

Eco-Friendly Synthesis of Benzimidazole Derivatives: Advances in Green Chemistry and Applications

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Abstract: *The increasing presence of chemical substances in our environment poses a significant challenge, as many of these compounds are non-degradable and contribute to pollution. These persistent pollutants disrupt the ecosystem, leading to environmental instability and potential health risks. To address this issue at its source rather than merely mitigating its effects, the concept of Green Chemistry (GC) was introduced. GC focuses on designing chemical products and processes that minimize or eliminate the use and generation of hazardous substances. In recent years, heterocyclic compounds have gained prominence due to their diverse pharmacological properties. Among them, benzimidazole, an aromatic heterocyclic compound, holds great significance in medicinal chemistry. It exhibits a wide range of therapeutic activities, including analgesic, anti-inflammatory, antiulcer, antihypertensive, antibacterial, antiviral, antifungal, anticancer, and antihistaminic properties. Given its medicinal importance, the synthesis of benzimidazole derivatives has become a key area of research for synthetic chemists. Traditional methods for synthesizing benzimidazoles often require prolonged heating, intricate apparatus setups, and costly procedures that contribute to environmental pollution. In contrast, green synthetic approaches offer eco-friendly alternatives that are cost-effective, energy-efficient, and sustainable. This review highlights various green methodologies for synthesizing substituted benzimidazoles, emphasizing their advantages over conventional techniques in terms of efficiency, simplicity, and environmental safety.*

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