

Examination of the Impact of a Special Mechanical Pre-treatment Method in order to Increase Biogas Yield

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(Doctoral dissertation summary)

A predictable and efficient anaerobic degradation may increase the intention of installing new biogas plants. To increase the energy security the overall aim is the exploitation of the domestic possibilities. Sometimes the efficiency of digestion is not sufficient, which is shown by the significant amount of recoverable methane in the residual fermentation broth. The primary goal of biogas plants is to increase the quantity and quality of the biogas production, and to reduce the degradation time. In order to increase yields the pre-treatment of raw materials is suggested. Mechanical equipment which is suitable for pre-treating the different kinds of raw materials in biogas plants has not appeared on the market yet.

In the course of my research, from the comminuting methods of substrate, I studied the possibilities of the application of mechanical surface treatments. I used a device that is suitable for efficient surface renewal of agricultural raw material and agricultural and industrial wastewater fermentation broth. I examined the conditions of the comminution in the device and also the characteristics of the raw material. I determined the pre-treatment experimental space for each raw material. In the course of post-fermentation of wheat straw and the two types of fermentation broth, the biogas and methane yield surpluses were also determined. After evaluating the above listed factors I found the typical pre-treatment conditions which influence the biogas and methane yield surpluses. I showed the interactions that occur in the combined effect of these factors. I determined the difference of energy invested during the pre-treatment of raw materials and the energy originated from the methane yield surpluses. I set up the energy balance in respect of the three primary materials. I proved that in the case of agricultural and industrial wastewater fermentation broth the treatment causes biogas quality change.

The knowledge of factors influencing the efficiency of degradation and their interactions for each primary material are of key importance. With the determined regression function of the estimated values of biogas and methane yield surpluses- in laboratory conditions-, the application of this pre-treatment technology can be made predictable. Knowing the expected yields and energy balance it is possible to set the the pre-treatment conditions according to the requirements of optimal operation for the given raw material.

My research results may open up towards the application of new generation equipment, encouraging the establishment of new domestic biogas plants. Hungary's decreasing energy defencelessness is a basic condition of the security of the country.