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# Green Chemistry Techniques for Enhancing Pharmaceutical Waste Management

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**Abstract:** *The pharmaceutical industry is a significant contributor to chemical waste, posing severe challenges to environmental sustainability. Green chemistry offers innovative techniques to minimize waste generation and enhance the management of pharmaceutical residues. This study explores the application of green chemistry principles—such as the use of renewable feedstocks, greener solvents, and atom-economical reactions—in reducing the environmental footprint of pharmaceutical processes. Particular emphasis is placed on advanced waste management strategies, including bioremediation, catalysis-driven degradation of harmful residues, and recycling of active pharmaceutical ingredients (APIs). Furthermore, the integration of life-cycle assessment in pharmaceutical production enables a comprehensive understanding of environmental impacts, guiding the adoption of eco-friendly practices. By implementing these techniques, the pharmaceutical sector can transition toward more sustainable operations, contributing to global efforts in achieving environmental harmony. This research underscores the pivotal role of green chemistry in revolutionizing waste management practices and fostering sustainable innovation in pharmaceuticals*

**Keywords:** Green chemistry, green synthesis, clean chemistry, environmental sustainability


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