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Electrochemical Study of Ti-O Modified Electrode towards Tyrosinase Catalytic Activity

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Abstract : The detection of tyrosinase holds considerable interest in the domains of food nutrition and human health due to its significant role in causing a detrimental effect on the colour, flavour, and nutritional value of food as well as in the synthesis of melanin causing skin melanoma. Compared to other conventional analytical techniques, electrochemical (EC) sensors are highly promising owing to their quick response, great sensitivity, ease of use, and low cost. Particularly, titania nanoparticle-based electrochemical sensors have drawn special attention in identifying several biomolecules including enzymes, antibodies, and receptors, owing to their enhanced electrocatalytic activity and electron-accepting properties. In this study, Ti-O film-modified electrode is fabricated using reactive magnetron sputtering, and its affinity towards tyrosinase is examined via electrochemical methods. To comprehend the physiochemical and surface properties-governed electrocatalytic activity of modified electrodes, Ti-O films are grown under various compositional ranges and deposition temperature, and their corresponding electrochemical activity towards tyrosinase is studied. Further, to understand the underlying atomistic mechanisms and electronic-scale electrochemical characteristics, density functional theory (DFT) is employed. The main goal of the current work is to determine the correlation between macroscopic measurements and the underlying atomic properties to improve the tyrosinase activity on Ti-O surfaces. Moreover, this work offers an intriguing new perspective on the use of Ti-O-modified electrodes to detect tyrosinase in the areas of clinical diagnosis, skincare, and food science.

Keywords : density functional theory, electrochemical sensor, Ti-O film, tyrosinase
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