

Harnessing the Power of Visible Light with GO-Ni-ZnO Nanohybrid Electrospun Polymeric Membranes for Improved Photocatalysis: A Focused Approach to Fabrication, Characterization, and Applications

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Photocatalysis exhibits considerable potential for a range of environmental, energy, and biomedical applications, especially when employing metal-doped nanoparticle systems like Ni-doped ZnO. By giving nanohybrid stability and structural support, graphene oxide (GO) enhances photocatalytic activities and increases its durability and resistance to photo-corrosion. Electrospinning is used to create GO-Ni-ZnO nanohybrid membranes, which are then characterized by FTIR, Raman spectroscopy, SEM, XRD, and UV diffuse reflectance spectroscopy. The outcomes show a notable improvement in the organic dye methylene blue's photocatalytic breakdown when exposed to visible light, underscoring the membranes' potential for environmental remediation and wastewater treatment. After 15 minutes, a nanohybrid consisting of 4% graphene oxide (GO) and 5% nickel-doped zinc oxide (Ni-doped ZnO) incorporated into a cellulose acetate electrospun mat produced the greatest photocatalytic activity of 93.41%. This outcome validates the nanohybrid system's synergistic benefits. The DPPH assay was used to measure radical scavenging activity (RSA), which is thought to be the main mechanism underlying this occurrence. With a rate constant of 0.3208 mM/min for the nanoparticles, the nanohybrid mat showed the highest RSA, achieving 80.44% of radical scavenging activity after 60 minutes. This electrospun mat's gap energy, which

was measured at 3.1346 eV, provides more evidence of the nanohybrid system's efficacy in visible light. Furthermore, an antimicrobial test demonstrated the mat's potent antibacterial qualities, showing the biggest zones of inhibition (between 25.5 and 33.0 mm) against pathogens like Salmonella typhi, Shigella sonnei, Candida albicans, Escherichia coli, and Staphylococcus aureus. All things considered, GO-Ni-ZnO nanohybrid electrospun membranes offer a viable strategy for raising photocatalytic efficiency, providing affordable and environmentally friendly answers for a range of uses.

Keywords:

Photocatalysis; Dye degradation; Semiconductor; Electrospinning; Antimicrobial.

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