STUDI SINTESIS TURUNAN SENYAWA 1,4-DIHIDROPIRIDIN TERKATALISIS Fe_3O_4-Cu MELALUI REAKSI MULTIKOMPONEN DENGAN METODE SONOKIMIA

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INTISARI

Sintesis turunan 1,4-dihidropiridin dilakukan melalui reaksi multikomponen Hantzsch menggunakakan katalis Fe_3O_4-Cu 10% dengan metode sonokimia telah dilakukan. Tujuan dari penelitian ini yaitu membandingkan sintesis turunan senyawa 1,4-dihidropiridin secara konvensional dan sonokimia, membandingkan reaksi multikomponen pada turunan 1,4-dihidropiridin simetris (*acridinedione*) dan asimetris (polihidrokuinolin), serta mempelajari kemampuan penggunaan ulang katalis dalam sintesis senyawa turunan 1,4-dihidropiridin.

Turunan 1,4-dihidropiridin simetris disintesis melalui reaksi tiga komponen dari benzaldehida, dimedon, dan amonium asetat. Reaksi empat komponen berbahan dasar dimedon, etil asetoasetat, amonium asetat, dan turunan aldehida (benzaldehida, vanilin, furfural) dilakukan untuk mensintesis turunan 1,4-dihidropiridin asimetris. Perbandingan metode sonikasi dan konvensional dilakukan dengan membandingkan persen hasil dan waktu reaksi pada sintesis 1,4-dihidropiridin simetris. Perbandingan 1,4-dihidropiridin simetris dan asimetris dilakukan dengan mensintesis dan membandingkan persen hasil dari berbagai turunan 1,4-dihidropiridin asimetris. Senyawa 1,4-dihidropiridin simetris menghasilkan produk dengan persen hasil lebih besar dari 1,4-dihidropiridin asimetris. Penggunaan ulang katalis Fe_3O_4-Cu 10% dilakukan pada sintesis 1,4-dihidropiridin asimetris dari benzaldehida, dimedon, etil asetoasetat, dan amonium asetat sampai penurunan yield yang signifikan.

Sintesis turunan 1,4-dihidropiridin simetris dengan metode pemanasan dan sonikasi dilakukan selama 3 jam dan 1,5 jam. Produk reaksi multikomponen, yakni 3,3,6,6-tetrametil-4-fenil-3,4,6,7,9,10-heksahidroacridine-1,8(2H,5H)-dione diperoleh dengan persen hasil berturut – turut sebesar 80% dan 97%. Sintesis dengan metode sonikasi lebih efisien, menghasilkan produk dengan persen hasil lebih tinggi, dan waktu yang lebih singkat. Sintesis turunan 1,4-dihidropiridin asimetris dengan menggunakan benzaldehida, vanilin, dan furfural menghasilkan produk dengan persen hasil berturut – turut sebesar 69%, 51%, dan 73%. Katalis nanopartikel magnetit Fe_3O_4-Cu 10% dapat dengan mudah dipisahkan dari campuran reaksi dengan magnet eksternal dan digunakan kembali pada sintesis 1,4-dihidropiridin asimetris sebanyak 7 kali tanpa mengurangi aktivitas katalitiknya.

Kata kunci: acridinedione, 1,4-dihidropiridin, Fe_3O_4-Cu, polihidrokuinolin, sonokimia

SYNTHESIS OF 1,4-DIHYDHYDROPYRIDINE DERIVATIVES Fe_3O_4-Cu CATALYZED VIA HANTZSCH MULTICOMPONENT REACTION USING SONOCHEMICAL METHOD

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ABSTRACT

Synthesis of 1,4-dihydropyridine derivatives was carried out by a multicomponent Hantzsch reaction using a 10% Fe_3O_4-Cu catalyst with a sonochemical method. The aims of this study were to compare the conventional and sonochemical synthesis of 1,4-dihydropyridine derivatives, to compare the multicomponent reactions of symmetric (acridinedione) and asymmetric (polyhydroquinoline) 1,4-dihydropyridine derivatives, and to study the ability to reuse catalysts in the synthesis of 1,4-dihydropyridine derivative.

The symmetric 1,4-dihydropyridine (acridinedione) derivative is synthesized via a three-component reaction from benzaldehyde, dimedone, and ammonium acetate. A four-component reaction based on dimedone, ethyl acetoacetate, ammonium acetate, and aldehyde derivatives (benzaldehyde, vanillin, furfural) was carried out to synthesize the asymmetric 1,4-dihydropyridine derivative (polyhydroquinoline). Comparison of sonication and conventional methods was carried out by comparing the percent yield and reaction time of the symmetric 1,4-dihydropyridine synthesis. A comparison of symmetric and asymmetric 1,4-dihydropyridines was carried out by synthesizing and comparing the percent yields of various symmetric 1,4-dihydropyridine derivatives (polyhydroquinolines). The symmetric 1,4-dihydropyridine compound produces a product with a yield percentage greater than the asymmetric 1,4-dihydropyridine compound. Re-use of 10% Fe_3O_4-Cu catalyst was carried out in the asymmetric synthesis of 1,4-dihydropyridine from benzaldehyde, dimedone, ethyl acetoacetate, and ammonium acetate until a significant decrease in yield.

Synthesis of the symmetric 1,4-dihydropyridine derivative by heating and sonication method was carried out for 3 hours and 1.5 hours. The multicomponent reaction product, ie 3,3,6,6-tetramethyl-4-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione was obtained with successive percent yields by 80% and 97%. Synthesis using the sonication method is more efficient, produces products with higher yields and shorter time. Synthesis of the asymmetric 1,4-dihydropyridine derivative using benzaldehyde, vanillin, and furfural produced products with yields of 69%, 51%, and 73%, respectively. The 10% Fe_3O_4-Cu magnetite nanoparticle catalyst can be easily separated from the reaction mixture with an external magnet and reused in the asymmetric 1,4-dihydropyridine synthesis 7 times without reducing its catalytic activity.

Keyword: acridinedione, 1,4-dihydropyridine, Fe_3O_4-Cu, polyhydroquinoline, sonochemistry