



Improvement of the efficiency of sewage sludge anaerobic digestion by bioaugmentation with microbial consortia in concentrated forms



O.Stepkowska ⁽¹⁾, K. Poszytek ⁽²⁾, M. Ciezkowska ⁽³⁾, L. Dziewit ⁽⁴⁾,
L. Drewniak ⁽⁵⁾

⁽¹⁾⁽²⁾⁽³⁾⁽⁵⁾ Laboratory of Environmental Pollution Analysis, Faculty of Biology, University of Warsaw,
Ilji Miecznikowa 1, 02-096 Warsaw, Poland.
olga.stepkowska@gmail.com

⁽¹⁾⁽⁴⁾ Department of Bacterial Genetics, Institute of Microbiology, Faculty of Biology, University of Warsaw

INTRODUCTION

In recent years an increase in the amount of treated wastewater resulted in elevated production of sewage sludge. Bioaugmentation of sewage sludge with specialized microorganism could be a powerful tool to improve the wastewater treatment processes to which we can include anaerobic digestion, one of the most popular method for effective sludge stabilization

OBJECTIVES

The aim of this work was to check if bioaugmentation with microbial consortia in concentrated form produced on the basis of: (i) dairy wastes (DW), (ii) cattle manure (CM) and (iii) microbial consortium (MP) containing the isolates with high hydrolytic activities (proteolytic, cellulolytic, lipolytic) improves the efficiency of the anaerobic digestion of sewage sludge originating from the municipal wastewater treatment plant in Lodz (Poland).

EXPERIMENTAL

The anaerobic digestion process was carried out in 2.0 L reactors at 37°C for 30 days. The feed ratio of inoculum and sewage sludge for each reactor was 1:1 (10 gvs/L: 10 gvs/L). The tested microbial consortia (DW, CM and MP) were added as a concentrate containing 10¹⁰ cells/mL. To monitor the anaerobic digestion process, the following parameters were determined: the volume and composition of the biogas, soluble chemical oxygen demand (CODs), total solids (TS), volatile solids (VS), volatile fatty acids and the pH.00

RESULTS

The conducted analyses showed that:

- Bioaugmentation with such concentrates increases production of biogas from 8% to 25%(Fig.1.).
- in the control – at the level of ~ 216 dm³ biogas/day/1kg of TS
- in the culture with cattle manure (CM)= – at level of ~271 dm³ biogas/day/1kg of TS (25%)
- in the culture with microbial consortium (MP)= – at level of ~247,8 dm³ biogas/day/1kg of TS (15%)
- in the culture with dairy wastes (DW)= – at level of ~235 dm³ biogas/day/1kg of TS (8%)
- Concentrates can increase content of methane in produced methane even up to 56% (Fig. 2.).
- CM, MP and DW increase degree of reduction in total solids, volatile solids and CODs (Fig. 3.).
- Bioaugmentation with concentrates decreased level of volatile fatty acids about : CM(40%), MP (19%) and DM(54%) (Fig. 4.).

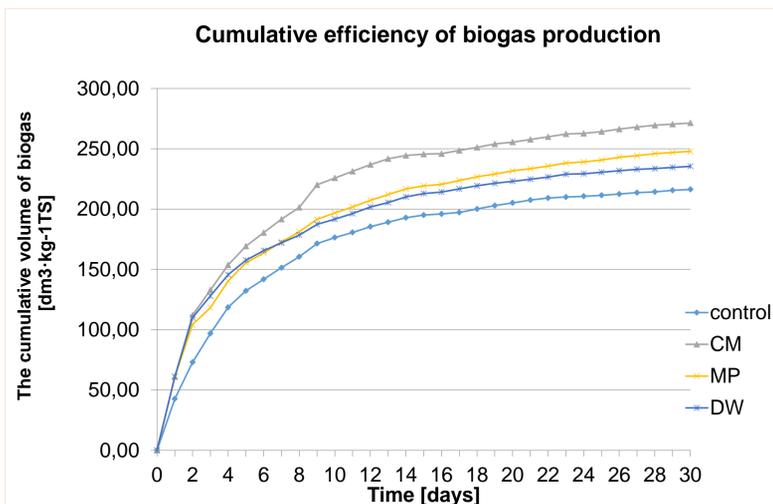


Fig. 1. Effect of CM, MP and DW on the production of biogas during anaerobic digestion.

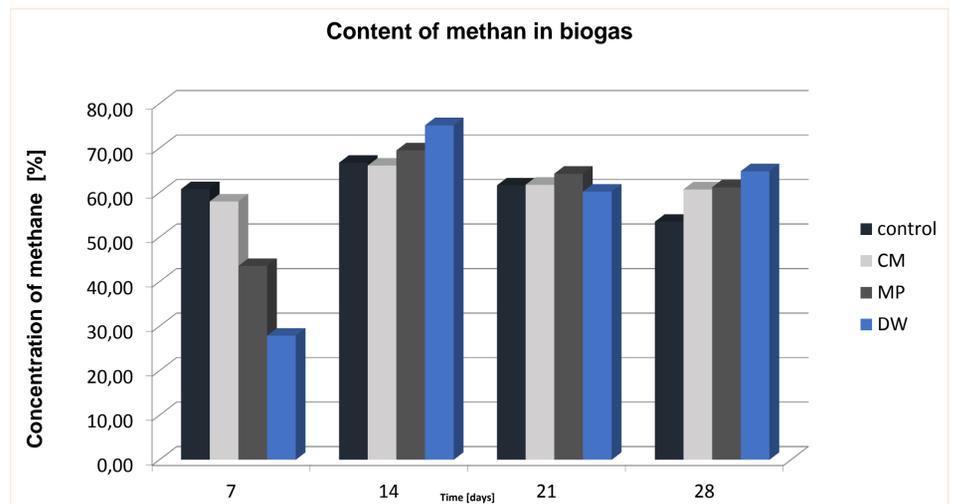


Fig.2. Influence of CM, MP and DW on the methane content in the biogas produced during anaerobic digestion.

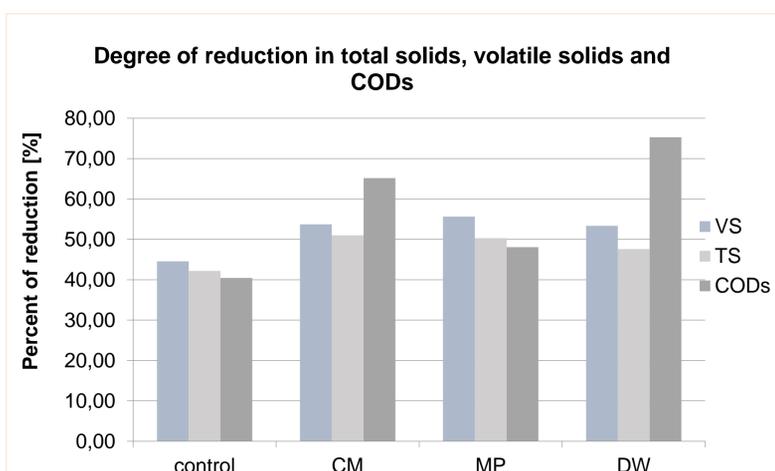


Fig.3. Effect of bioaugmentation with concentrates on reduction in total solids, volatile solids and CODs during anaerobic digestion.

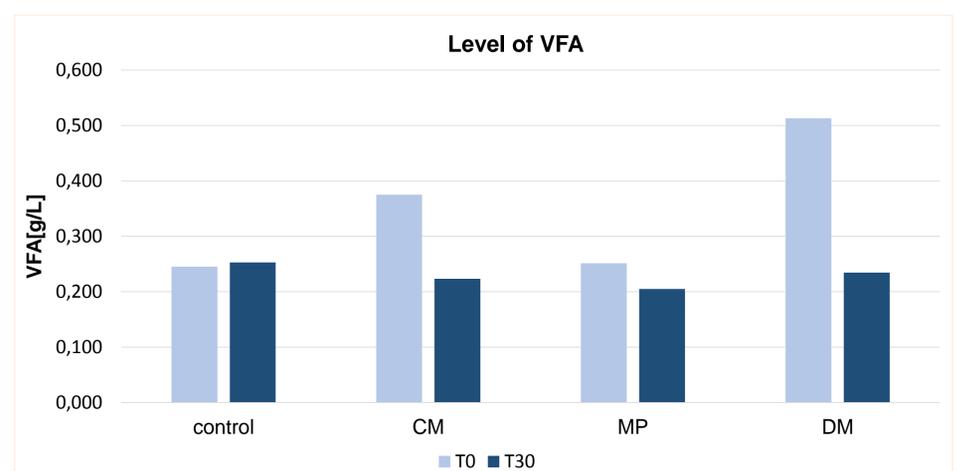


Fig.4. Effect of microbial consortia in concentrated form on the level of VFA at the start and after 30 days of culture during anaerobic digestion.

CONCLUSIONS

Presented work showed that microbial consortia CM, DW and MP had a potential for improvement of the efficiency of sewage sludge anaerobic digestion and bioaugmentation with such consortia in concentrated form can be used in wastewater treatment plants in order to increase an overall efficiency of the biogas production.

This work was supported by the Research Project funded by National Centre for Research and Development and National Fund for Environmental Protection and Water Management [Project number = No. 266405]

