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Eco-Friendly Synthesis of Metallic Nanoparticles Using Plants: Advances and Applications

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Abstract: In recent years, the green synthesis of metallic nanoparticles has gained significant attention due to its eco-friendly and sustainable approach. This review presents an in-depth analysis of the principles, methodologies, and applications of plant-based green synthesis of metallic nanoparticles. By utilizing plant extracts, microorganisms, and other natural resources, this method offers a sustainable alternative to conventional chemical synthesis, minimizing environmental hazards and enhancing biocompatibility. The review explores the key mechanisms involved in biosynthesis, emphasizing the role of phytochemicals in reducing and stabilizing nanoparticles. Additionally, it highlights the diverse applications of greensynthesized nanoparticles in fields such as medicine, catalysis, environmental remediation, and electronics. Their antimicrobial, antioxidant, and catalytic properties make them highly promising for addressing global challenges, including pollution control, renewable energy solutions, and sustainable water treatment. The emergence of green nanotechnology underscores the need for responsible scientific advancements that align with environmental conservation. By investigating the latest developments in green nanoparticle synthesis, this review contributes to the ongoing efforts to integrate sustainability into nanotechnology for a greener future.

Keywords: Green synthesis, metallic nanoparticles, plant-mediated synthesis, biocompatibility, eco-friendly nanotechnology

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