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Zirconia-based catalyst for the one-pot synthesis of coumarin through Pechmann reaction

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Abstract

Coumarins play an important role in drug development with diverse biological applications. Herein, we present the synthesis of coumarin through Pechmann reaction by using zirconia-based heterogeneous catalysts (ZrO₂-TiO₂, ZrO₂-ZnO, and ZrO₂/cellulose) in a solvent-free condition at room temperature. ZrO₂-TiO₂, ZrO₂-ZnO, and ZrO₂/cellulose were identified through spectroscopic techniques such as FESEM, X-ray, EDS, XPS, and FT-IR. ZrO₂-TiO₂ showed the best catalytic performance while ZrO₂/cellulose was inactive. The kinetic parameters were observed in a solvent-free condition as well as in toluene and ethanol. The temperature effect was extensively studied which revealed that increasing the temperature will increase the rate of reaction. The rate of reaction in a solvent-free condition, ethanol, and toluene were 1.7 x 10⁻³, 1.7 x 10⁻², and 5.6 x 10⁻³ g mol⁻¹ min⁻¹, respectively.

Keywords

Author Keywords: Zirconia; Heterogeneous catalyst; Coumarin; Pechmann reaction; Kinetic study; Room temperature; Solvent-free condition

KeyWords Plus: ELECTRO-CATALYST; OXYGEN EVOLUTION; IONIC LIQUID; COBALT OXIDE; EFFICIENT; DERIVATIVES; ACID; NANOPARTICLES; CONSTRUCTION; CONDENSATION

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