

RESEARCH ARTICLE

Biosynthesized Silver Nanoparticles Catalyzed Aqueous-Phase Synthesis of Isoxazol-5(4H)-One Derivatives

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ABSTRACT:

We developed a sustainable and efficient protocol for synthesizing isoxazol-5(4H)-one derivatives using green synthesized silver nanoparticles as a green nonocatalyst. The one-pot, three-component reaction of aromatic aldehydes, ethyl acetoacetate, and hydroxylamine hydrochloride proceeded smoothly in aqueous phase at room temperature, affording the target compounds in high to excellent yields with short reaction times. The plant-derived silver nanoparticles demonstrated exceptional catalytic activity while offering advantages such as low toxicity, cost-effectiveness, and easy handling. Notably, electron-donating substituents on the aromatic aldehydes enhanced reactivity, whereas steric and electronic factors influenced reaction efficiency. This method aligns with green chemistry principles by eliminating organic solvents, minimizing energy consumption, and utilizing a biodegradable catalyst. The protocol provides a practical, eco-friendly, and scalable approach to heterocyclic synthesis, making it a valuable addition to sustainable organic transformations.

KEYWORDS: Isoxazol-5(4H)-one, Silver nanoparticle, Benzaldehyde, Green synthesis, Mild conditions.

INTRODUCTION:

A catalyst is a chemical entity that facilitates the acceleration of a chemical transformation by offering an energetically favorable alternative reaction pathway, thereby reducing the activation energy barrier, without undergoing net chemical change in the overall reaction cycle¹. Although it may transiently engage in intermediate complex formation during the reaction mechanism, the catalyst is regenerated at the end of the catalytic cycle and thus remains stoichiometrically unaltered.

Catalysis functions through the provision of active sites that promote the stabilization of high-energy transition states or facilitate the generation of reactive intermediates, enabling an enhanced reaction rate for both the forward and reverse processes, while preserving the equilibrium position of the system.

Catalysts are characterized by three principal physicochemical properties such as catalytic activity, referring to their ability to accelerate reaction kinetics; selectivity, which determines the preferential formation

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