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ROZPRAWA DOKTORSKA

Efektywność energetyczna produkcji metanu w procesie fermentacji z wydzieloną fazą hydrolizy kwaśnej

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Abstract

Despite the good knowledge of the biogas production process itself, methods of energy-efficient and economically viable pre-treatment of substrates are still being sought in order to increase the productivity of biogas and methane. This applies in particular to materials that are difficult to decompose, such as lignocellulosic raw materials, which are characterized by a complex and comprehensive structure, which makes them resistant to the methane fermentation process. One of the ways to treat the materials may be the use of a pre-hydrolysis process by separating it in a separate fermentation tank. Despite numerous studies on hydrolysis pre-treatment, there is still an area that requires in-depth scientific study. Areas requiring special attention include examining the impact of the use of microbial-chemical hydrolysis on the production of biogas and methane in the mode of continuous substrate feeding.

The situation described above is associated with a scientific problem that can be formulated as a question: what should be the combination of technological factors and process parameters that will allow for highly efficient and economically viable biogas production, using acid hydrolysis as a substrate pre-treatment? This is particularly important not only from a scientific point of view, but also from an economic point of view. In the European biogas sector, maize silage is the main substrate in more than a thousand installations.

The conducted research showed that the use of microbial and chemical acid hydrolysis allows to increase the efficiency of biogas and methane production in the process of methane fermentation carried out in a single-stage technology and in a semi-continuous mode using maize silage as a raw material.

The financial analysis carried out showed that despite obtaining the appropriate technological factors and process parameters to increase the efficiency of biogas and methane production, in the current economic conditions there is no financial justification for implementing the investment based on monosubstrate fermentation of maize silage, even with the use of an acid hydrolysis system. Stable and high support for renewable energy production and reducing the cost of raw material purchase are of the greatest importance for achieving positive profitability of biogas projects.