

EFFECTS OF ANTIBIOTIC RESIDUES IN MANURE ON BIOGAS YIELD



University of
Natural Resources and
Life Sciences, Vienna



Department for
Sustainable Agriculture Systems

Division of Agricultural Engineering

Bauer A., Amon T., Winckler C.

University of Natural Resources and Life Sciences, Department of Sustainable Agricultural Systems
Division of Agricultural Engineering, Konrad-Lorenz-Strasse 24, 3430 Tulln, Austria
Division of Livestock Sciences, Gregor-Mendel-Strasse 33, 1180 Vienna, Austria

Gans O., Scharf S.

Umweltbundesamt GmbH, Spittelauer Lände 5, 1090 Wien/Österreich

BACKGROUND

In the next years, the utilisation of manure for biogas production will strongly increase. Currently, antibiotics are used in high quantities in veterinary medicine and are found in manure afterwards. They are substances used in the prevention and treatment of infectious diseases, which act on pathogenic bacteria, either by killing them (bactericidal) or by inhibiting their growth (bacteriostatic). Hence, it can be expected that their presence will have an inhibitory effect on biogas processes. The antibiotics Chlortetracycline and Enrofloxacin are relevant veterinary antibiotics with high persistency in the environment.

AIMS:

- Analysis of the effect of antibiotics on the specific biogas and methane yield as well as the effect on the stability of the biogas process.
- Determination of the influence from antibiotics on microorganisms.
- Identification of measures to avoid, minimize and mitigate these impacts on biogas process.

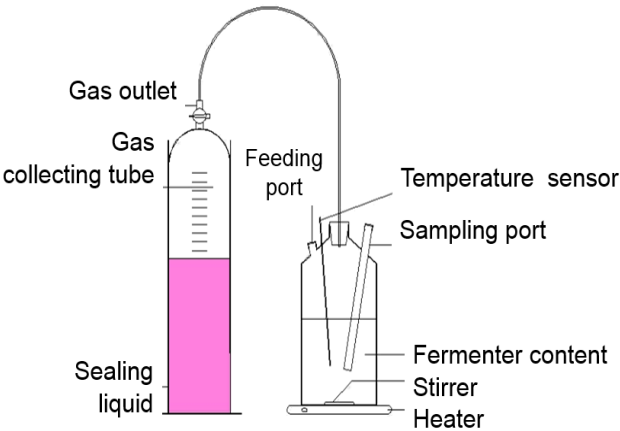


Figure 1: Fermentation unit used in the tests.

MATERIAL AND METHODES:

The Fermenters were fed daily with a fixed amount of substrate with different concentrations of antibiotics (Chlortetracycline and Enrofloxacin). The same amount of fermentation residue was extracted. Temperature was established at 37.5 ° C and the fermenter was stirred 10 minutes every 30 minutes.

- Experiment I: Feeding rate: 10 g/day; Antibiotics concentration: 40, 200, 400, 4,000 and 8,000 mg/kg DM; Experimental phase: 18 days
- Experiment II: Feeding rate: 40 g/day; Antibiotics concentration: 100, 150 and 200 mg/kg DM; Experimental phase: 26 days

Analyses:

- Pig slurry and inoculum: dry matter (DM), organic dry matter (VS), Kjeldahl-nitrogen and ammonia determination.
- Biogas: biogas production and methane concentration.
- Statistical Analysis Tukey-Test (p = 0.05)

RESULTS:

EXPERIMENT I

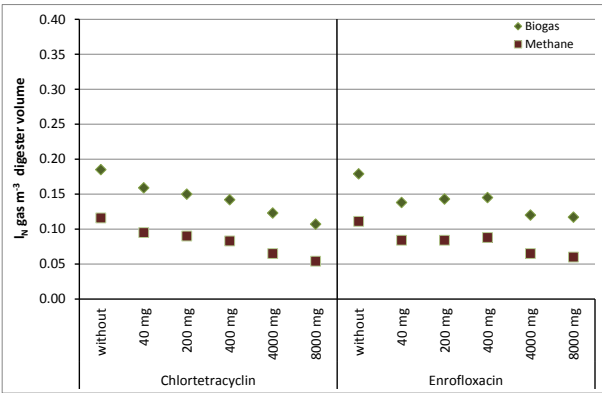


Figure 2: Specific biogas yields from Experiment I

EXPERIMENT II

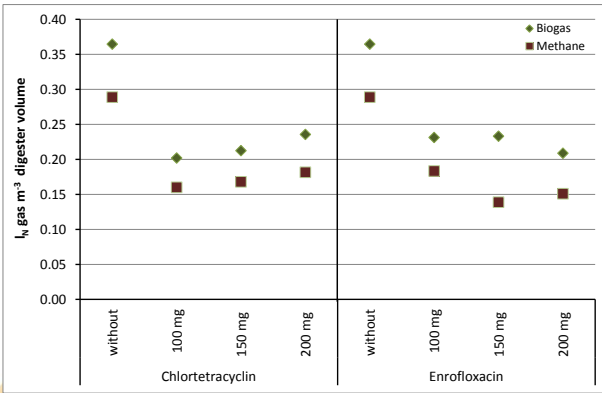


Figure 3: Specific biogas yields from Experiment II

CONCLUSIONS:

- Antibiotics have a strong effect on the specific biogas yield.
- Methane yields were notably reduced: 18-60% in Experiment I and 33-55% in Experiment II
- Biogas process was inhibited → a reduction in the profits of practical biogas plants can be expected.
- Application of antibiotics should be reduced to a minimum through e.g. better livestock husbandry conditions.
- In case of administration of substantial amounts of antibiotics to livestock, manure should not be used as an input material in a biogas plant to avoid loss in methane production.