PREPARASI NANOPARTIKEL Fe_3O_4-Cu DAN APLIKASINYA SEBAGAI KATALIS DALAM SINTESIS TURUNAN PROPARGILAMIN MELALUI REAKSI MULTIKOMPONEN

Erti Listyorini
18/427615/PA/18575

INTISARI

Penelitian ini bertujuan untuk melakukan preparasi dan mengkarakterisasi nanopartikel Fe_3O_4-Cu serta mengevaluasi aktivitas katalitiknya sebagai katalis asam pada sintesis turunan propargilamin. Penelitian diawali dengan sintesis Fe_3O_4 dengan metode sono-kopresipitasi, dilanjutkan sintesis Fe_3O_4-Cu dengan penambahan logam Cu menggunakan $CuSO_4 \cdot 5H2O$. Hasil sintesis material Fe_3O_4 dan Fe_3O_4-Cu dikarakterisasi menggunakan XRD, FTIR, SEM-EDX, TEM, VSM, SAA, dan uji keasaman secara gravimetri. Uji aktivitas katalitik Fe_3O_4-Cu sebagai katalis asam dalam sintesis propagilamin dilakukan melalui reaksi multikomponen berbahan dasar benzaldehida, fenilasetilena, dan morfolin. Produk reaksi dielusidasi dengan spektrometer inframerah, ^{1}HNMR, ^{13}CNMR, serta *elemental analyzer*.

Hasil analisis FTIR, XRD, dan SEM-EDX menunjukkan bahwa sintesiss nanopartikel Fe_3O_4-Cu telah berhasil dilakukan. Katalis Fe_3O_4-Cu yang memiliki nilai keasaman terbesar yaitu Fe_3O_4-Cu 10%mol dengan nilai 6,63 mmol g^{-1}. Analisis TEM menunjukkan bahwa partikel Fe_3O_4-Cu 10% berbentuk bola bulat dan sebagian teraglomerasi. Hasil uji kemagnetan dengan VSM menunjukkan bahwa Fe_3O_4-Cu 10% bersifat superparamagnetit dan dapat dipisahkan dalam medium cair. Hasil analisis SAA mengindikasikan Fe_3O_4-Cu merupakan material mesopori dengan luas permukaan, volume pori, dan diameter pori masing-masing sebesar 50,58 m^2 g^{-1}, 0,20 cm^3 g^{-1}, dan 6,919 nm. Uji aktivitas katalitik menunjukkan bahwa katalis optimum dalam reaksi multikomponen adalah nanopartikel Fe_3O_4-Cu 10%, dimana turunan propargilamin dapat disintesis dengan persen hasil 99%.

Kata kunci: nanopartikel Fe_3O_4-Cu, reaksi multikomponen, sono-kopresipitasi, turunan propargilamin

PREPARATION OF Fe_3O_4-Cu NANOPARTICLE AND AND ITS APPLICATION AS A CATALYST IN MULTICOMPONENT REACTION TOWARDS THE SYNTHESIS OF PROPARGYLAMINE DERIVATIVE

Erti Listyorini
18/427615/PA/18575

ABSTRACT

This research was aimed to prepare and to characterize of Fe_3O_4-Cu nanoparticle and to evaluate their catalytic activity as an acid catalyst in the synthesis of propargylamine derivatives. The research was started by synthesizing Fe_3O_4 through a sono-coprecipitation method, followed by the synthesizing Fe_3O_4-Cu through doping of Cu metal using $CuSO_4 \cdot 5H_2O$. The materials were characterized by XRD, FTIR, SEM-EDX, TEM, VSM, SAA, and gravimetrically acidity test. The catalytic activity test of Fe_3O_4-Cu as an acid catalyst in synthesis of propargylamine through a multicomponent reaction was carried out from benzaldehyde, phenylacetylene, and morpholine. The products were elucidated with infrared spectrometer, ^{1}H-NMR, ^{13}C-NMR, and elemental analyzer.

The results of FTIR, XRD, and SEM-EDX analysis showed that the synthesis of Fe_3O_4-Cu had been successfully carried out. Fe_3O_4-Cu catalyst has the greatest acidity value at concentration of 10% mol with a value of 6,63mmol g^{-1}. TEM analysis showed that Fe_3O_4-Cu 10% particles were spherical and partially agglomerated. The results of magnetic test with VSM showed that Fe_3O_4-Cu 10% was superparamagnetic and could be separated in liquid medium. The results of SAA analysis indicate that Fe_3O_4-Cu 10% is mesoporous material with surface area, pore volume, and pore diameter of 50,58 m^2 g^{-1}, 0,20 cm^3 g^{-1}, and 6,919 nm, respectively. The catalytic activity test showed that the optimum catalyst in the multicomponent reaction was Fe_3O_4-Cu 10% nanoparticles, where propargylamine derivatives could be synthesized in 99% yields.

Keyword: Fe_3O_4-Cu nanoparticle, multicomponen reaction, propargylamine derivative, sono-coprecipitation