

Review Article

SUSTAINABLE SOLUBILITY ENHANCEMENT USING BIODEGRADABLE HYDROTROPES: A GREEN CHEMISTRY PERSPECTIVE

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The growing demand for sustainable, environmentally friendly solutions in pharmaceutical formulations has led to the exploration of biodegradable hydrotropes as an alternative to traditional solubilizing agents. Hydrotropes are compounds that enhance the solubility of poorly soluble drugs in aqueous environments without forming micelles, making them ideal for replacing toxic organic solvents in pharmaceutical applications. This review focuses on the potential of biodegradable hydrotropes to address challenges related to the solubility and bioavailability of poorly water-soluble drugs, which are prevalent in the Biopharmaceutical Classification System (BCS) Class II and Class IV categories. These hydrotropes offer a green chemistry solution by providing an eco-friendly and sustainable means of enhancing solubility while maintaining biocompatibility and biodegradability. We highlight the applications of biodegradable hydrotropes in various drug delivery systems, including oral, topical, and injectable formulations, as well as their role in nanoparticle-based drug delivery, controlled release, and personalized medicine. The integration of biodegradable hydrotropes into greener pharmaceutical manufacturing processes also aligns with increasing regulatory demands for reduced environmental impact and toxicity. Future advancements in the design, production, and application of biodegradable hydrotropes are expected to enhance their effectiveness in improving solubility and bioavailability, facilitating more efficient, cost-effective, and sustainable drug development. This review emphasizes the promise of biodegradable hydrotropes as an essential tool for green pharmacy, offering both environmental and therapeutic benefits in pharmaceutical practice.

Keywords: Biodegradable hydrotropes, Solubility enhancement, Bioavailability, Green chemistry, Pharmaceutical formulations

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