

**Pengaruh Parameter Reaksi terhadap Efektivitas MOFs sebagai
Katalis Reaksi Sikloadisi CO₂-Epoksida (Studi Literatur)**

SKRIPSI

disusun untuk memenuhi sebagian syarat guna memperoleh gelar Sarjana Sains
Program Studi Kimia



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Sebuah skripsi yang diajukan untuk memenuhi salah satu syarat memperoleh gelar Sarjana Sains pada Fakultas Pendidikan Matematika dan Ilmu Pengetahuan Alam

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ABSTRAK

Reaksi sikloadisi antara karbon dioksida (CO_2) dan epoksida merupakan salah satu upaya yang dapat dilakukan untuk mengurangi jumlah emisi gas CO_2 di atmosfer. *Metal Organic Frameworks* (MOFs) merupakan katalis heterogen yang telah berhasil digunakan untuk mengkonversi CO_2 menjadi karbonat siklik. Penelitian ini bertujuan untuk mengetahui efektivitas penggunaan MOFs serta pengaruh waktu, suhu, tekanan CO_2 , konsentrasi katalis dan kelembapan terhadap efektivitas MOFs sebagai katalis reaksi sikloadisi. Jenis katalis MOFs yang dianalisis adalah ZIF-71, ZIF-95, ZIF-78, $\text{Zn}(\text{atz})(\text{bdc})_{0,5}$, Fe/ZIF-8, Cu(TPA), HKUST-1 dan MOF-14 yang ditentukan melalui metode studi literatur. Analisis dilakukan dengan membandingkan hasil konversi epoksida dan selektivitas terhadap karbonat siklik pada kondisi reaksi yang berbeda. Katalis ZIF-71, ZIF-95, $\text{Zn}(\text{atz})(\text{bdc})_{0,5}$, Fe/ZIF-8 dan Cu(TPA) mampu mengkonversi epoksida >90% dengan selektivitas >99%. Sebaliknya, ZIF-78 menunjukkan hasil konversi dan selektivitas yang rendah yaitu 88 dan 61%. Berdasarkan penelitian ini, ditemukan bahwa ZIF-71 merupakan katalis yang paling efektif untuk reaksi sikloadisi CO_2 -epoksida. Karena menghasilkan konversi sebesar 99% dengan selektivitas >99%. Selain itu, ZIF-71 efektif digunakan kembali hingga 6 kali tanpa adanya perubahan aktivitas katalitik yang signifikan dengan nilai TOF 124/h. Secara umum, variabel waktu, suhu, tekanan CO_2 dan konsentrasi katalis diamati berpengaruh positif terhadap hasil konversi. Sedangkan, kelembapan udara berpengaruh negatif terhadap kemampuan MOFs mengadsorpsi CO_2 .

Kata Kunci: *Sikloadisi, CO_2 , MOFs, ZIFs dan Epoksida*

ABSTRACT

The cycloaddition reaction between carbon dioxide (CO_2) and epoxide is one of the methods that are used to reduce the amount of CO_2 gas emissions in the atmosphere. Metal Organic Frameworks (MOFs) are heterogeneous catalysts that have been successfully used to convert CO_2 into cyclic carbonates. This study aims to determine the effectiveness of using MOFs and the effect of time, temperature, CO_2 pressure, catalyst concentration and humidity on the effectiveness of MOFs as a cycloaddition reaction catalyst. The types of MOFs catalyst analyzed were ZIF-71, ZIF-95, ZIF-78, $\text{Zn}(\text{atz})(\text{bdc})_{0.5}$, Fe/ZIF-8, Cu(TPA), HKUST-1 and MOF-14 which were determined through the literature study method. The analysis was carried out by comparing the results of epoxide conversion and selectivity to cyclic carbonate under different reaction conditions. The ZIF-71, ZIF-95, $\text{Zn}(\text{atz})(\text{bdc})_{0.5}$, Fe/ZIF-8, and Cu(TPA) catalyst were able to convert >90% epoxide with >99% selectivity. On the other hand, ZIF-78 showed low conversion and selectivity results, namely 88 and 61%, respectively. Based on this research, it was found that ZIF-71 was the most effective catalyst for the CO_2 -epoxide cycloaddition reaction. Because it produces a conversion of 99% with >99% selectivity. In addition, ZIF-71 was effectively reused up to 6 times without significant change in catalytic activity with a TOF value of 124/h. In general, the variables of time, temperature, CO_2 pressure and catalyst concentration were observed to have a positive effect on the conversion results. Meanwhile, air humidity has a negative effect on the ability of MOFs to adsorb CO_2 .

Key word: *Cycloaddition, CO_2 , MOFs, ZIFs, Epoxide*

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