PENGGUNAAN KATALIS HIDROTALSIT Mg/Al DALAM REAKSI KONDENSASI ALDOL ANTARA FURFURAL DAN SIKLOPENTANON

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INTISARI

Studi terhadap penggunaan katalis Hidrotalsit Mg/Al (HTMA) dalam reaksi kondensasi aldol antara furfural (F) dan siklopentanon (CP) bertujuan untuk menentukan kondisi optimum. Kajian terhadap kondisi optimum reaksi meliputi studi tentang pengaruh dosis katalis, suhu, waktu reaksi dalam kondisi bebas yang pelarut, serta studi terhadap pengaruh penambahan air terhadap selektivitas produk yang dihasilkan.

Sintesis katalis HTMA dilakukan menggunakan metode kopresipitasi. Material yang terbentuk kemudian dikalsinasi pada suhu 350, 450, 550, dan 650 °C (HTMA-C350, HTMA-C450, HTMA-C550, dan HTMA-C650). Katalis yang dihasilkan kemudian dikarakterisasi menggunakan XRD, FTIR, dan CO_2-TPD. Uji aktivitas katalis dan kajian kondisi optimum dilakukan dengan menambahkan katalis pada campuran furfural dan siklopentanon pada kondisi reaksi yang telah ditentukan, kemudian hasil reaksi dianalisis menggunakan GCMS.

Hasil penelitian menunjukan bahwa reaksi kondensasi aldol antara furfural dan siklopentanon telah berhasil dilakukan menggunakan katalis HTMA-C550 yang menghasilkan total produk 65,27% dengan presenstase FCP (2-(2-furilmetiliden)siklopentanon) 41,82% dan F_2CP (2,5-bis(2-furilmetiliden)-siklopentanon) 23,45% yang dilakukan pada suhu reaksi 50 ℃, massa katalis 50 mg, perbandingan molar F: CP adalah 1 : 5, dalam waktu 3,5 jam. Studi ini juga menyelidiki efek penambahan air ke dalam campuran reaksi dalam kondisi serupa. Hasil penelitian menunjukkan bahwa penambahan 8 mmol air ke dalam campuran reaksi dapat meningkatkan total hasil produk menjadi 94,4%.

Kondisi optimum untuk menghasilkan F_2CP 100% diperoleh dengan menggunakan katalis HTMA-C550 pada suhu reaksi 100℃, dosis katalis 75 mg, perbandingan molar antara F:CP 1:1, dalam waktu 3,5 jam. Perubahan rasio molar F/CP mempengaruhi selektivitas produk yang dihasilkan.

Kata kunci: hidrotalsit, kondensasi aldol, siklopentanon dan furfural.

UTILIZATION Mg-Al HYDROTALCITE CATALYSTS IN ALDOL CONDENSATION BETWEEN FURFURAL AND CYCLOPENTANONE

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ABSTRACT

This research study focused on utilizing a hydrotalcite Mg/Al (HTMA) catalyst in the aldol condensation reaction between furfural and cyclopentanone. The goal is to determine the optimum conditions for this reaction, by systematically varying the catalyst dose, temperature, and reaction time under solvent-free conditions and exploring the impact of adding water. The study's findings could have implications for the efficient and selective synthesis of the desired product.

The HTMA catalyst synthesized using the coprecipitation method. The material formed was then calcinated at different temperatures (350, 450, 550, and 650 ℃) to produce variants known as HTMA-C350, HTMA-C450, HTMA-C550, and HTMA-C650. The resulting catalysts were characterized using various techniques such as XRD, FTIR, CO_2TPD. The reaction products from catalyst activity tests and optimum condition studies were analyzed using GCMS.

The aldol condensation reaction between furfural and cyclopentanone successfully carried out using HTMA-C550 catalyst produced total product of 65.27% at the reaction temperature of 50 ℃, catalyst dosage of 50 mg, molar ratio of F:CP of 1:5, within 3.5 hours. The percentage of FCP (2-(2-furilmethyliden)cyclopentanone) was 41.82%, and F_2CP (2,5-bis(2-furilmethyliden)-cyclopentanone) was 23.45%. Water addition could play a positive role in enhancing the reaction efficiency. The results indicated that adding 8 mmol of water to the reaction mixture under similar conditions increased the total product yield to 94.4%.

The optimum reaction condition successfully produced 100% F_2CP used the HTMA-C550 at reaction temperature of 100 ℃, 75 mg catalyst dosage, molar ratio of F:CP of 1 : 1, within 3.5 hours. The study found that changes in the molar ratio of furfural to cyclopentanone (F:CP) affected the selectivity of the resulting product. This emphasizes the importance of controlling the molar ratio for achieving specific reaction outcomes.

Keyword: hydrotalcite, aldol condensation, cyclopentanone, and furfural