Experiences with biogas plant modernization with ADA reactor

M.Sc., Mustamäki Saara
Preseco Oy, Tekniikantie 14, 02150 Espoo, Finland
tel./ fax: +358 9 2517 4001
email: saara.mustamaki@preseco.fi

Ph.D., Piątek Robert
NILU Polska Sp. z o.o., ul. Reymonta 24, 40 – 029 Katowice, Poland
tel./ fax +48 32 2570858
e-mail: rpiatek@nilu.pl

Streszczenie

Fermentacja beztlenowa jest powszechnie akceptowaną i uznaną metodą utylizacji odpadów pochodzenia organicznego, której towarzyszy produkcja biogazu. Obecnie nabiera ona coraz większego znaczenia ze względu na wsparcie prawne i finansowe dla technologii opartych na odnawialnych źródłach energii. W pracy przedstawiono podstawowe informacje o procesie fermentacji oraz zwrócono uwagę na typowe problemy eksploatacyjne biogazowni rolniczych. Zaprezentowana została technologia ADA, która znacząco wpływa na stabilizację procesu biodegradacji. Potwierdzeniem tej tezy są doświadczenia zebrane z pierwszego wdrożenia technologii ADA – modernizacji biogazowni w Danii.

Abstract

Anaerobic digestion (AD) is an acceptable process for organic origin wastes treatment worldwide. One of the major advantages of this process is the generation of biogas – energy carrier from the renewable resource which can be utilized in many ways, depending on local conditions. Another benefit of the anaerobic digestion process is usability of digestion residues using as soil conditioner or valuable fertilizer in organic farming. Recently knowledge of AD process has radically increased however many of technical issues are still under development.

The process of anaerobic digestion has a purely biological nature – it is caused by different genres of bacteria in special conditions, like the absence of molecular oxygen and proper ranges of pH and temperature. Biodegradation of complex organic compounds proceeds in stages and takes time measured in days. The process occurs naturally in the environment (problem of uncontrolled greenhouse gases and odors emission) but it is not as efficient as it is needed for technical solutions.

As a result of the variety of anaerobic digestion applications many different types of anaerobic digesters are in use [1, 2]. In case of feedstock from agriculture or co-digestion biogas plants, digesters are commonly based on a continuously stirred tank reactor (CSTR). The system is usually designed as a one stage wet fermentation and demands mechanical

and thermal pre-treatment. Hydraulic retention time is about 12-36 days. Common operational difficulties in such a type of installation are organic overload, scum and foam problems and other reasons of the process instability, like temperature and pH changes or presence of inhibitors in the feedstock [3]. Due to high sensitivity of AD process and a lack of simple direct methods of measuring microbiological activity, complex monitoring and control systems need to be applied in a biogas plant to ensure stability and high yield of the biogas production [4].

The Anaerobic Digestion Accelerator Technology (ADA) was developed by the Finnish company Preseco Oy. This is a good solution to improving the stability of the process related with the decrease of ammonia level in reactor. The ADA could be applied as a complete system in a new biogas plant as well as a modernization of existing installation. Such a modernization was carried out as the first implementation of the ADA in the Danish biogas plant operated on pig manure and animal fat in January 2005. A brief description of advantages of the technology and experiences obtained from the first implementation are presented in the paper. Results from this implementation confirmed the usability of ADA technology to decrease ammonia content and improve the stability and the effectiveness of anaerobic digestion process. Apart from mentioned above measured effects the customer's satisfaction is a noteworthy proof of the usability of ADA technology.

Literatura

[1] Angelidaki I., Ellegaard L., Ahring B.K., Applications of the Anaerobic Digestion Process, Advances in Biochemical Engineering, Biotechnology, Vol. 82, Springer-Verlag Berlin Heidelberg 2003.

[2] Vandevivere P., De Baere L., Vestraete W., Types of anaerobic digesters for solid wastes, Chapter in Biomethanization of the Organic Fraction of Municipal Solid Wastes, IWA, 2002.

[3] Gerardi M.H., The Microbiology of Anaerobic Digesters, John Wiley & Sons, Inc., Hoboken, New Jersey, 2003.

[4] Pind P.F., Angelidaki I., Ahring B.K., Stamatelatou K., Lyberatos G., Monitoring and Control of Anaerobic Reactors, Advances in Biochemical Engineering, Biotechnology, Vol. 82, Springer-Verlag Berlin Heidelberg 2003.