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Flexible 3D ZnO/Polymer Composite by Simple-Step Growth Processing for Highly Photocatalytic Performance

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Zinc oxide (ZnO) is one of the most powerful materials for purifying organic pollutants using photocatalytic activity. In this study, we have introduced a novel method to design highly photoreactive flexible 3 dimensional (3D) ZnO nanocomposite [F-ZnO-m (m: reaction time, min)] by electrospinning and simple-step ZnO growth processing (one-step ZnO seed coating/growth processing). Significantly, the F-ZnO-m could be a new platform (or candidate) as a photocatalytic technology for both morphology control and large-area production. The highest photocatalytic degradation rate ($[k]$) was observed for F-ZnO-m at 2.552 h⁻¹, which was 8.1 times higher than that of ZnO nanoparticles (NPs; $[k] = 0.316$ h⁻¹). The enhanced photocatalytic activity of F-ZnO-m may be attributed to factors such as large surface area. The F-ZnO-m is highly recyclable and retained 98.6% of the initial decolorization rate after fifteen cycles. Interestingly, the F-ZnO-m samples show very strong antibacterial properties against both Gram-negative *Escherichia coli* (*E. coli*) and Gram-positive *Staphylococcus aureus* (*S. aureus*) after exposure to UV-light for 30 min. The antibacterial properties of F-ZnO-m samples are more effective than those of ZnO NPs. More than 96.6% of the *E. coli* is sterilized after ten cycles. These results indicate that F-ZnO-m samples might have utility in several promising applications such as highly efficient water/air treatment and inactivation of pathogenic microorganisms.

Keywords: ZnO; nanocomposite; hybrid; photocatalytic activity