

ABSTRAK

Biogas merupakan salah satu sumber energi terbarukan yang berpotensi menggantikan bahan bakar fosil. Namun, kandungan karbon dioksida (CO_2) dan hidrogen sulfida (H_2S) yang cukup tinggi dalam biogas menyebabkan nilai kalor biogas menurun, bersifat korosif, serta mengurangi kualitas pembakaran. Oleh karena itu, diperlukan proses pemurnian untuk meningkatkan kadar metana (CH_4) sehingga kualitas biogas menjadi lebih baik. Penelitian ini bertujuan menganalisis pengaruh pH larutan natrium hidroksida (NaOH), debit biogas, dan waktu kontak terhadap penyisihan CO_2 dan H_2S serta peningkatan kadar CH_4 menggunakan *Bubble column*.

Penelitian dilakukan menggunakan *Bubble column* dengan basis drum HDPE berdiameter 46 cm dengan tinggi 100 cm dan *sparger* berbahan nylon mesh 500 berdiameter 114 mm. Variasi penelitian meliputi pH absorben yang berupa air dengan penambahan NaOH sehingga nilai pH nya menjadi 8, 10, dan 12, debit aliran biogas sebesar 1, 2, dan 3 L/menit, serta waktu selama 20, 40, dan 60 menit. Komposisi biogas dianalisis menggunakan gas analyzer SCD 30 dan BH-90A untuk mengukur kadar CO_2 , CH_4 , dan H_2S setelah proses pemurnian.

Hasil penelitian menunjukkan bahwa peningkatan pH larutan NaOH meningkatkan efisiensi pemurnian biogas, sedangkan peningkatan debit biogas menurunkan efisiensi penyisihan CO_2 dan kadar CH_4 . Kondisi optimum diperoleh pada pH 12, debit biogas 1 L/menit, dan waktu kontak 20 menit dengan kadar CO_2 sebesar 4,51%, kadar CH_4 sebesar 95,49%, serta H_2S tidak terdeteksi (0 ppm). Kondisi tersebut menghasilkan efisiensi penyerapan CO_2 sebesar 90,57%.

Kata kunci : pemurnian biogas; *Bubble column*.

ABSTRAK

Biogas is one of the most promising renewable energy sources as an alternative to fossil fuels. However, its relatively high carbon dioxide (CO₂) and hydrogen sulfide (H₂S) contents reduce the heating value of biogas, promote corrosion, and deteriorate combustion performance. Therefore, an effective upgrading process is required to increase the methane (CH₄) concentration and improve biogas quality. This study aimed to investigate the effects of sodium hydroxide (NaOH) solution pH, biogas flow rate, and contact time on CO₂ and H₂S removal as well as CH₄ enrichment using a bubble column reactor.

The experiments were conducted in a bubble column reactor constructed from an HDPE drum with a diameter of 46 cm and a height of 100 cm, equipped with a 114 mm diameter porous sparger made of 500-mesh nylon. The experimental variables included absorbent solution pH values of 8, 10, and 12, adjusted by adding NaOH to water; biogas flow rates of 1, 2, and 3 L/min; and contact times of 20, 40, and 60 min. The biogas composition after the upgrading process was analyzed using SCD30 and BH-90A gas analyzers to determine the concentrations of CO₂, CH₄, and H₂S.

The results demonstrated that increasing the NaOH solution pH significantly enhanced the biogas upgrading performance, whereas increasing the biogas flow rate reduced the CO₂ removal efficiency and methane concentration. The optimum operating condition was achieved at pH 12, a biogas flow rate of 1 L/min, and a contact time of 20 min, resulting in a CO₂ concentration of 4.51%, a CH₄ concentration of 95.49%, and a non-detectable H₂S concentration (0 ppm). Under these conditions, the CO₂ removal efficiency reached 90.57%.

Keywords: *Biogas upgrading; Bubble column reactor.*