An integrated approach for enhancing biogas yield of manure-based anaerobic digestion

Lymperatou, Anna; Gavala, Hariklia N.; Skiadas, Ioannis V

Published in:
Book of Abstracts. DTU's Sustain Conference 2015

Publication date:
2015

Document Version
Publisher's PDF, also known as Version of record

An integrated approach for enhancing biogas yield of manure-based anaerobic digestion

Anna Lymperatou[1], Hariklia N. Gavala[1], Ioannis V. Skiadas*[1]

1: DTU Chemical Engineering

*Corresponding author email: ivsk@kt.dtu.dk

Anaerobic digestion (AD) is a biological process that occurs spontaneously in nature under anaerobic conditions and results to the formation of biogas (CH_4 and CO_2). When performed under controlled conditions, the biogas can be collected, stored and used as a renewable energy source for both heat and power production. Livestock manure is an abundant waste stream that poses the adequate characteristics for AD and thus it is widely used for biogas production in many countries. Nevertheless when digested solely it results to be an economically non-feasible process due to the low degradability of its solid fraction. Thus, pretreating the solid fraction could release the biogas potential of manure and decrease the dependence of the process on additional organic materials.

AMMONOX is an innovative concept that aims at improving the biogas yield of manure-based AD by integrating an ammonia-pretreatment of the solid fraction of manure without encumbering the economy of the whole process. Based on previous results [1,2] Aqueous Ammonia Soaking (AAS) is capable of increasing significantly the CH_4 yield of the solid fraction of manure (up to 180%). These results indicate that the AAS pretreatment coupled with an ammonia recovery/recycling step (securing thus the availability of ammonia) could be a promising technology for improving the performance of manure-based AD. Furthermore, an excess of ammonia is expected to be produced when the ammonia recovery process includes both the pretreatment mixture (aqueous ammonia and manure fibers) and the N-rich effluent of the digester. This excess can be used for the catalytic reduction of NO_x emissions of gas engines that convert biogas to electricity. An overview of the proposed process is illustrated in Figure 1.

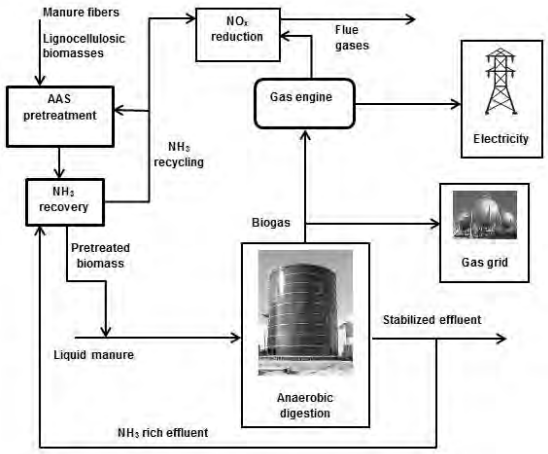

Figure 1 ***Overview of the AMMONOX concept for improving the biogas yield of swine manure in a sustainable way.***

The implementation of the AMMONOX concept follows a first step where statistical optimization of the most influencing parameters of AAS takes place for maximizing the CH_4 yield of treated manure fibers. Subsequently, the economic feasibility of different ammonia recovery technologies will be assessed in order to proceed with the proof of concept by performing the AMMONOX process in a continuous mode at laboratory scale.

References

[1] Jurado, E., Skiadas, I.V. and Gavala, H.N. Enhanced methane productivity from manure fibers by aqueous ammonia soaking pretreatment. Applied Energy, 109, 104-111 (2013)

[2] Lymperatou, A., Gavala, H.N., Esbensen, K.H., Skiadas, I.V. AMMONOX – Ammonia for enhancing biogas yield and reducing NO_x: Analysis of effects of aqueous ammonia soaking on manure fibers. Waste & Biomass Valorization 6, 449-457 (2015)