

Simultaneous determination of phenolic compounds by multicomponent biosensors

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Nowadays the determination of phenolic compounds is of great importance, since these compounds are widely used for industrial processes such as the manufacture of plastics, polymers, drugs and dyes. This kind of compounds is also resulted as a breakdown from some pesticides and by-products from paper pulp industry. Due to their toxicity, phenolic residues constitute an acute environmental problem and their control is regulated by several European and EPA directives. Many methods are available for the determination of these compounds, including chromatographic and spectrophotometric analyses, but these methods request laborious sample pre-treatment, which makes them unsuitable for on-line monitoring. Amperometric biosensors offer an attractive alternative for the monitoring of such compounds. Laccase and tyrosinase, which are polyphenol oxidases, can catalyze the conversion of phenolic compounds to the corresponding quinones in the presence of oxygen, the liberated quinone can be electrochemically reduced to phenolic substances at low potential without any mediator. In the present work, the difference between the sensitivity of laccase and tyrosinase biosensors for

different phenolic compounds was used to allow the quantitative determination of phenolic compounds in mixtures. A multichannel potentiostat was used to simultaneously monitor the biosensors and data treatment was made by chemometric algorithms (PCA and PLS). This system showed an excellent efficiency for the resolution of mixtures of phenol/chlorophenol; catechol/phenol; cresol/chlorocresol and phenol/cresol. For example, in the phenol/chlorophenol mixture it was possible to determine these species in a concentration range from 1.0×10^{-6} up to 1.0×10^{-5} mol L⁻¹ with average relative standard deviations of 2.5% and 2.3%, respectively. The excellent correlation between the estimated and the real concentrations can also be observed by the correlation coefficients (r^2) of 0.9988 and 0.9991 for phenol and catechol, respectively. These results show that this methodology is a good alternative to simultaneous determination of phenolic compounds in mixtures and in environmental samples.

[FAPESP]