COFERMENTATION OF AGRICULTURAL WASTE AND BY-PRODUCTS

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ABSTRACT
The energetic utilisation of the liquid pig manure with other wastes together with by-products significantly increases the profit-making ability of the agricultural enterprises. The economical operation of the pork breeding claims the increase of the firm size especially, which may entail the considerable increase of the environment-damaging effects (ARTHURSON, 2009). The many times beneficial application of the biogas production (energy production + environmental protection investment + biomanure production + the treatment of hazardous waste and its utilisation) expounds his effect then only, if the possible coferment's power generating ability is modelled similar to operating circumstances between conditions on an experimental road beforehand. I outlined the possible techniques of application being attached to the different methane content of the biogas in my work. I pretended with the loads changing, the changing of substrat combinations and the changing of manure production in the course of the experiments. The intensity of the methane production is the direct measure of the activity of the methanogen bacteria, and than like that, the most sensitive, typical indicator of the digester's yield. The combination of the produced gas and its yield features, that may be useful to estimate the stability of the anaerobic system. Consequently the results of the examinations bring practical profit on the sizing, investment and firm operational area indispensable.

Keywords: renewable energy sources, laboratory with half firm methods, fermentation process, agricultural main and by-products

INTRODUCTION

The biogas production based on the pork liquid dung, and the other, waste of agricultural main product of processing known, and accepted technological procedure in the EU's member states, as the result of which biogas and fermented manure is produced. The quantity and the quality of the raw materials and additives, and the biogas forming in the function of the parameters of the applied technology are strongly variable. The target of my experiments aimed the increasing of the proportion of the renewable energy sources of application is to increase the methane quantity originating from the various organic matters, to increase of the intensity of the formation, to produce stabile gas content. Making the organic matters polluting the environment harmless is the indirect result of the application of the technology (GOTTSCHALK, 1979).. The biogas increasing the greenhouse effect with big methane content means concentrated environmental load and source of danger and on the other hand unutilized energy source in on a farming area where the use of the exterior power sources is considerable anyway. While the economy size is his principle from below, the relatively little energy content of the biomass in the view of the transportation expense from above limits the firm concentration (GERARDI, 2003). Because of this it is expedient to examine the energetic utilisation of all possible organic waste at least with laboratory or half firm methods.

MATERIAL AND METHOD

At the Engineering and Agricultural Faculty of Szolnok College there is an appropriate, available, semi-automatic experimental system, representing the operating circumstances, providing similar conditions suitable the formation process of the biogas, regulating change of influencing factors and all of necessary measurements of typical data. The liquid pig manure was used during my biogas production experiments as basic substance. The application of appropriate strain may decrease the time of fermentation and the measure of the demolition may improve and the methane content of the forming biogas may be growing.

The supreme features of industrial by-products and wastes suitable for biogas production:

the dry matter-,
organic matter,
nitrogen content,
C:N proportion,
specific gas yield.

The technology of fermentation experiments, the process of the experiment series:

a) Loading of laboratory digesters, setting of the treatment combinations
b) sampling.
c) Measurements, examined parameters

We may split the process of the fermentation into sections according to the *Table 1*.

We can dose ~50 dm^3 of liquid dung mixture pro treatment to take the factors in connection with the capacity of the fermentors into account. It is possible the simultaneous examination the effect of 9 treatment combinations with in a heat able room placed, mobile by manual power, hermetically closed fermentors. We applied the continuous (filling up) system, which is most widespread in the practice, it can be reproduced the process sections, as the launching, load change, receipt change, according to certain expert opinions each single daily measurement combination for a separate experiment can be qualified (KALMÁR ET AL., 2003).

Table 1. The parameters measured during the experiment series, measuring devices, methods, frequency

serial number	measured parameter	device	method	comment
1.	Fermentor temperature (^oC)	digital thermometer		once a day, at the same time
2.	gasyield (dm^3)	gasmeter		
3.	gas content %	GA45 gas analyser		
4.	conductivity (mS/cm)	Hydrolab	electrometry	once a day, at the same time
5.	soluted oxigen (mg/l)			
6.	pH			
7.	salination (PSS)			
8.	Redoxpotential (mV)			
9.	BOD5 (mg/l)	Oxi Top 110	pressure dropping	from samples selected based on professional viewpoints
10.	COD (mg/l)	NANOCOLOR	photometry	
11.	dry matter content	drying cupboard		once a day, at the same time

I measured the most important parameters to follow the degradation process *(* Table*1.).* The

Table *2* contains the different treatments in the different process periods.

The technology of fermentation experiments, experiments in the series progress

We divided the process of the fermentation into sections according to *Table 2.*

Table 2. Technology of co-fermentation experiments

serial number	1.	2.	3.	4.
period of the process	stabilization	refilling period with fresh substance	running-up period	comparative experiments
treatment		running-up period with fresh substance		
duration time	7 days	14 days	21 days	21 days

The statistical methods used by the evaluation of co-fermentation experiments

I used for the statistical analysis Excel spreadsheet and SPSS for Windows 18.0. The data were analysed by variance with independent two-T sample. I examined the homogeneity with Levene test. By the group pair comparison I used Tamhane test in the case of heterogeneity, and LSD test in the case of homogeneity. The relationship between variables was performed with correlation analysis tests (Pearson's correlation coefficient) and linear regression analysis.

RESULTS

Experiments associated liquid pig manure with variables dry matter content

Various additives used, the material is always necessary to take into account the variable quality because of the pig manure production itself may change. For this reason, measurements can also be a control or variable dry matter content. Nearly 35% average increasing in dry matter content meant approximately 35% average plus in the amount of gas during the same time. So the pig slurry dry matter content increased the performance improvement in the same proportion *(*

Table *3).*

Table 3. Data of liquid pig dung basis experiments

load of fermentor/day; dry matter, treatment	average dry matter content (%)	gas releasing (Ndm^3/ day)	Methane content (%)	average methane releasing (Ndm^3/day)	specific fermentor volume referred	
					biogas-production	methane-production
Control I.	3,40	16,98	58,92	26,52	14,5	0,3
Control II.	4,59	23,04	59,07	10,3	0,41	0,26
30g MC/ (0,06-0,07%)	3,80	29,00	54,50	36,3	9,20	0,58

In this range (3.4 to 4.6%) of the dry matter content did not affect significantly the growth of methane. The average dry matter content 3.4% dry weight changes in control liquid pig manure R^2 = 0.5473 with strong descriptive, y = 0.0001 x^3 - + 0.0149 x^2 0.3893 x+ 1.1269 x dry matter depending on the trend of decline forecasting allow additional load growth, which may lead to increased production *(Figure 2)*. The 4.59% dry matter content of dry matter changes of liquid pig slurry control R^2 = 0.6214, y = 11.048 describing the intensity x-0, 3658 depending on the trend does not indicate future growth, so that the fermentation parameters are expected to be sustainable (*Figure 3).*

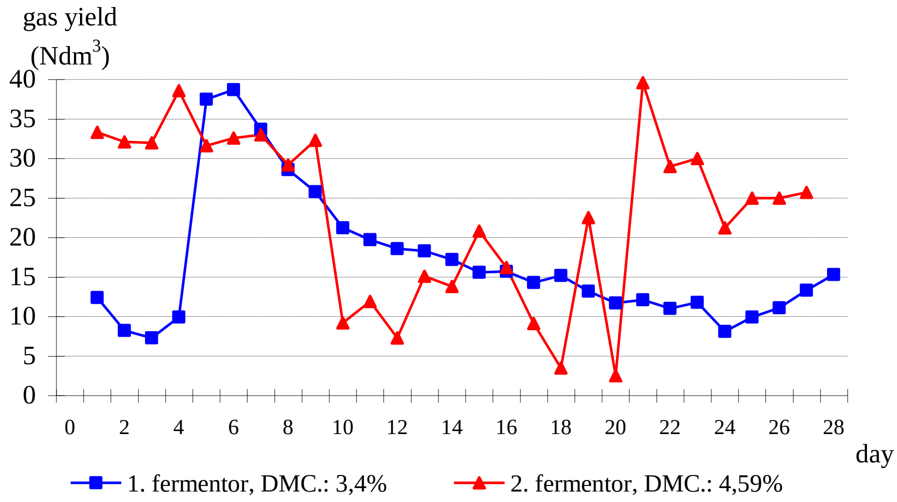

Figure 1. Gas production in the control fermentors

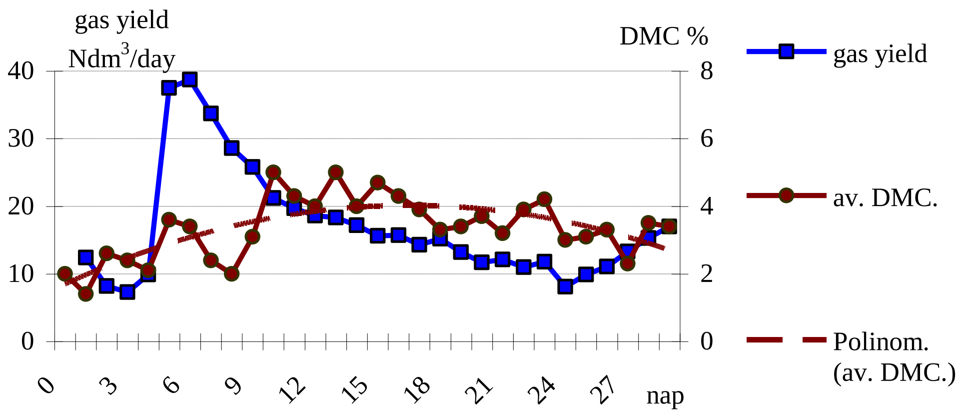

Figure 2. Gas production and dry matter content in the fermentor with average 3,4% DMC

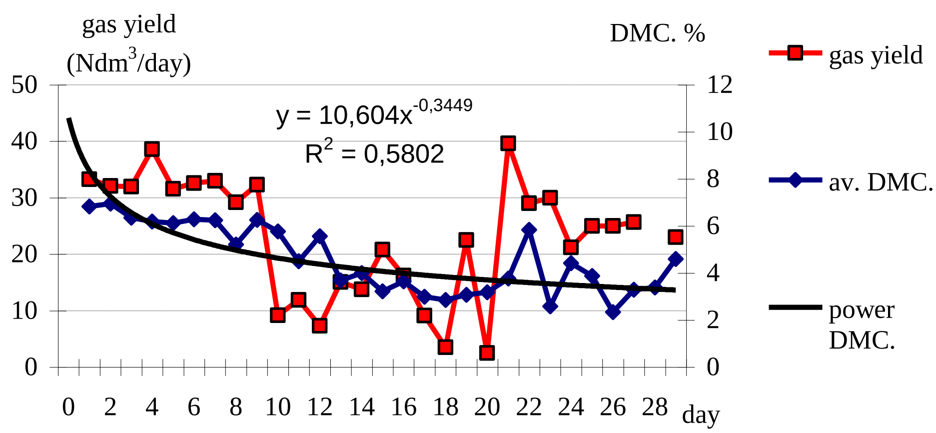

Figure 3. Gas production and dry matter content in the fermentor with average 4,6% DMC

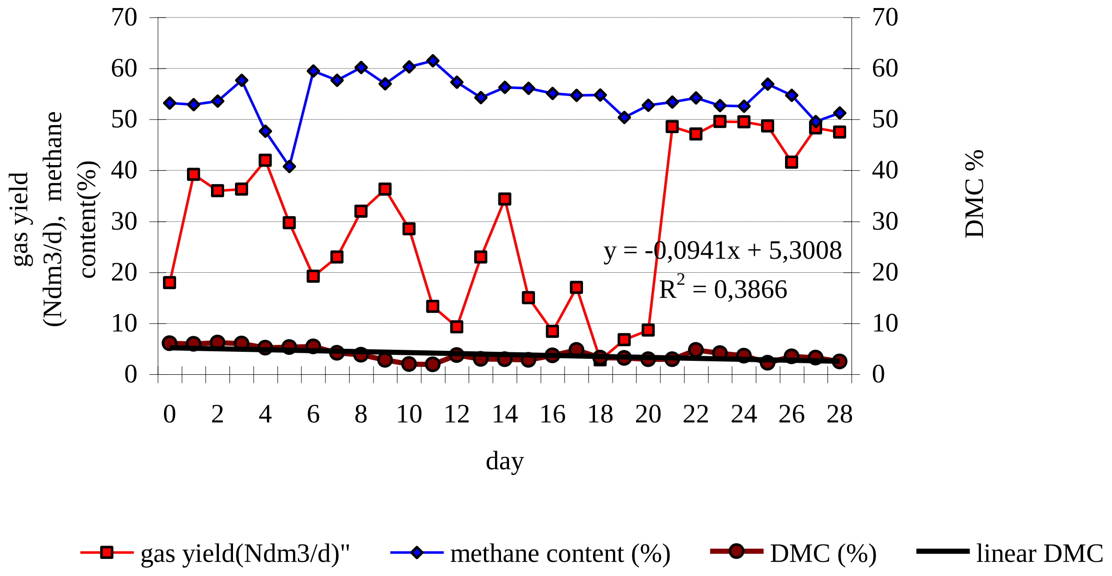

Figure 4. Evolution of the experimental parameters yielded mushroom compost added (30 dmc./d)

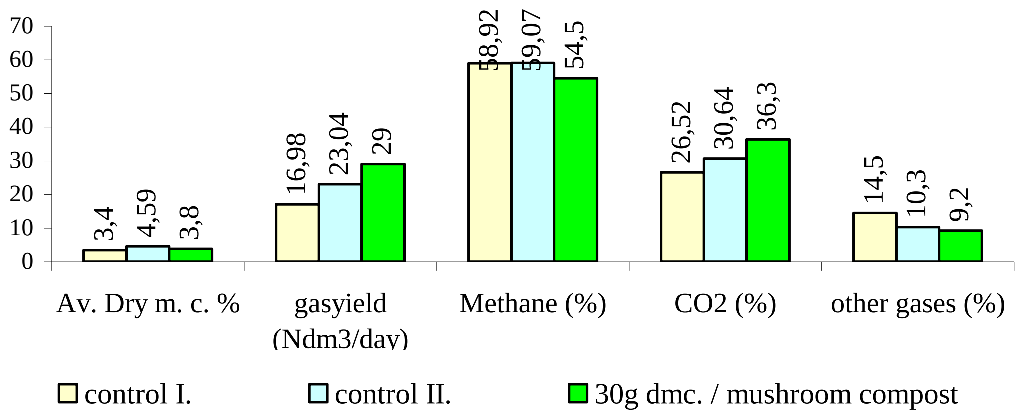

Figure 5. Average gas development parameters on liquid pig manure basis, yielded mushroom compost dosed

Gas production of liquid pig slurry basis yielded mushroom compost added (additive: 30g 100% mushroom compost)

The control and the use of mushroom compost additive comparison shows that the addition increased the development of the gas, the methane content has decreased. The carbon-dioxide content also increased, and decreased the amount of other gases.

The gas development increasing bigger compared to the control with similar dry matter content than the methane reduction, and the result is still the applicable category. (29 Ndm^3 / day / digester 30 g 100% load of mushroom compost, 16.7 Ndm^3 / day / fermentor control - +70% production increase, 54.5% methane content of 30 g 100% load of mushroom compost, methane control 58.9% - 7.5 % decrease).

The control and the yielded mushroom compost - liquid pig slurry co-fermentation experiments performed visually displayed represents the *Figure 5*. The other gases (hydrogen sulfide, ammonia, etc) reduces the appearance of large-scale application conditions. The experiments show that the additive is used as by-products significantly increased the biogas production of liquid pig slurry with low dry matter content of organic material, but did not reduce the methane content of biogas*(Figure5.)*.

CONCLUSIONS

By the slurry-based controls, the bigger dry matter content (3.4% - 4.6%) increased in the average releasing gas volume (16.98 -23.04 dm^3/day dm^3/ day) and 35% average dry matter content increased nearly 35% in the amount of gas. The pig manure loads increase in proportion to performance improvement was measured. The yielded mushroom compost in dry matter content 1,5% (30g) additive produced 60% of energy surplus. 100g (5%) 25% corn silage chaff, 75% doping of mushroom compost is 3.6-fold, a 50% addition of a 2.7-fold methane quantity growth. The lower values of methane (48.86%, respectively around 40.42%) of the gas produced utilisable only under restricted conditions.
The 30g(dry matter content), 100% yielded mushroom compost additive in approx. 2000g dry matter pro fermentor of liquid pig manure containing increased 70% in production (16.98 << Ndm^3/day 29.00), and decreased 7.5% methane content (58.9> 54.5%). This is 60% excess amount of energy is produced in the methane production,. The result is still the applicable category

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