

JOINT EVENT

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Capillary electrophoresis in the analysis of volatile fatty acids, ammonium, K, Ca and Mg from mesophilic anaerobic digestion samples

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Statement of the Problem: Biogas process monitoring help to maintain stable process and costs of basic monitoring are often much lower than the costs with re-establishing a destabilised plant. Reactor acidification through reactor overload is one of the most common reasons for process deterioration in anaerobic digesters (ADs): A build-up of volatile fatty acids (VFAs) decrease pH and result in toxic conditions. Ammonia ensure supply of nitrogen as nutrient for biomass and increase system's buffer capacity, but elevated NH₄ concentration causes toxic effects. To obtain accurate monitoring results, sampling, sample pre-treatment need to be controlled. This may be a challenge when plant is located far away from the laboratory. In this study, a capillary electrophoresis (CE) was utilized in the analysis of individual VFAs, ammonium, and nutrients (K, Ca, Mg) from the AD samples obtained from biogas factory. On-site monitoring of the analytes was performed to obtain fast analysis and minor sample storage and transportation times. In addition, longer chain fatty acids and bacterial profiles of the samples were studied.

Methodology & Theoretical Orientation: Samples were collected in biogas plant consisting three separate mesophilic AD reactors (4000 m³ each) where the main feedstock was swine slurry together with complex mixture of agricultural plant and animal wastes. Samples were diluted in water prior to CE analysis. The effect of sample storage in RT and -18C was studied. Long chain fatty acids were analysed by GC-MSD. Bacterial profiles were analysed based on their DNA (16SrDNA).

Findings: Acetic acid decreased fast when sample was stored in a room temperature. Correlation was observed between VFAs and long chain FAs concentrations as well as bacterial profiles.

Conclusion & Significance: CE was utilized successfully and is attractive method for the analysis of separate VFAs, NH₄ and nutrients in the biogas production site. Samples should be analysed in the sampling date if stored in RT or frozen for longer storage time.



Figure 1. On-site capillary electrophoresis analysis of VFA, ammonium and nutrients in the AD reactors.

Biography

Jasmiina Haverinen, (Project researcher, M.Sc.) in the Kajaani University Consortium, Unit of Measurement Technology (MITY), which operates under University of Oulu, Finland. She has been working in the bio fermentation, food, and environmental sectors co-operating closely with companies.

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