



DEMETER – DEMONSTRATING MORE EFFICIENT ENZYME PRODUCTION TO INCREASE BIOGAS YIELDS

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First year project results



In the first year of the project an improved fermentation process for enzyme production at lab-scale was developed by GIBV and transferred to partner BBEU for scale-up to pilot level. In addition, a Design of Experiment (DoE) approach has been applied to the fermentation process and GIBV is currently finalizing the DoE experiments. Once completed, the results will be used to model the fermentation and to obtain an even further optimized process. In addition to fermentation optimization via the DoE approach, RNA expression data analysis has been also performed during the fermentation phase. GIBV is currently

analysing the obtained expression data to identify possible limitations and therefore to further improve the fermentation process.



The improved fermentation process to produce the enzymes for biogas applications has been successfully transferred to BBEPP. Similar titers and yields, as obtained in the labs of GIBV, have been reproduced at 150 L scale. In the first year of DEMETER project, BBEPP has compared different strategies to optimize the downstream process for enzymes purification. BBEPP is now going to front the next steps involving the scale up of the process to 1500 L and to 15 000 L.



During the first year of DEMETER project, first results of testing actual FibreZyme, one of the biogas enzyme products from DuPont, in full-scale biogas plants have been achieved by Miavit GmbH. In addition, further search and evaluation of methods for testing the enzyme effects in full-scale biogas plants are currently carried out. Finally, Miavit GmbH is currently performing analysis of biogas plants in which enzymes had positive or no results to find the optimal parameters for enzyme efficiency.



DBFZ initiated a biogas plant operator survey, with more than 7000 biogas plants in Germany that were asked to participate. Additionally, in the first year, laboratory tests in batch and semi-continuous scale have started. All together eight semi-continuous biogas tests with a substrate mixture of straw plus cow manure and rye-silage in combination cow manure are now in operation. After reaching stable conditions (steady state) the addition of enzyme products will start.



In the first half year of the project, OWS performed preliminary tests to assess the effect of the enzyme on the hydrolysis of grass. These tests showed very promising results in regard to later anaerobic digestion. Indeed, the reactor with enzyme had 17% more soluble COD (Chemical Oxygen Demand) after 14 days of spontaneous hydrolysis. On the other hand, no significant effects of the enzymes have been obtained when maize silage was has been used as substrate.

Recently, several continuous lab-scale digesters were start-up to assess the long-term effect of the enzyme on different types of organic waste material:

- Separately collected organic household waste and roadside grass
- Residual household waste
- Manure and agricultural waste (mainly corn stover)

For each substrate, 4 reactors were start-up: 2 without enzyme and 2 with enzyme addition. The results of these operations will be available during the second year of the DEMETER project.



BioMoer Energie BV will demonstrate the enhanced production of the biogas in field trials in their on-site biogas production, during the next phases of the DEMETER project. During the first year, Biomoer has weekly monitored its digester system and kept records of its current procedure. During the second year of the project these data will be compared with the results obtained through the C1-LC4 addition to evaluate the increased performance of the plant.



Many public dissemination materials and tools have been produced in the project's framework. A poster and a brochure are available on the website (public documents page) and they will be used to disseminate the project's results in events and other communications activities. The whole consortium has been very active in taking part in international and national conferences where the project has been presented orally and with posters. CIAOTECH has produced a first draft of the market analysis and all partners have been involved in giving input and suggestions.



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