

Ammonia Management Strategies for Enhancing Biogas Production from Broiler Chicken Manure in Thailand

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Abstract

Anaerobic digestion of broiler chicken manure is often limited by ammonia accumulation due to its high nitrogen content. This study evaluated the effects of inoculum, dilution water type, and ammonia stripping on biogas production under ammonia-rich conditions. Broiler manure was diluted at a ratio of 1:4 and tested under different conditions, including inoculum and non-inoculum systems, the use of tap water and recycled water, and ammonia stripping. Ammonia concentration ranged from 1,267 to 5,054 mg-N/L corresponding to approximately 1.54–6.14 g/L NH₃, showing a strong influence on process performance. The use of recycled water led to ammonia accumulation, resulting in reduced biogas production and lower methane content compared to tap water. In contrast, seeding improved system stability and enhanced methane yield, reaching up to 0.6 mL CH₄/g VS. Ammonia stripping effectively reduced ammonia levels by 54.2%, leading to improved biogas production and methane content up to 60%. Overall, ammonia was identified as the key limiting factor in the system. While recycled water can improve buffering capacity, it may intensify ammonia inhibition if not properly managed. The combined use of seeding and ammonia removal with use Tep water provides an effective strategy to enhance methane production from ammonia-rich manure. Economically, non-stripping conditions achieved positive returns (up to +708 THB/ton), while ammonia stripping incurred high energy costs (~5,800 THB/ton), limiting its feasibility.

Keyword: Anaerobic digestion, Broiler chicken manure, Ammonia inhibition, Biogas production Methane yield, inoculum, Ammonia stripping, Recycled water