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METHANE GETTING FROM DIFFERENT KIND OF ORGANIC MATERIALS UNDER THE EXPERIMENTAL CIRCUMSTANCES
PRODUCE BIOMETAN DIN DIVERSE SUBSTANȚE ORGANICE ÎN CONDIȚIILE EXPERIMENTALE

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Summary
The projects of renewable energy production and utilization which are based on connecting of technological processes are among R-D&I theme which enjoy priority because in the sphere of decision- makers the natural conscious way of thinking predominates more and more. Renewable energy with methane content can be produced by anaerobe degradation from any kind of organic waste. Organic wastes and by-products arise abundantly in agriculture. In Szolnok University College Technical and Agricultural Faculty in frame of more projects we made biogas experiments with different kinds of organic wastes. We tested that the given recipes how influence the commencing of biogas production, the evenness of production, biogas and methane production.
Keywords: biogas and methane production, energetic changing, sustainable development

INTRODUCTION

In our days the energetic can be defined on global level as well energy safety has basic importance for the whole humanity. We do not know the full measure of the extant stores of energy in the Earth so we do not know whether how long they will be enough to supply our demands. ***[Kacz – Neményi, 1998.]*** Energetic systems based on biomass can mean the necessary energetic changing namely our obligations for the environmental protection came into prominence with our joining to European Union, as well as the supporting tasks of renewable energy production. By the previous aspects can be determined that the biologically produced energy carriers (also biogases) are more and more rival of fossil (conventional) energy carriers.

As first step of energetical changing have to decide those factors which are needed to optimize to show more favourable image the using of renewable energy sources – among the biogas – than using of fossil/conventional energy carrier. These factors are the next:

- effects on environment (climate, people)
- social - economical aspects
- energetic efficiency

In the interest of optimization we have to elaborate a scientifically established method and model – based on experiments –, that decides the technology, the basic materials and admixtures with them can be produced biogas. ***[Kalmár – Nagy, 2008.]***

The totality of local opportunities and makings as well quantitative and qualitative characteristics of available basic materials decide the most suitable biogas production. ***[Bai, 2002.]***

Objects of biogas (biomethane) producing experiments are increasing of the quantity – energy quantity –, to enhance intensity of formation and to prove constant composition of gas. *Indirect object* is liquidation of organic wastes which is present concentrate by producing of renewable energy source like biogas because in our days not the energetic, not the agriculture cannot be independent from environmental problems.

1. APPLIED INSTRUMENTS AND METHODS

We made biogas production experiments with semi-automatic fermentor line at Szolnok University College in Mezotur. In the fermentors we modeled refilling biogas production technology under mezophilic circumstances. In the corrosion-proof, lagged, double wall fermentors which are supplied with peep windows the quantity of biomass to be fermented is ~50dm^3. On the top of the fermentors we created the screw-hole of feeding port and gas cock for as well as the borehole for positioning of mixing shaft. The mixing – like a technological parameter which influences the biogas production – and its frequency and time span – representing the industrial circumstances – considering changeable parameter. That is why we supplied the fermentors with time controlled and electrical operated individual mixing apparatus in a way it can be ensured homogenous per-mixing of the biomass. The mixing blades on the mixing shaft can be shifted thus there is possibility to per-mix both the surface and bottom of the layers to be fermented.

On the bottom of the fermentors we have fitted a cock for emptying and taking samples from biomass, respectively it can be here put the heaters as well as the pet-cock. In the fermentors the temperatures of biomass must be kept between 26-36 ºC considering the mezophil circumstances. With the fitted heat exchangers the temperatures of biomass can be kept on ± 0.5 ºC precision

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by manual control. On the side of the fermentors there are some holes for putting the thermometer.

We made anaerobe fementation process based on pig manure and residues of distillery. The period of the experiments was 50 days. The natural degradation process of basic materials is slow so increasing of formation intensity can be ensured with multifariousness of admixtures. In the course of experiments – representing continuous technology – the dry material content of used pig manure was 8 % in the case of control fermentors, in the case of manipulated fermentors the dry material of the pig manure – like basic material – is 4 % while the dry organic matter of added distillery waste was 4 %. In such way we made experiments by 8 % dry matter content. In the comparison period of experiments (from 16th day to 45th day) we changed every day 5 V/V % of fermented material – corresponding to the fermentor content – to fresh biomass which was pig thin manure corresponded to 200 g dry solid in the case of control fermentor, while in the treated fermentors it was thin manure corresponded to 100 g dry solid and additive corresponded to 100 g dry solid. We made the bacteria treatment on the 26th day. *Table 1* shows manipulation of several fermentors.

Table 1 Manipulations of some fermentors

number of fermentors	*pig manure*	*bacteria*	*fruit-marc*	*grape-marc*	*corn-marc*
I.	+	–	–	–	–
II.	+	–	+	–	–
III.	+	+	+	–	–
IV.	+	–	–	+	–
V.	+	+	–	+	–
VI.	+	–	–	–	+
VII.	+	+	–	–	+

The quality and the composition of basic materials are variant so the pig manure, residues of alcohol production are basically inhomogeneous "system" which contains organic and inorganic parts. The composition of given organic material limits biogas quantity getting from volumetric unit of the biomass.

2. EXPERIMENTAL RESULTS

Biomass energetic systems base on agricultural production, they escort history of the humanity a few thousands years so no have to be afraid the energy carrier will suddenly consume. ***[Somogyvári, 2007.]***

We tested the fermentation of pig manure (like reference basic material) and different kinds of by-products and wastes of distillery. Our object was to get and decide the methane content from different kind of organic matter under experimental circumstances.

The additives of our biogas production experiments are fruit-, grape-, corn-marc like wastes of alcohol production. ***[Szakál – Túróczi, 2008]*** examined the intrinsic content of the marcs by their examination it can be determined that their characteristics make possible to use them in biogas producing experiments.

In the course of our experiments we looked for the answer to that question if can get much more significant biogas quantity from additive with given composition or manipulating with bacteria has only deciding role in formation of biogas production, as well as in equalization of biogas production? Chosen fermentors we manipulated with bacteria which was cultured under laboratory circumstances for additives.

Figure 1 shows biogas production of the fermentors. It can be determined that intensive enhance came true as well as the biogas productivity (methane productivity) of the fermentors with plant additives increased significantly referred to biogas productivity of control fermentor which is contains only pig thin manure. At the same time daily biogas production (methane production) of the control fermentor was approximate one fermentor capacity.

Our test improved that it is necessary to use plant additives – to optimize the C/N ratio of biomass to be fermenting – because it can be increased not only the quantity of biogas but also energetic usable methane content of the biogas.

The average methane content of biogas showed great variation, the standard deviations were 9-17 % in the case of some fermentors. But the intensive enhance did not influence the quality as well as the methane content of biogases is between small limits by tested recipes, and it can refined with further experiments.

In the fermentors which contain different kind of additives the bacteria manipulation has diverse effects on the biogas and methane production. In the case of the fermentors with fruit marc the bacteria culture increased significantly the biogas- and methane production. In the case of fermentors with grape- and corn marc additives the bacteria manipulation din not increase or just increased the biogas and methane production. The bacteria culture – reared under laboratory circumstances on given additives – just influenced the intensity of biogas formation. In a short time after the application

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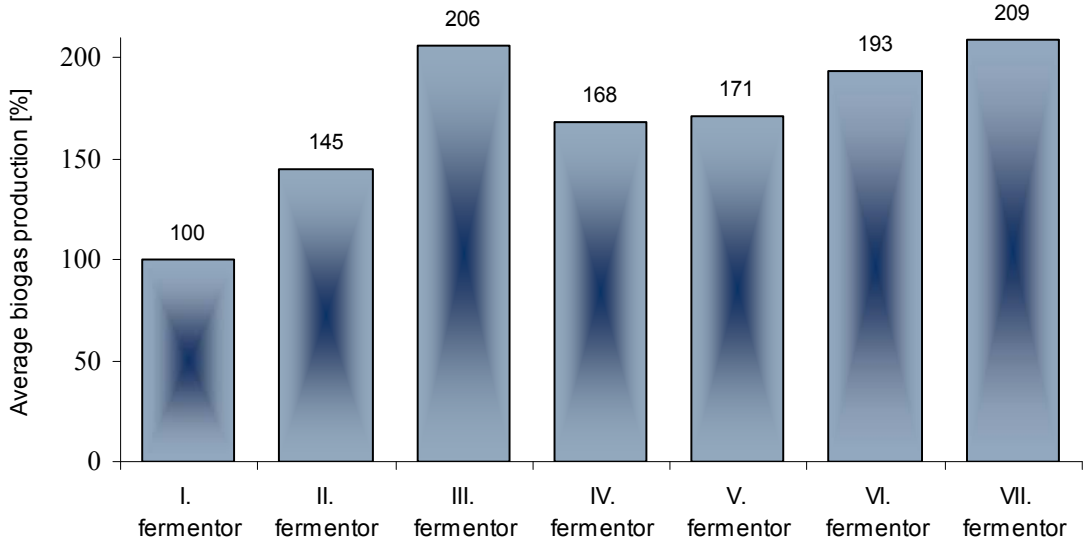

Figure 1 Biogas productivity of the fermentors referred production of the control fermentor

of bacteria manipulation – in a day or two – the biogas formation getting started.

In the view of biogas utilization the quality next to the quantity has determining role, so in any case it is to be wished to decide the methane production referred to dry solid and organic dry solid because 1 % increasing of methane content of biogas results 1.5-2 % increasing of energy value in the biogas. ***[Szabó – Nagy, 2009.]***

In the *table 2* we summarized methane productivity of some fermentors referred dry solid and organic dry solid.

Table 2 Methane productivity in case of different manipulations

Fermentor content	Methane production [dm^3 /1 kg DS]	Methane production [dm^3 / 1 kg ODS]
Pig manure	145.0	152.6
Pig manure + fruit marc	200.0	217.4
Pig manure + fruit marc + bacteria	297.5	323.4
Pig manure + grape marc	237.5	254.0
Pig manure + grape marc + bacteria	232.5	248.7
Pig manure + corn marc	279.8	299.4
Pig manure + corn marc + bacteria	303.1	324.3

* DS = dry solid ODS = organic dry solid

Based on this table it can be determined that as the result of the recipes the methane productivity can be increased, but – supposed gas engines utilization – the recipes they apply fruit marc or corn marc doping simultaneous manipulated with bacteria produced biogases which satisfy engine requirements quantitative and qualitative aspects. The increased methane production by influence of the corn marc and the fruit marc additives couples stable gas composition. So the methane production of added recipes satisfies criterions of energetic utilization because heat engines operate properly as expected if it is provided even more methane production.

Additionally, it can be determined that it is got to our environment more less pollutant by complex energetic utilization of the corn marc and the fruit marc additives couple stable gas composition.

CONCLUSIONS

The energetic is a complex system, in consequence the energetic change desires systemic thinking. First of all it is necessary changing of aspect for interchange. First aspect to satisfy energy demands fully with the less using of energy, as well as in the course of planning of the different kinds of technical sets and establishments have to predominate way of ecological thinking the better and better (Nemcsics, 2003).

In this paper we showed such biogas (biomethane) production with this end in view also keystone of sustainable development next to the satisfying requirements of energy transforming apparatus.

It can be produced higher methane with application of plant additives (fruit-, grape and corn marc) than by fermentation of only pig manure. The organic dry solid of plant additives degrade more easily than do it manure's. But the differences of biogas and methane production motivate to make biogas producing experiments, have to do them when we establish biogas plants, and changing of recipes (changing of additives). In every case we have to test characteristics of input materials, have to make the possible treatment combinations to choose the optimal technological parameters. Beyond that it is proper to test the effect of bacteria culture – which reared is on given additives – also under experimental circumstances.

Our experimental results improve that can be made homogenous biomass from the mixtures of basic materials and different kind of admixtures. Smooth operation of energy producing biogas establishment – indirectly making harmless of wastes – can be helped and insured with application of our recipes.

The gas production (methane production) increased approximately double by effect of the recipes, high carbon- organic matter content of the plant additives and the bacteria manipulation ensure jointly the proper composition of biomass to be fermenting.

Also by study of (Petis, 2009) the producing and using of biogases is just rival against of conventional energy carrier if we take into consideration them with their complex advantages and we admit proportionately how provide advantages for social.

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