ABSTRAK

KONVERSI CO_2 MELALUI PROSES METANASI MENGGUNAKAN KATALIS Ni/Al_2O_3 DENGAN VARIASI BERAT KATALIS DAN WAKTU OPERASI TERHADAP *YIELD* METANA

Nadya Shafa Febiola, 2026

Peningkatan emisi karbon dioksida (CO_2) menjadi salah satu penyebab utama pemanasan global sehingga diperlukan upaya untuk mengurangi konsentrasinya di atmosfer. Salah satu metode yang dapat dilakukan adalah mengkonversi CO_2 menjadi metana (CH_4) melalui proses metanasi menggunakan katalis Ni/Al_2O_3. Penelitian ini bertujuan untuk menganalisis pengaruh berat katalis dan waktu operasi terhadap *yield* metana serta menentukan kondisi operasi optimum. Variasi berat katalis yang digunakan yaitu 60, 65, 70, 75, dan 80 gram, sedangkan waktu operasi divariasikan selama 60, 90, dan 120 menit pada suhu 200°C dan tekanan 7,5 psi. Produk gas hasil reaksi dianalisis menggunakan *Multi Gas Detector Analyze*r. Hasil penelitian menunjukkan bahwa peningkatan berat katalis dan waktu operasi meningkatkan pembentukan metana serta menurunkan sisa CO_2 dan H_2. *Yield* metana tertinggi diperoleh pada berat katalis 80 gram dan waktu operasi 120 menit dengan kadar CH_4 sebesar 61,47%vol, sedangkan kadar CO_2 dan H_2 masing-masing sebesar 35,57%vol dan 1,00%vol. Hasil tersebut menunjukkan bahwa peningkatan jumlah katalis dan lamanya waktu operasi mampu meningkatkan efektivitas konversi CO_2 menjadi metana. Kondisi optimum proses metanasi diperoleh pada berat katalis 80 gram dan waktu operasi 120 menit.

Kata kunci: karbon dioksida, katalis Ni/Al_2O_3, metana, metanasi, waktu operasi.

ABSTRACT

CO_2 Conversion Through the Methanation Process Using Ni/Al_2O_3 Catalyst with Variations Catalyst Mass and Operation Time on Methane Yield

Nadya Shafa Febiola, 2026

The increasing concentration of carbon dioxide (CO_2) emissions has become one of the primary contributors to global warming, creating a need for effective methods to reduce atmospheric CO_2 levels. One promising approach is the conversion of CO_2 into methane (CH_4) through a methanation process using a Ni/Al_2O_3 catalyst. This study aimed to investigate the effects of catalyst weight and operating time on methane yield and to determine the optimum operating conditions. The catalyst weight was varied at 60, 65, 70, 75, and 80 g, while the operating time was set at 60, 90, and 120 minutes under a reaction temperature of 200°C and atmospheric pressure. The gaseous products were analyzed using a Multi Gas Detector Analyzer. The results showed that increasing catalyst weight and operating time enhanced methane formation while reducing the concentrations of residual CO_2 and H_2. The highest methane yield was obtained at a catalyst weight of 80 g and an operating time of 120 minutes, producing 61.47% vol CH_4, while the remaining CO_2 and H_2 concentrations were 35.57% vol and 1.00% vol, respectively. These findings indicate that increasing catalyst loading and extending operating time improve the effectiveness of CO_2 conversion into methane. The optimum methanation condition was achieved at a catalyst weight of 80 g and an operating time of 120 minutes.

***Keywords**: carbon dioxide (CO_2), methane, methanation, Ni/Al_2O_3 catalyst, operating time.*