

ABSTRAK

Biogas merupakan sumber energi terbarukan yang berpotensi dikembangkan sebagai alternatif bahan bakar fosil, namun masih mengandung gas pengotor seperti karbon dioksida (CO_2) dan hidrogen sulfida (H_2S) yang dapat menurunkan kualitas biogas. Penelitian ini bertujuan untuk menganalisis pengaruh variasi berat adsorben dan laju aliran biogas terhadap kinerja pemurnian biogas menggunakan kombinasi adsorben serbuk besi dan zeolit. Variasi berat adsorben yang digunakan adalah 0,5 kg, 0,75 kg, dan 1 kg, dengan laju aliran biogas sebesar 1, 2, dan 3 l/menit. Parameter yang dianalisis meliputi peningkatan konsentrasi metana (CH_4), penurunan kadar CO_2 , serta penghilangan H_2S . Hasil penelitian menunjukkan bahwa peningkatan berat adsorben dan penurunan laju aliran biogas berpengaruh signifikan terhadap peningkatan kualitas biogas. Penggunaan berat adsorben 1 kg dengan laju aliran 1 l/menit menghasilkan peningkatan CH_4 tertinggi yaitu (50,67%), dan penurunan CO_2 terbesar sampai (49,33%), serta penghilangan H_2S hingga tidak terdeteksi (0%). Hasil ini menunjukkan bahwa berat adsorben dan laju aliran biogas berperan penting dalam meningkatkan kinerja proses adsorpsi.

Kata kunci : Biogas, pemurnian biogas, gram besi, zeolit, adsorpsi, metana (CH_4), karbon dioksida (CO_2), hidrogen sulfida (H_2S).

ABSTRACT

Biogas is a renewable energy source with significant potential to be developed as an alternative to fossil fuels; however, it still contains impurity gases such as carbon dioxide (CO₂) and hydrogen sulfide (H₂S), which can reduce its quality. This study aims to analyze the effect of variations in adsorbent mass and biogas flow rate on the performance of biogas purification using a combination of iron powder and zeolite adsorbents. The adsorbent mass variations applied were 0.5 kg, 0.75 kg, and 1 kg, with biogas flow rates of 1, 2, and 3 L/min. The parameters analyzed included the increase in methane (CH₄) concentration, the reduction of CO₂ content, and the removal of H₂S. The results indicate that increasing the adsorbent mass and decreasing the biogas flow rate significantly improve biogas quality. The use of 1 kg of adsorbent at a flow rate of 1 L/min resulted in the highest CH₄ increase of 50.67%, the greatest CO₂ reduction of up to 49.33%, and complete removal of H₂S to undetectable levels (0%). These findings demonstrate that adsorbent mass and biogas flow rate play a crucial role in enhancing the performance of the adsorption process.

Keywords: *Biogas, biogas purification, iron powder, zeolite, adsorption, methane (CH₄), carbon dioxide (CO₂), hydrogen sulfide (H₂S)*