

28. Methane fermentation of chicken manure at mesophilic conditions

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Introduction. Poultry is one of the most intensive and mechanized agricultural sectors. Poultry manure is the main ecological problem of poultry farms and its poor management can cause serious environmental damage. As far as birds absorb energy of plant feed badly and that more than half of the energy is used unproductively – it goes to the manure, it can be seen as a powerful source of renewable energy. Methane digestion is an effective method of animal waste processing. Poultry manure has a higher fraction of biodegradable organic matter than other livestock wastes [1]. The aim of our study was to investigate methanogenesis of chicken manure in a wide range of moisture content values in the mesophilic mode.

Materials and methods. The experiments were carried out in forty five 60 ml syringes three times in a row. Moisture content of the substrate was 72 - 99%. Manure was diluted with tap water to get the desired moisture level. Each syringe contained 20 g of substrate. Mass fraction of anaerobic sludge was 10%. The syringes were placed in a dry-air thermostat TC 80 M2. The process was carried out in the mesophilic mode at the temperature of 35 °C. The amount of biogas produced was determined by deviation of the syringe piston. The concentration of carbon dioxide was measured by passing the biogas through 2% NaOH solution.

Results and discussions. With decreasing of moisture content in the substrate from 99% to 96%, biogas production from volatile solids (VS) increased. Starting from moisture content of 94%, gas yield decreased. Production of methane decreased with decreasing of moisture content in the substrate. Biogas yield ranged from 66.2 ml/g VS to 301.8 ml/g VS and methane yield – from 11.9 ml/g VS to 150 ml/g VS (Fig.1).

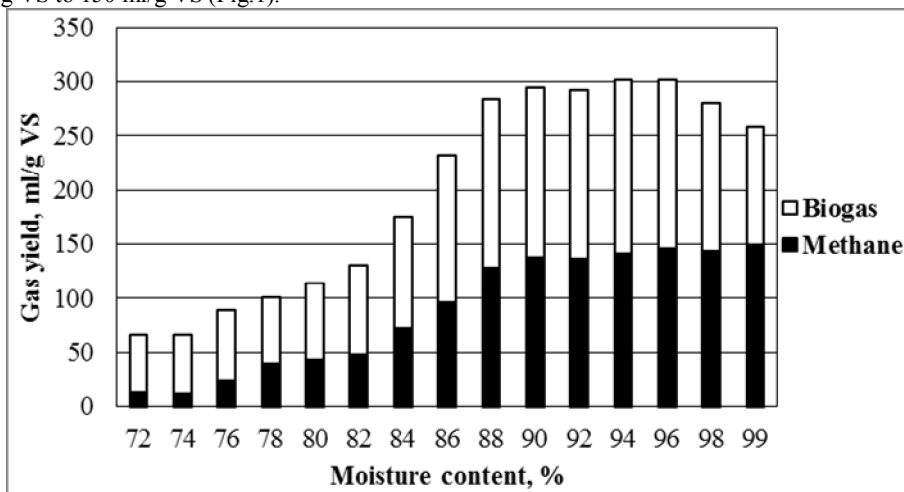


Fig. 1. Gas yield from VS with different moisture values of substrate

The maximum biogas yield per unit of weight was 301.8 ml/g VS at the moisture content of the substrate of 96% and methane yield – 150 ml/g VS at the moisture content of the substrate of 99%.

The maximum rate of methanogenesis increased with increasing of moisture content of the substrate. The increase had an exponential character. The maximum rate of methanogenesis was 22.1 ml CH₄ / (g VS • day).

Conclusions. 1. The regularities of methane fermentation of poultry manure in batch mode at mesophilic conditions have been determined.

2. Methane production took place at all values of moisture content of the substrate.

3. The maximum biogas yield per unit of weight was at the moisture content of the substrate of 96% and methane yield – at the moisture content of the substrate of 99%.