Simultaneous immobilisation of Glucose Oxidase and Horseradish Peroxidase on SBA-15 mesoporous silica

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In this work an Enzymatic Tandem System (ETS) was prepared by simultaneously immobilizing Glucose Oxidase (GOx) and Horseradish Peroxidase (HRP) on SBA-15 mesoporous silica. The goal of such system is that a controlled amount of H₂O₂ is produced in situ by GOx and used for the oxidation of a HRP substrate [1]. This permits to overcome HRP inactivation that occurs in the presence of an excess of H₂O₂ [1]. SBA-15 was synthesized and characterized by N₂ adsorption/desorption isotherms, Fourier-Transform Infrared spectroscopy (FT-IR), Small Angle X-Ray scattering (SAXS), and Transmission Electron Microscopy (TEM). GOx and HRP were then immobilized by either physical adsorption or covalent binding. The kinetics of enzymes immobilization (Fig. 1A), measured through UV-VIS spectrophotometry, was found to follow a pseudo-second order model [3]. The catalytic activity of the obtained ETS was found to be strongly affected by the post immobilization drying step. Indeed, the activity was very high for wet preparations and very low for dried ones, regardless the type of enzyme-support interaction (physical or covalent). ETSs might find application for biosensing[4] or bioremediation [5]. Here, the obtained ETS was used for the degradation of two model phenolic pollutants, namely, ferulic acid and caffeic acid. A conversion of about 70 mol% was obtained for both phenolics after only 15 minutes (Fig. 1B).

Figure 1: A) kinetics of loading of some mass ratios of GOx/HRP; B) efficiency of the catalyst in the removal% of two fenolic compounds: ferulic and caffeic acid.

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