

Sustainable heterocyclic chemistry: Green paths, systematic perceptions, and energy applications

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ABSTRACT The evolution of environmentally friendly and sustainable chemical procedures has been increased rapidly with the emerging demand for energy universally and also due to environmental concerns. The heterocyclic compounds can play a major role in fulfilling the demand of energy needs, such as fuel cells, hydrogen compounds, energy storage systems, due to its miscellaneous structures and adaptable electrical characteristics, and for various other applications. However, its harmful by-products range, challenging reaction condition, and toxic reagents are also the part of heterocyclic synthesis. Recent advancements in environmentally friendly heterocyclic synthesis are emphasized and highlighted in this review, with a major focus on its environmental friendly processes, such as catalysis, its precursors, and various friendly solvent-free and beneficial reactions from biomass. The paper also focuses on the forthcoming perceptions of merging green chemistry with artificial intelligence, nanotechnology, as well as sustainable and circular economy techniques for energy applications. Alongside, the paper also focuses and addresses the significant concerns like commercialization, cost-effectiveness, and regulatory barriers and limitations. The advancements in the eco-friendly synthesis of heterocyclic compounds are comprehensively examined in this paper, with a key insights of green technologies that help to gain sustainable heterocyclic chemistry solutions.

KEY WORDS: Heterocyclic compounds, Green heterocyclic synthesis, Organic photovoltaics, Nanotechnology.

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