Research on Chemical Intermediates
https://doi.org/10.1007/s11164-024-05265-x

A bio-waste-mediated novel fabrication of $ZnCr_2O_4$ nanoparticles: a heterogeneous catalyst in Biginelli reaction

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Received: 23 January 2024 / Accepted: 6 March 2024

Abstract

Nowadays, emerging nanocatalysts have gained much attention in the field of organic transformations for the development of greener chemistry protocols. Also, the Biginelli reaction has gained prominence amidst multicomponent reactions due to the extensive therapeutic significance of the product dihydropyrimidinones (DHPMs). In this work, first-time zinc chromite nanoparticles ($ZnCr_2O_4$ NPs) were prepared using cow urine (CoU) as a natural source through a biogenic approach. The physicochemical traits of the synthesized $ZnCr_2O_4$ NPs were investigated via XRD, UV-DRS, IR, FESEM, EDX, HRTEM, and XPS techniques. Furthermore, $ZnCr_2O_4$ NPs were implemented as a heterogeneous nanocatalyst for sustainable, uncomplicated, and one-pot synthesis of DHPM analogs. The synthetic strategy offers diverse appealing attributes, such as simplicity, bland reaction systems, facile work-up, reusability of catalyst, and excellent yield. Being heterogeneous, the nanocatalyst was simply retrieved after the reaction and reused (up to 5 cycles) in the Biginelli reaction without any noticeable diminishment in catalytic performance. As a result, the current study reveals that creating $ZnCr_2O_4$ NPs through a simple green approach and evaluating excellent catalytic activity may aid nanochemistry research by opening up new pathways for advanced organic transformations.

Extended author information available on the last page of the article

Published online: 30 March 2024