

Enhancing Biogas Quality Through the Addition of H₃PO₄-Activated Rice Husk Charcoal as an Additive for Reducing CO₂ Content

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ABSTRACT

Biogas is a renewable energy source with significant potential to be developed from livestock waste. However, its quality is often reduced by the high concentration of carbon dioxide (CO₂), which lowers its calorific value and combustion efficiency. This study aimed to analyze the effect of adding H₃PO₄-activated rice husk charcoal on biogas quality based on CH₄ and CO₂ contents, flame color, flame burning duration, biogas volume, and biogas production rate. The study employed laboratory-scale biodigesters using goat manure as the primary substrate, with the addition of H₃PO₄-activated rice husk charcoal at concentrations of 0%, 5%, 10%, and 15%. Observations were conducted for 21 days. The CH₄ and CO₂ contents were analyzed through laboratory testing, while combustion quality was evaluated based on flame color and burning duration. The results showed that the 10% H₃PO₄ activation treatment (P3) produced the best performance, with a CH₄ content of 39.56%, a CO₂ content of 21.93%, a CO₂ reduction efficiency of 20.25%, and a flame burning duration of 177 seconds. The highest biogas volume was obtained in treatment P0, reaching 2,523 mL on the 13th day. All treatments exhibited a similar biogas production pattern, in which biogas volume gradually increased until reaching its peak on the 13th day and subsequently decreased until the end of the observation period. The study concluded that the addition of H₃PO₄-activated rice husk charcoal was effective in improving biogas quality, with an activator concentration of 10% identified as the optimum condition.

Keywords: Adsorption, Biogas, Carbon dioxide, H₃PO₄, Rice husk charcoal.