Sunlight-powered cleaning: breaking down industrial dyes with nanofibers

Abstract

This study demonstrates superior photocatalytic performance using electrospun strontium-doped SnO_2 nanofibers. The synthesized one-dimensional nanostructures offer increased surface area, enhanced light harvesting, and improved electron transport pathways compared to conventional nanoparticles. Optimized 1% Sr-doped nanofibers achieved 84.74% methylene blue degradation under visible light, significantly outperforming undoped SnO_2 and its UV activity (69%). Electrochemical analyses revealed Sr doping reduces charge transfer resistance threefold while increasing carrier density. These improvements stem from Sr-induced structural modifications, including increased oxygen vacancies, reduced crystallite size, and higher microstrain. The electrospinning fabrication method enables precise dopant distribution, effectively shifting SnO_2's activity from UV-dependent to efficient visible light degradation of organic pollutants.