ABSTRAK

S*lurry* biogas merupakan limbah atau buangan semiliquid, yang berisi partikel halus, dan sisa hasil proses digesti anaerobik kotoran sapi. *Slurry* biogas tersebut mengandung residu bahan organik cukup tinggi dan bersifat toksik, terutama amoniak. Berdasarkan kandungan bahan organik, *slurry* biogas tersebut mempunyai potensi untuk dimanfaatkan sebagai pupuk. Senyawa toksik amoniak (NH_4^+) mudah terikat dalam partikel tanah sehingga tidak mudah diserap oleh akar tanaman. Tujuan penelitian adalah memanfaatkan *slurry* biogas untuk pupuk organik melalui aktivitas bakteri dengan laju aerasi yang berbeda; menganalisis kualitas pupuk hasil degradasi *slurry*, terutama kadar N tersedia; serta mengidentifikasi bakteri yang aktif dalam degradasi *slurry* biogas. Penelitian diawali dengan pengambilan *slurry* dari fasilitas digesti anaerobic biogas pada Pusat Inovasi Agribisnis Terpadu (PIAT) UGM Yogyakarta. Kualitas *slurry* ditentukan berdasarkan hasil analisis pH, COD, BOD, dan TSS. Percobaan degradasi *slurry* dilakukan dalam digester dengan sistem sekali unduh (*batch system*) skala laboratorium (volume 5 L) dan; yang diperlakukan dengan laju aerasi bervariasi (0 mL/ det, 15 mL/ det, 30 mL/det) sampai menjadi pupuk organik. Tiap interval waktu tertentu, pertumbuhan bakteri dipantau secara *plate count*; dan kualitas hasil degradasi *slurry* biogas sebagai pupuk ditentukan dengan analisis kadar nitrat secara spektrofotometri. Hasil penelitian menunjukkan bahwa *slurry* biogas masih mengandung bahan organik cukup tinggi (COD ~ 4235 mg/L dan BOD ~ 1900 mg/L); pH 6,5; serta N total mencapai 444,45 mg/L. Peningkatan aktivitas bakteri degradatif memerlukan oksigen dengan laju aerasi tinggi (30 mL/det) setelah 15 hari sehingga terjadi penurunan pH (pH 5,5), residu bahan organik (COD ~ 1835 mg/L dan BOD ~ 1247 mg/L), NH_3 kurang dari 0,0002 mg/L, dan peningkatan kadar NO_3~187,85 mg/L. Setelah 15 hari kultivasi, sepuluh (10) jenis isolat bakteri yang aktif dan berbeda pada proses degradasi *slurry* biogas. Berdasarkan sifat morfologi koloni dan sel, semua isolat memiliki sel berbentuk kokus, gram negatif, dan sifat biokimia mirip dengan genus Paracoccus (strain H151C), Aeromonas (strain H152C), Acidaminococcus (strainH153C), Acinetobacter (strain H154C, strain H155C), Nitrosomonas (strain H156C), Methylococcus (strain H157C, strain H158C), Azotobacter (strain H159C), Actinobacillus (strain H160C). Kesimpulan penelitian adalah *slurry* biogas merupakan substrat yang baik untuk pembuatan pupuk organik melalui aktifitas bakteri. Kualitas hasil degradasi *slurry* sebagai pupuk organik yang menjanjikan dengan kadar N-tersedia yang memadai (> 100 mg/L) setelah mendapat aerasi (30 mL/det).

Kata kunci : *Slurry* biogas, Kotoran Sapi, Amoniak, Nitrit, Nitrat

ABSTRACT

Biogas slurry, was a semiliquid waste, which contains fine particles, and the rest of the anaerobic digestion process from cow dung. The biogas slurry contains high organic residues and act as toxic compound, especially ammonia. Based on the content of organic matter, the biogas slurry has the potential to be used as fertilizer. The ammoniac toxic compound (NH4 +) is easily bonded in soil particles so it is not readily absorbed by plant roots. The objective of this research is to utilize biogas slurry for organic fertilizer through bacterial activity with different aeration rate; analyzing the quality of slurry-degraded fertilizers, especially N content available; as well as identifying bacteria which active in the degradation of biogas slurry. The research begins with the taking of slurry from biogas digester facility at Integrated Agribusiness Innovation Center (PIAT) UGM Yogyakarta. The quality of slurry was determined based on the results of pH, COD, BOD, and TSS analyzes. Slurry degradation experiments were performed in digesters with a laboratory batch system (volume 5 L) and; which were treated with varying aeration rates (0 mL / s, 15 mL / s, 30 mL / s) to produce organic fertilizer. Each interval time, bacterial growth was monitored by plate count; and the quality of degradation of biogas slurry as fertilizer was determined by the analysis of nitrate concentration by spectrophotometry. The results showed that the biogas slurry still contain high enough organic matter (COD ~ 4235 mg / L and BOD ~ 1900 mg / L); pH 6.5; and total N reached 444.45 mg / L. Increased activity of degradative bacteria requires oxygen at high aeration rate (30 ml / s) after 15 days, resulting in a decrease in pH (pH 5.5), organic material residue (COD ~ 1835 mg / L and BOD ~ 1247 mg / L), NH_3 less than 0.0002 mg / L, and increased levels of NO_3 ~ 187.85 mg / L. After 15 days of cultivation, ten (10) different types of bacterial isolates were active and different in the biogas slurry degradation process. Based on the morphological properties of colonies and cells, all isolates have coccus, gram-negative, and biochemical cells similar to the genus Paracoccus (H151C strain), Aeromonas (H152C strain), Acidaminococcus (strainH153C), Acinetobacter (H154C strain, H155C strain), Nitrosomonas (H156C strain), Methylococcus (H157C strain, H158C strain), Azotobacter (H159C strain), Actinobacillus (H160C strain). The conclusion of the research, biogas slurry was a good substrate for the production of organic fertilizer through bacterial activity. The quality of the degraded-slurry results as a promising organic fertilizer with sufficient N-available (> 100 mg / L) after aeration (30 ml / sec).

Keywords: Biogas Slurry, Cow Manure, Ammonia, Nitrite, Nitrate