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High Catalytic Activity and Stability of Ginger Peroxidase Immobilized on Amino Functionalized Silica Coated Titanium Dioxide Nanocomposite: A Promising Tool for Bioremediation

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Abstract : Improving the activity and stability of the enzyme is an important aspect in bioremediation processes. Immobilization of enzyme is an efficient approach to amend the properties of biocatalyst required during wastewater treatment. The present study was done to immobilize partially purified ginger peroxidase on amino functionalized silica coated titanium dioxide nanocomposite. Interestingly there was an enhancement in enzyme activity after immobilization on nanosupport which was evident from effectiveness factor (η) value of 1.76. Immobilized enzyme was characterized by transmission electron microscopy, scanning electron microscopy and Fourier transform infrared spectroscopy. Immobilized peroxidase exhibited higher activity in a broad range of pH and temperature as compared to free enzyme. Also, the thermostability of peroxidase was strikingly improved upon immobilization. After six repeated uses, the immobilized peroxidase retained around 62% of its dye decolorization activity. There was a 4 fold increase in Vmax of immobilized peroxidase as compared to free enzyme. Circular dichroism spectroscopy demonstrated conformational changes in the secondary structure of enzyme, a possible reason for the enhanced enzyme activity after immobilization. Immobilized peroxidase was highly efficient in the removal of acid yellow 42 dye in a stirred batch process. Our study shows that this bio-remediating system has remarkable potential for treatment of aromatic pollutants present in wastewater.

Keywords : acid yellow 42, decolorization, ginger peroxidase, immobilization
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