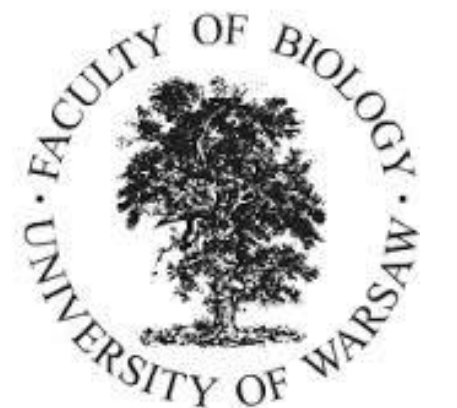


# STIMULATION OF BIOGAS PRODUCTION FROM SEWAGE SLUDGE BY SUPPLEMENTS ADDITION



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## INTRODUCTION

Anaerobic digestion (AD) is a common method of wastes treatment aimed at reduction of the amount of organic waste and energy recovery. AD is a complex process carried out by a number of microorganisms whose activities are determined by a variety of physicochemical parameters, as well as the availability of the nutrient substrates and growth supplements.

## OBJECTIVE

The objective of this work was to investigate the effect of addition of microbial supplements on the biogas production during anaerobic digestion of sewage sludge. During semi-continuous anaerobic digestion of sewage sludge from municipal sewage treatment plant in Oswiecim, the following supplements were tested:

- "microbial vaccine" containing specialized strains of archaea, bacteria and fungi - variant M
- "methanogenesis supplements" containing organic compounds which could stimulate the activity of methanogenic archaea - S variants: (i) S-CS supplement prepared from cattle slurry, (ii) S-L supplement prepared from sewage sludge and (iii) S-H hydrolysing extract.

## EXPERIMENTAL

Anaerobic digestion in semi-continuous mode was carried out in the single-stage anaerobic laboratory reactor. The operating volume of the bioreactors was 1L. Digestion process took place for 20 days and was carried in 37°C. For the control of the anaerobic digestion process, the following parameters were determined: the volume and composition of the biogas, volatile fatty acids (VFAs), total solids (TS), volatile solids (VS), chemical oxygen demand (COD), total ammonia (NH<sub>3</sub>) and pH. Daily biogas production was monitored by Milligascounter MGC-1 (Ritter). Methane content was analyzed by gas chromatography GC/MS (Agilent).

## RESULTS

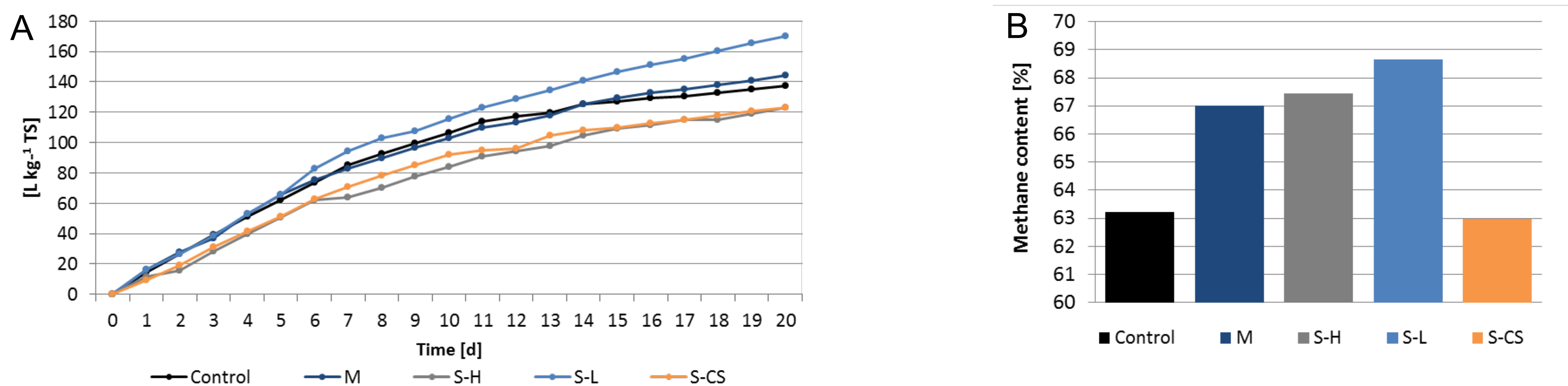


Fig. 1. Efficiency of biogas production; (A) cumulative biogas production; (B) maximal methane content during anaerobic digestion process

Table 1. The chemical analyses and total cell count of digeste during anaerobic digestion process

Microbial supplements	Control			M			S-H			S-L			S-CS		
	T0	T10	T20	T0	T10	T20	T0	T10	T20	T0	T10	T20	T0	T10	T20
pH [-]	8,1	7,94	7,68	8,04	8,03	7,65	8,04	8,02	7,65	7,84	7,87	7,46	8,14	7,86	7,7
COD [g/l]	11,1	14,9	21,1	14,8	15,1	17,4	15,5	15,7	23,9	20,5	18,5	30,7	11,1	21,1	29,6
VFA [g/l]	2,27	6,58	12,39	3,34	7,58	1,7	5,07	8,01	10,01	5,66	7,39	12,27	12,83	7,21	8,47
NH <sub>3</sub> [mg/l]	8,1	7,94	8,17	0,94	1,75	2,19	1,92	1,73	2,01	1,01	1,86	2,3	3,3	2,2	2,56
DAPI [cells/ml]	1,3E+08	1,22E+08	9,23E+07	2,19E+08	1,85E+08	1,62E+08	1,40E+08	1,43E+08	2,91E+08	7,52E+07	1,41E+08	2,65E+08	2,78E+08	6,77E+08	5,70E+08

The results showed that only addition of the microbial vaccine M and the supplement S-L increased biogas production during anaerobic digestion of sewage sludge. Addition of those products resulted in enhanced biogas production (of 24% for S-L and 5% for M) and increased quality (elevated amount of methane) of the produced biogas. Furthermore, the addition of the M vaccine and S-L supplement also increased the reduction of organic matter. The reduction degree for control was 55%, while for anaerobic digestion with the M vaccine and S-L supplement was at the level of 83% and 85%, respectively.

## CONCLUSIONS

The obtained results showed that the applied microbial vaccine and S-L supplement could efficiently enhance biogas production from sewage sludge.