# Importance of livestock manure storage: Reduction of odor/greenhouse gases emission and enhancement of subsequent biogas production

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**Abstract**

Due to the long storage period of livestock manure (LM) (1-6 months), useful organic matters presented in LM are susceptible to be degraded by aerobic/anaerobic microorganisms, resulting in releasing huge amounts of greenhouse gases (GHGs) and odor. In this study, the effect of acidification and temperature of LM on GHGs (CH4) and odor emission during storage were investigated. Additionally, the biogas potential of stored LM was estimated.

In the lab scale tests, pig slurry (PS) and cattle manure (CM), were used. For the PS with high water content, both acidification and temperature control were applied, while only temperature control was applied to the CM that has a high solid content. The optimal storage method drawn from the lab scale tests was then tested in a pilot scale PS storage system. Each manure was stored until the biogas emission was negligible.

In the lab scale tests, 3.7 kg CO2 eq./ton PS (CH4) was emitted from the control (without pH adjustment) for 40 d. This value was found to be limited to 1.8, 0.9, 0.4, 0.2, and 0.1 kg CO2 eq./ton PS at pH values of 7.0, 6.5, 6.0, 5.5, and 5.0, respectively. When the storage temperature of PS was 25oC, GHGs emission was also decreased by 74-27% compared to the control (at 35oC). Further, these storage methods have a positive effect on the reduction of the odor (NH3, H2S) emission. Compared to the control (pH 7.8), the amount of emitted NH3 and H2S was reduced by 40 and 90% at pH 7.0 and pH 6.5, respectively. Moreover, the highest CH4 yield of 14.6 L CH4/L PS was attained at pH 6.0, whereas the control showed a 10.6 L CH4/L PS. The overall reduced GHGs emission can be calculated based on summation of that reduced during storage and subsequent biogas production step. In sum, a total reduction of 5-20 kg CO2 eq./ton PS was achieved with these storage methods, compared to the control. With CM with >20% of total solid (TS), 67 kg CO2 eq./ton CM was acquired at 35oC, however it was reduced by 24-94% through lowering storage temperature. For the biogas potential of stored CM, the enhanced CH4 yield (25 and 43 L CH4/kg CM at 35 and 15oC, respectively) could be ascribed to the preservation of organics in CM and temperature shock. In the pilot scale PS test (working volume 30-33 tons), GHGs emission during 30 d of storage was reduced by 70% when pH of PS and storage temperature were controlled to pH 7.0 and 25oC, respectively.

***Keywords:*** *Livestock manure, Storage, Methane, Acidification, Temperature control, Biogas production*

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**Biography**

Dr. Dong-Hoon Kim has completed a PhD at KAIST in 2008 with the topic on anaerobic digestion of organic solid wastes. Since 2015, he started to work at Inha University as a faculty member, majoring in environment and energy field. He could publish 98 international papers, and has 11 patents. He received a “Distinguished Young Scientist Award” in 2015, and he is currently a young member of Korean Academy of Science and Technology.