CO-FERMENTATION EXPERIMENTS WITH AGRICULTURAL WASTE AND BY-PRODUCTS OF BIOFUEL INDUSTRY

LÁSZLÓ SALLAI[1]
[1] ***Univerisy of Szeged, Faculty of Agriculture, Hódmezővásárhely, Hungary***

Abstract: *My research work proposes the study of the impact for the qualitative and the quantitative property of the biogas production by the co-fermentation of the biofuel industrial by-products and the dangerous liquid pig manure of the concentrated stock of the big pig farms. The energetic utilization of these materials means more profitable technology for the biofuel industry with a longer product course, bigger income for the agricultural enterprises, savings in the replacement of the plant nutrition with the utilization of the bio-manure, increase the performance of the plant production, making harmless the dung which means a big environmental load. Because of the profitability of bioenergy utilization depends on the local conditions it is necessary to do experiments to try the available composition of organic wastes in the ratio of the formation in advance..*

Keywords*: Sustainable agriculture, environmental protection, energy aimed waste utilisation, increasing the profitability of the agricultural production*

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.

MATERIALS AND METHODS

1. Table

The most important parameters of the input materials influencing the biogas releasing process

Measured parameters	*pH value*	*C/N ratio*	*Dry matter content*	*Organic dry matter content*
Liqid pig slurry	6,8-7,2	5-10	~4	~3,8
Róna sugar sorghum press residue	-	31-33	42	39

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:

a) the dry matter-,
b) organic matter,
c) nitrogen content,
d) C:N proportion,
e) 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.
d) Eveluation

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

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).

2. Table

The parameters of the utilized materials, 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 *(*2. Table*)*.The ***Error! Reference source not found.***. 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 the 3. Table.

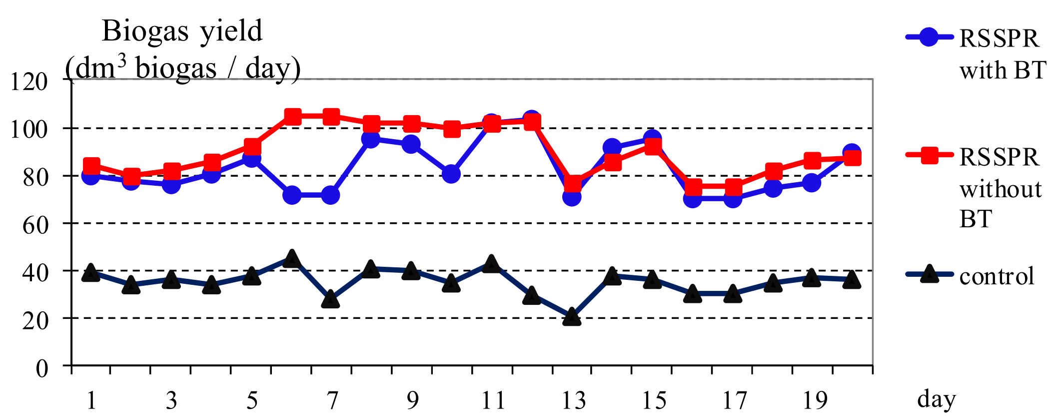
3. Table

Technology of co-fermentation experiments.

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

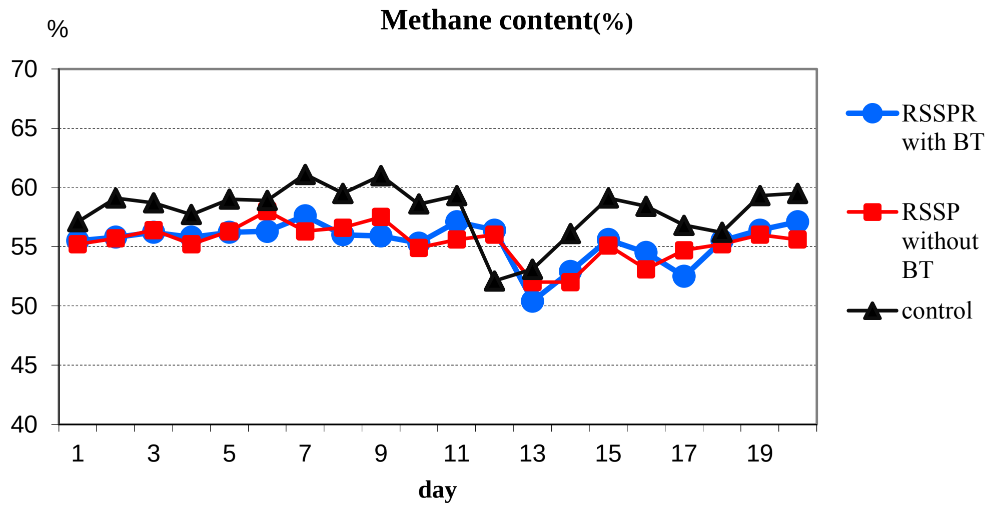
The statistical methods used by the evaluation of co-fermentation experiments
I used for the statistical analysis Excel spreadsheet and SPSS for Windows 18.0. The data were analysed by variance with independent two-T sample. I examined the homogeneity with Levene test. By the group pair comparison I 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.

RESEARCH RESULTS



1. Figure Biogas yield of the fermentors during the comparative period of the experiment (RSSPR=Róna Sugar Sorghum Press residue added, BT-bacteria treatment) on liquid pig dung basis

Examining the gas production of the reactors it is verifiable that much less biogas was produced in the untreated control in the given period, besides given parameters than in the other two, at pork liquid dung basis, with vegetal byproducts added. The sugar sorghum bagasse (press residue) used as additive increased the specific biogas yield more the two times in the experiment. In the concern of bacteria treated fermentor verifiable, that the bacterium culture bred between the laboratory circumstances did not increase significantly the production of the biogas or the methane. His effect appeared in the faster running-in of the gas production. In the case metanogen bacteria not containing fermentors filled up with pork liquid dung the biogas production after the vaccination under very short time, started up inside 1 – 2 days.



2. Figure: The methane content of the released biogas throught the comparative period of the experiment (RSSPR=Róna Sugar Sorghum Press residue added, BT-bacteria treatment) on liquid pig dung basis

The methane content almost parallel oscillated between 50-60% in all fermentors. There was no significant difference among the data of the Róna Sugar Sorghum Press residue treated (55,4%) with or without bacteria and the control fermentor(58,6%).

4. Table

Average biogas yield of liquid pig dung and sugar sorghum press residue added fermentors

Actual production value compared to the control	control fermentor		Róna sugar sorghum press residue added			
			without bacteria trewatment		bacteria treatment	
Treatment to assure the perfect dmc.	~5%*		200g**		200g**	
Average biogas production (Nm^3/day;%)	35,2	100	90,0	257	84	238
Methane content (%)	58,6	100	55,4	94,5%	55,4	94,54%

**200g dmc. liquid pig slurry overloaded*
***100g dmc. liquid pig slurry and 100g dmc. additive mix overloaded*

The Róna sugar sorghum press residue addition encreased the biogas production about 2.5 times compared to the biogas releasing of the control experiment but the methane content decreased only ~ 3%. From the proportion of the methane measured in the course of our experiments representing halfindustrial circumstances it is verifiable, that the ratio of the mathane is changing according to the intensity of the gas development(2. figure).

CONCLUSIONS

We simulated topping up (continuous) technology with 20days Hydraulic Retention Time in mesophil circumstances, that's wy we emptied 5% digested effluent substrate and fill up 5% influent row pig sludge into the control fermentor, and the same amount of liquid pig slurry and the by-product of biofuel industry sugar sorghum press residue with or without bacteria treatment. To summerise the results we can prove, that the 100g DMC bagasse additive increased the biogas production almost 2,5 times in the about 2000g DMC contained liquid manure. On the contrary the methane contant didn't decreased significantly, only 3% was the diclineing. The produced biogas is utilisable for energetical aim. folyamatos

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