Enhanced Photocatalytic Activity of Vertically-Aligned Transition Metal-Doped Zinc Oxide Nanorods Synthesized by a Facile Electrochemical Method

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The present work aims to study the photocatalytic activity of vertically-aligned $\text{Mn}_x\text{Zn}_{1-x}\text{O}$ nanorods ($x = 0, 0.05, 0.1, 0.15$ and 0.2) by optical, electrochemical analyses and rhodamine B (RhB) degradation. Therefore, high density of $\text{Mn}_x\text{Zn}_{1-x}\text{O}$ nanorods array were electrodeposited on ITO coated glass and GCE substrates. The XRD analysis indicated the wurtzite structure for ZnO and confirmed formation of Mn_2O_3 impurity phase in $\text{Mn}_x\text{Zn}_{1-x}\text{O}$ samples. Optical study showed the edges of absorption spectra were blue-shifted with increasing Mn concentrations. The photocatalytic performance of $\text{Mn}_x\text{Zn}_{1-x}\text{O}/\text{GCE}$ was studied through electrochemical determination of Gallic acid and RhB degradation. Amperometric analysis exhibited that the electrocatalytic current density was increased with increasing the dopant concentration in ZnO nanorods. The photoelectrocatalytic capability was studied in dark and under light irradiation conditions. Results showed that the stability, detection limit, sensitivity and photocatalytic activity of $\text{Mn}_x\text{Zn}_{1-x}\text{O}/\text{GCE}$ were improved remarkably by doping Mn in ZnO lattice. Furthermore, $\text{Mn}_x\text{Zn}_{1-x}\text{O}$ nanorods array displayed a desirable performance on RhB photocatalytic degradation.

Keywords: Photocatalytic activity; $\text{Mn}_x\text{Zn}_{1-x}\text{O}$ nanorods; Electrodeposition technique; Amperometric analysis; RhB degradation

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