Scientific work was funded from the budget for science by National Centre of Research and Development in Poland. LIDER Programme 2011-2014

BIODEGRADATION OF ORGANIC WASTE IN THE ANAEROBIC DIGESTION – BENEFITS OF THE CO-FERMENTATION PROCESS

Magdalena Frąc[1], Krzysztof Ziemiński[2], Karolina Oszust[1], Agata Gryta[1] and Nina Bilińska[1]

[1]Laboratory of Molecular and Environmental Microbiology, Institute of Agrophysics Polish Academy of Sciences, Doświadczalna 4, 20-290 Lublin, Poland, m.frac@ipan.lublin.pl,

[2]Institute of Fermentation Technology and Microbiology, Technical University of Lodz, Poland

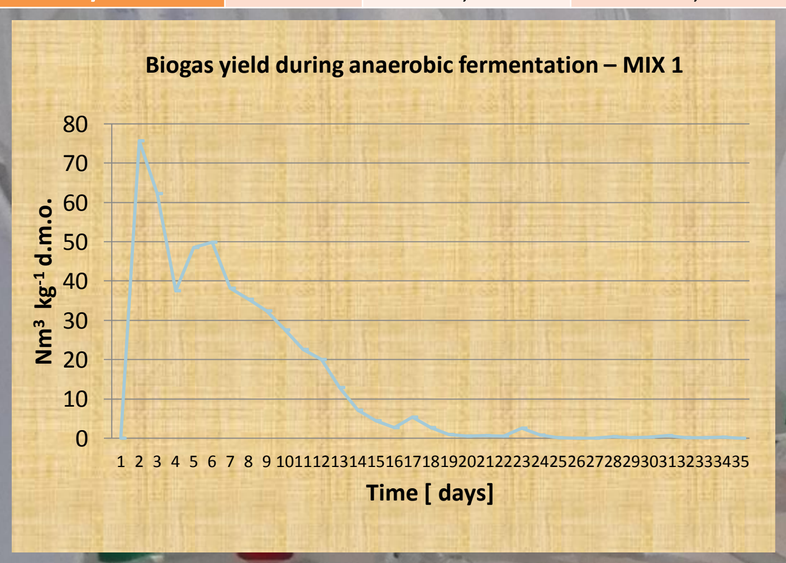
INTRODUCTION

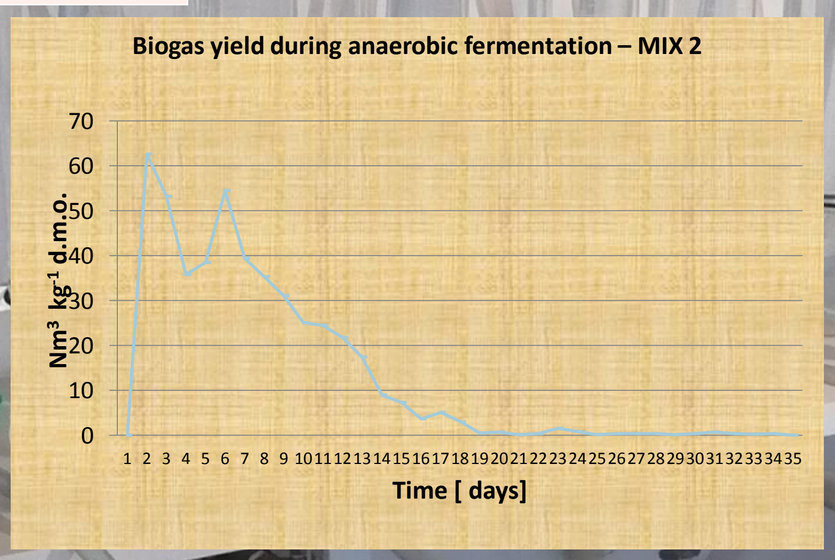
Anaerobic digestion of organic waste, products from agriculture and the food industry is a process known for many years and is widely used for waste stabilization, pollution control, improvement of manure quality and biogas production. Co-fermentation is one of the method used to the anaerobic digestion of different waste. The benefits of the co-fermentation include: dilution of potential toxic compounds, improved balance of nutrients, synergistic effects of microorganisms, increased load of biodegradable organic matter and better biogas yield.

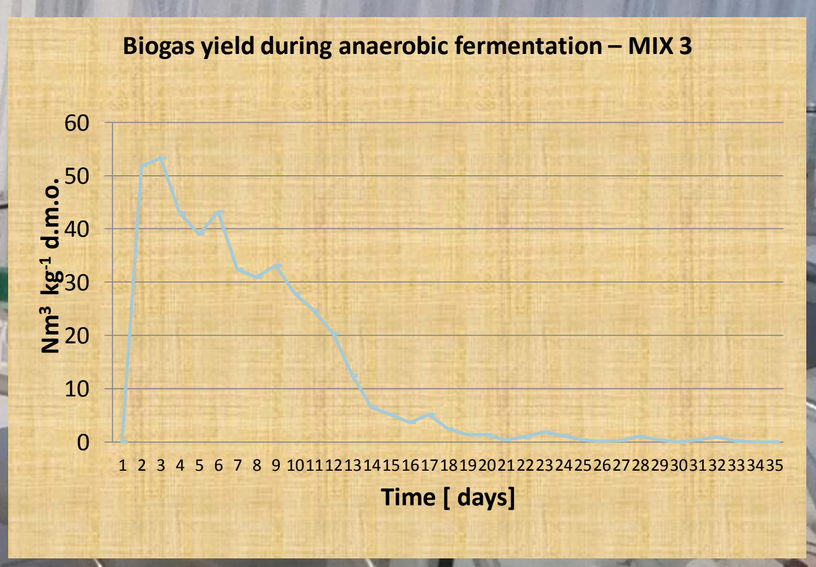
The aim of the study was to evaluate the biogas production from different mixtures of organic waste.

Parameters	Unit	Bio-waste		
		Mix 1 fruit processing waste (25%) + dairy sewage sludge (25%) + corn silage (12%) + grain brew (38%)	Mix 2 fruit processing waste (30%) + dairy sewage sludge (35%) + corn silage (8%) + grain brew (27%)	Mix 3 fruit processing waste (25%) + dairy sewage sludge (25%) + corn silage (15%) + grain brew (35%)
Dry mass	%	11,7	11,7	16,2
Organic dry mass	% d.m.	92,7	91,0	88,3
Ash	% d.m.	7,3	9,0	11,7
ChZT	g O_2 kg^{-1} d.m.	1,45	1,68	1,1
Total Nitrogen	% d.m.	4,9	5,76	4,03
P	g kg^{-1} d.m.	6,87	9,14	5,76
pH	pH	4,36	4,52	4,69
C/N	-	27,16	26,36	38,17

The study included the following mixtures bioweste in different proportions: mix 1: fruit processing waste (25%) + dairy sewage sludge (25%) + corn silage (12%) + grain brew (38%); mix 2: fruit processing waste (30%) + dairy sewage sludge (35%) + corn silage (8%) + grain brew (27%); mix 3: fruit processing waste (25%) + dairy sewage sludge (25%) + corn silage (15%) + grain brew (35%). Semi-batch anaerobic fermentation processes were conducted under mesophilic conditions at 37°C. Fermentations were run in three identical glass fermentation chambers with working volume of 2 dm^3.







The study showed that the intensity of the biogas production was varied and depended on the composition of fermented mixtures. The highest yield of biogas from 1 kg of organic dry matter – 629.4 dm^3 was obtained for the mixture 1. To this mixture was also obtained the best methane yield from 1 kg of organic dry matter – 402,81 dm^3. The highest efficiency of biogas was obtained on the 3rd day of fermentation for all the analyzed samples. After this time the biogas yield in all treatments decreased until day 35, when the process has been finished. Modification of the substrates composition as compared to individual waste, improved the fermentation mass hydration and balance of biogenic elements. Methane fermentation multicomponent mixtures significantly increased the amount of biogas efficiency compared to individual substrates fermentation.