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GAS PRODUCTION ANALYSIS OF A FIXED-DOME DIGESTER OPERATED UNDER TEMPERATE CLIMATES IN CENTRAL OHIO

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ABSTRACT The applicability of anaerobic digestion in small farms in the United States is ignored due to the high costs and large size of existing digesters. This creates a need to develop more affordable digesters to realize environmental and energetic benefits on smaller farms in temperate climates. Field and lab experiments were completed to determine the effects of seasonal temperature variation on gas production. After determining a baseline for gas production and digester function, methods can be identified to increase gas production in these conditions. At the OSU dairy farm, a modified fixed-dome digester of 1 m³ was buried 0.5 m below the soil surface and fed with 1 kg/m³ day of diluted cow manure (5% VS). Lab experiments were performed to determine the kinetics associated with six specific anaerobic trophic groups at 5°C and 15°C. For three months in 2009 (10/1/09-12/31/09), the average ambient temperature was 7.2°C, while the average digester temperature was 8.6°C. The average specific gas production during this period was 0.01746 l/Kg VS. Preliminary results show an average reduction of 44% in VS and VFAs concentration of 8441 mg/l inside the digester from which 61%, 26%, 1%, 7% and 5% were acetic, propionic, isobutyric, isovaleric and valeric acids respectively. These preliminary results suggest that the decreasing gas production is related to some kind of kinetic constraints for a specific trophic group.

Keywords: Anaerobic digestion, Biogas production, Fixed dome digester, Temperate climates.