Third International Symposium on Energy from Biomass and Waste

Venice 2010

EVALUATION OF THE BIOMETHANE POTENTIAL OF SILAGES, ANIMAL EFFLUENTS AND THEIR MIXTURES USED IN BIOMETHANATION PLANTS

A. Noo, C. Hermes, S. Lemaigre, F. Mayer, L. Hoffmann and P. Delfosse

noo@lippmann.lu
mayer@lippmann.lu

Objectives

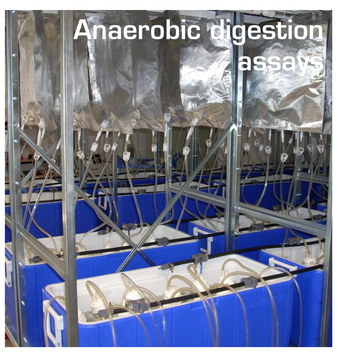
➢Develop knowledge on traditional and emerging energy crops;

➢Facilitate the management of digesters (information on substrates digestibility, optimum energy conversion of substrates);

➢Preserve the conducive conditions of the complex microbial processes;

➢Improve digestibility by optimizing rations, so:

- Increasing efficiency of biogas plants;
- Better use of organic substrates in a sustainable management of resources (raw materials efficient use).



Data analysis

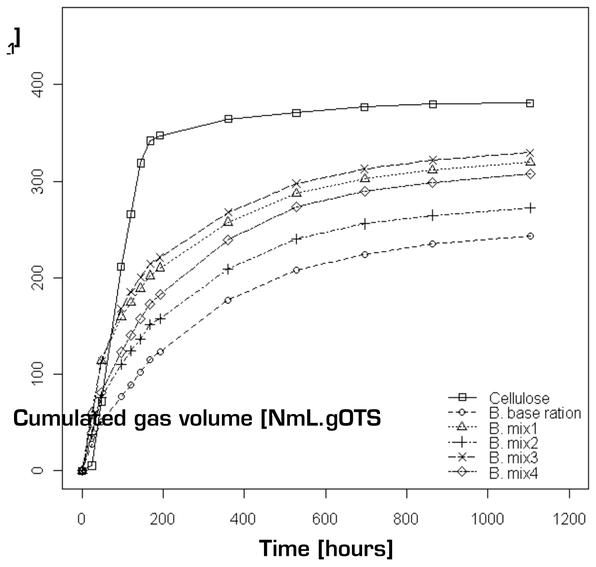
➢Cumulative CH_4 & CO_2 production curves were fitted to a non-linear model (Groot et al, 1996) [1];

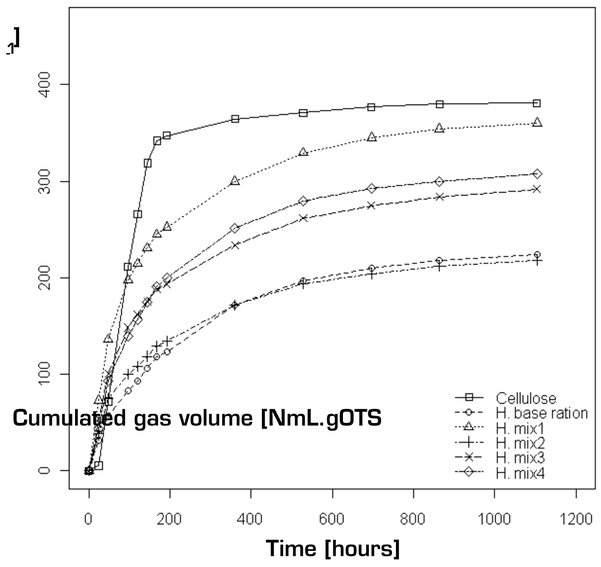
➢Calculation: software R, version 2.7.1;

➢Statistics: one-way ANOVA (α = 0.05) with SPSS, version 14.0.1.

Silages	Average BMP [NmL.gOTS^{-1}]	
Maize	455	33
Rye	367	25
Millet	380	49

Animal effluents	Average BMP [NmL.gOTS^{-1}]	
Pig slurry	252	14
Cow slurry	219	20
Manure	192	14





1. Groot J.C.J., Cone J.W., Williams B.A., Debersaques F.M.A., Lantinga E.A. (1996). Multiphasic analysis of gas production kinetics for *in vitro* fermentation of ruminant feed. Animal Feed Science Technology, 64, pp. 77-89.
2. VDI 4630. (2006). Fermentation of organic materials. Characterisation of the substrate, sampling, collection of material data, fermentation tests. VDI-Handbuch Energietechnik.

Material & methods

➢In accordance with the norm VDI 4630 (2006) [2];

➢Range: mesophilic (37-38°C);

➢Incubation period: min. 42 days;

➢Inoculum: seeding sludge from sewage treatment plant (diversified biocoenosis);

➢Biogas measurements:

- Volume: precision wet gas meter (Ritter, DE);
- CH_4 & CO_2 content: specific IR sensors (Dynament, UK);
- Normalized at 273K and 1013hPa.

		Animal effluents			Silages		
	Location	Manure	Cow slurry	Pig slurry	Maize	Rye	Millet
Basal Ration	Beckerich	20%	72%	8%			
	Hosingen	5%	84%	11%			
Mix1	Beckerich	16%	58%	7%	19%		
	Hosingen	4%	60%	7%	29%		
Mix2	Beckerich	17%	36%	7%		13%	
	Hosingen	4%	72%	9%		15%	
Mix3	Beckerich	14%	52%	6%	17%	11%	
	Hosingen	3%	53%	7%	26%	11%	
Mix4	Beckerich	16%	58%	7%			19%
	Hosingen	4%	60%	7%			29%

Results

➢Biomethane potential (BMP) superiority for energy crops compared to animal effluents:

- The silage process predigests crops & transforms complex organic molecules to more digestible ones;
- Silages still contained most of the potentially methanable matters whereas animal effluents contained only the non-digestible matters for ruminants or mono-gastric animals.

➢Animal effluents advantage versus energy crops:

- Their contribution to build up or maintain the bacterial consortium, especially the methanogenic flora.

➢Content in CO_2 larger than CH_4, during the first 2 days of anaerobic digestion of maize from Beckerich & rye from Hosingen:

- Indication of process imbalance such as a transient acidosis that could result from the presence of highly digestible substances.

Conclusion

➢Complementing the basal ration with energy crops did not drastically alter the specific digestibility of the animal effluents;

➢Energy crops such as immature cereals could be advantageously incorporated in the biogas plant rations to improve biogas production:

- Since they allow soil cover in winter time and more diversified cropping system;
- They could thus contribute to reduce erosion and pest problems often raised against the promotion of maize as an energy crop.

Centre de Recherche Public
Gabriel Lippmann

For further information or contact:
CRP - Gabriel Lippmann
41, rue du Brill - L-4422 BELVAUX
Tél. (+352) 47 02 61-1
contact@lippmann.lu