

Green Synthesis of Heterocyclic Compounds: A Comprehensive Review

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Abstract: *Heterocyclic compounds are essential scaffolds in medicinal chemistry, agrochemicals, and material sciences. Traditional methods for their synthesis often involve harsh reaction conditions, toxic reagents, and environmentally hazardous solvents. In response to growing concerns about sustainability, green chemistry approaches have been explored to develop eco-friendly and efficient synthetic routes for heterocyclic compounds. This review provides a comprehensive overview of green synthetic strategies, including the use of biocatalysts, microwave and ultrasonic-assisted synthesis, ionic liquids, deep eutectic solvents, and plant-mediated methods. The role of renewable feedstocks and solvent-free reactions in minimizing environmental impact is discussed. Furthermore, recent advancements in the field, challenges in scalability, and future prospects for green synthesis are highlighted. By integrating sustainable methodologies, green synthesis offers a promising avenue for the efficient and eco-conscious production of heterocyclic compounds with potential applications in pharmaceuticals, agriculture, and materials science.*

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