique is related to the concrete practical application. A good reproducibility of the voltammetric-based method using carbon nanofiber-epoxy composite electrode was determined and no interference effect was found for the cation and anion species that are common in the water matrix. Besides these characteristics, the long life-time of the electrode give to carbon nanofiber-epoxy composite electrode a great potential for practical applications.

Keywords : carbon nanofiber-epoxy composite electrode, electroanalysis, methylparaben, propylparaben
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