ENHANCE BIOMETHANIZATION OF SEWAGE SLUDGE BY BIOAUGMENTATION OF NATURAL MICROBIAL CONSORTIA

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INTRODUCTION

Anaerobic digestion is widely used to treat organic wastes, representing a valid alternative to landfilling as well as an attractive source of renewable energy. The efficiency of degradation of sludge waste during anaerobic digestion was determined by a wide spectrum of microorganisms provided this process.

OBJECTIVE

Novel microbial consortia enriched from daily wastes (DW) and cattle manure (CM), were used to treat sewage sludge from municipal sewage treatment plant in Lodz, Poland. The objective of this study was to determine the effect of bioaugmentation with novel microbial consortia on efficiency of biomethanisation of sludge waste.

EXPERIMENTAL

The anaerobic digestion process was performed in 1 L laboratory batch-reactors at 37 °C for 30 days. The bioreactors were supplied with: (i) inoculum - fermentative sludge in contraction $10g_{vs}$ L^{-1}, and (ii) feedstock - sludge sewage on concentration $10g_{vs}$ L^{-1}, (iii) drinking, spring water was added up to 800mL total volume. Microbial consortia were added as a lyophilisate containing 109 cells/mL. For the control of the anaerobic digestion process, the following parameters were determined: the volume and composition of the biogas, volatile fatty acids (VFA), total solids (TS), volatile solids (VS), chemical oxygen demand (COD), total ammonia, pH. Daily biogas production was monitored by Milligascounter MGC-1 (Rittr). Methane content was analyzed by gas chromatography GC/MS (Agillent).

RESULTS

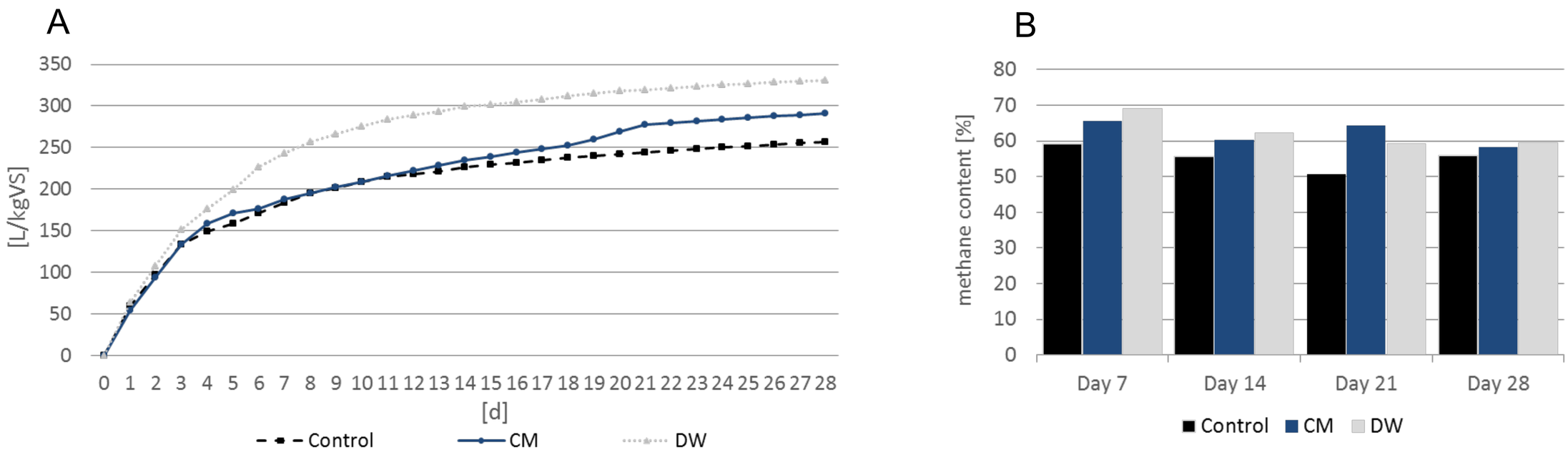

Fig. 1. Efficiency of biogas production; **(A)** cumulative biogas production; **(B)** maximal methane content during anaerobic digestion process

Table 1. The chemical analyses of digeste during anaerobic digestion process

Microbial consortia	Control					CM					DW				
Parameters	**T0**	**T7**	**T14**	**T21**	**T28**	**T0**	**T7**	**T14**	**T21**	**T28**	**T0**	**T7**	**T14**	**T21**	**T28**
pH [-]	7,29	7,41	7,51	7,52	7,47	7,6	7,55	7,52	7,68	7,51	7,52	7,51	7,44	7,65	7,42
COD [g/l]	1,8	1,23	1,26	0,85	0,9	4,5	2,3	1,37	1	1	4,63	1,87	1,26	0,7	0,67
VFA [g/l]	175	287	179	192	244	908	423	312	258	354	413	289	164	157	166
NH_3 [mg/l]	516	670	1106	880	983	570	793	1120	1033	980	486	776	1113	973	983

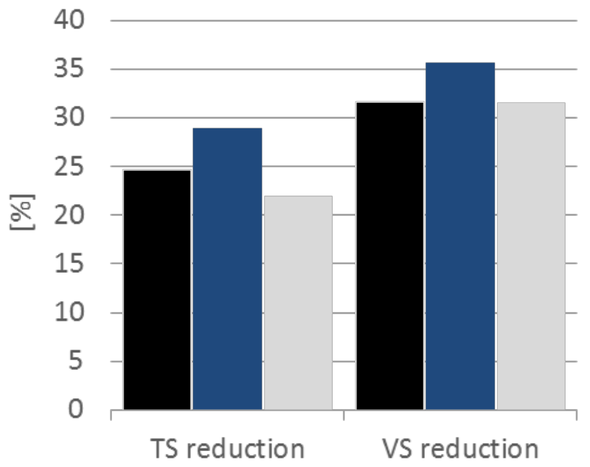

Fig. 2. TS and VS reduction during anaerobic digestion process

The results of the investigation revealed that bioaugmentation with microbial consortia DW and CM increased the degradation of sludge biomass and resulted in a 21 % increase in biogas production. The result indicates that the anaerobic digestion efficiency can be improved by bioaugmentation, which therefore may be a promising method for improving biomethanisation of sludge sewage.

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