AN OPTICAL BIOSENSOR FOR CATECHOL DETECTION BASED ON SOL-GEL IMMOBILIZED LACCASE

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Catechol and phenolic compounds have great environmental impact because they are widely used for the production of paper, plastics, resins and dyes. These industrial processes generate a large volume of phenolic compounds, which show different toxicity. The identified phenolic compounds include phenol, catechol, guaiacol and cresol. Therefore, the evidence of the presence of these compounds and their quantification in the environment are issues especially important because of their toxicity and persistence. Laccases are cuproproteins belonging to the group of oxidoreductases and they are able to catalyze the oxidation of various aromatic compounds (particularly phenols) with the concomitant reduction of oxygen to water. They are characterized by low substrate specificity and have a catalytic competence which widely varies depending on the source. Additionally, laccases have also very peculiar optical properties due to their copper active sites which participate to the reduction processes. All these characteristics make laccases very flexible biotic element for developing optical biosensors. During the years, a number of studies have been devoted at exploiting catalytic properties of laccases and very few at studying their optical properties and related sensing potentialities. A preliminary study by absorption, fluorescence, FT-IR and Raman spectroscopies of commercial laccases from various sources has evidenced their potential usefulness for optical biosensing of phenol compounds as catechol. Moreover the sol–gel process offers a convenient and versatile method for preparing optically transparent matrices at room temperature that can represent a very convenient support for laccase immobilization. Accordingly, optical and structural properties of laccase immobilised in sol-gel matrix have been also investigated by the above-mentioned techniques. The preservation of laccase optical features even for the immobilized enzyme and the well-suited optical properties of the selected sol-gel support demonstrated that laccase + sol-gel systems are good candidates for developing optical biosensors. Preliminary results have been obtained from a laccase based optical sensor for detecting the presence of phenolic compounds (like cathecol) which is of significant impact on environmental protection.