



Experimental setup and realization of testing enzymes in full-scale plants

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EU funded Project





Problems with testing enzymes in full-scale plants

- complexity of full-scale plants
- many influencing factors
- sensitivity of plant operator
- insufficient technical equipment
- different effects of enzyme activity



Possibilities for scientific data collection

- sensitization of operators
- simple application of testing products
- installation of additional sensors for optimal data collection
- installation of automated data loggers
- determination of possible effects of the enzymes



Experimental setup for DEMETER

- two testing plants with an installed electric capacity of 500 kWh
 - 1) site with one plant without a comparison
 - 2) site with more plants to have a comparison between the plants



Experimental setup for DEMETER

Site 1

- renewable resources plant
- fed with maize silage (58 %), whole plant silage (36 %) and corn cob mix (6 %)



Experimental setup for DEMETER

Site 2

- renewable resources plant
- fed with maize silage (approx. 27 t per day)
- Slurrying of maize silage with recirculate and condensate to reach a total dm of $\approx 30,5 \%$



Experimental setup for DEMETER

- Measurement of enzyme effects
 - Technical parameters (power consumption, biogas production)
 - laboratory analysis (mass balances, changes in fiber structure)



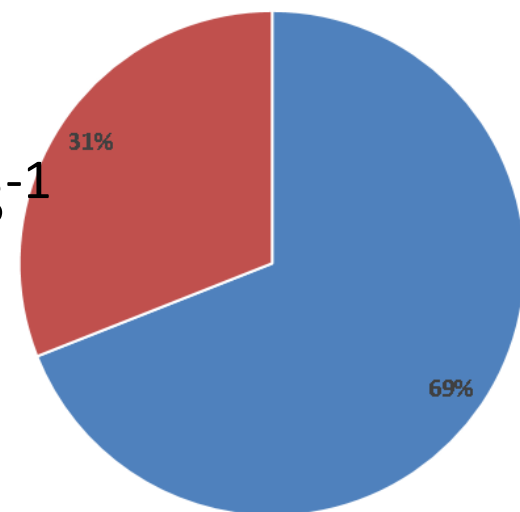
Experimental setup for DEMETER

- 1 month without enzymes
- 6 months with enzymes
- 1 month without enzymes



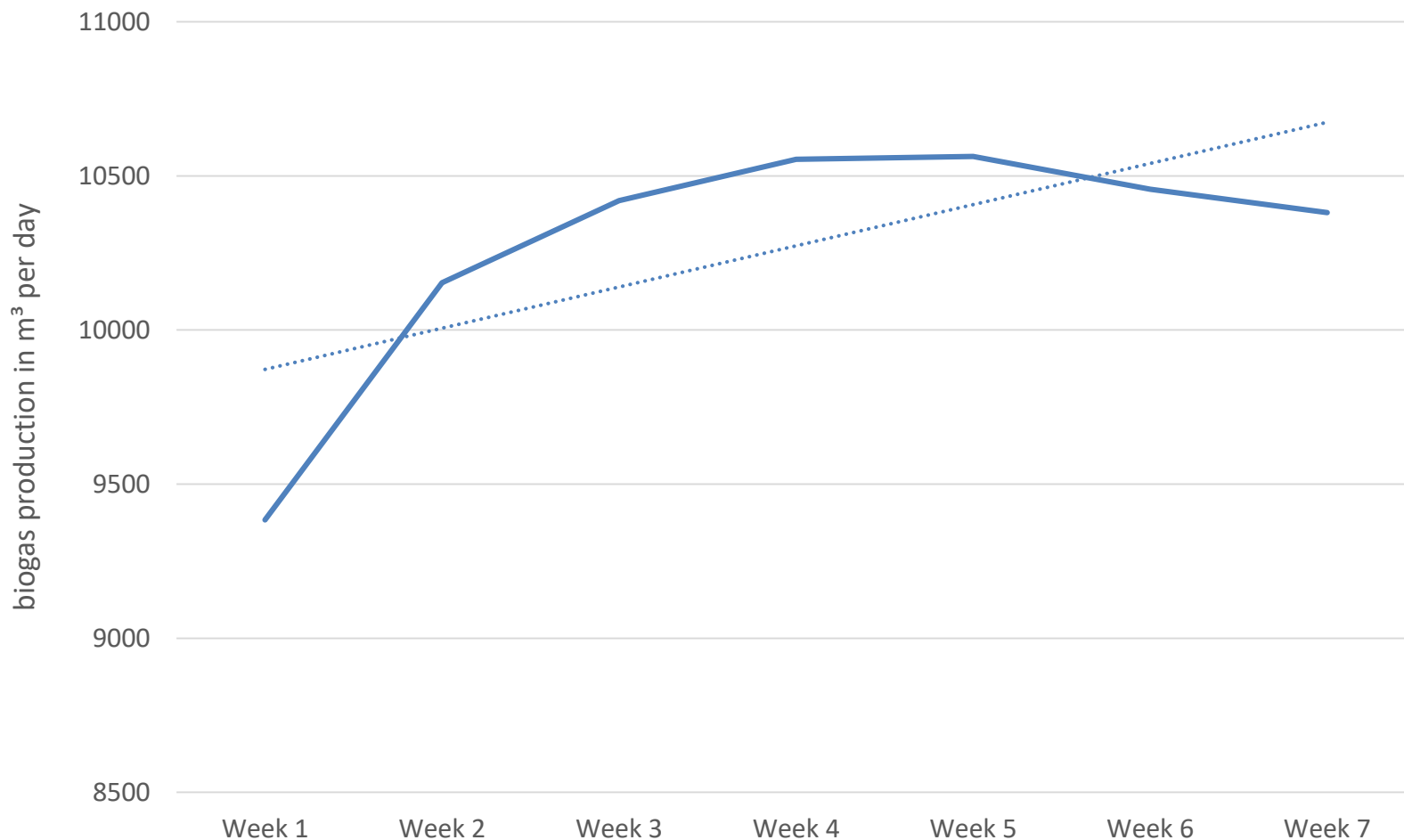
Results full-scale plant

- Biogas Plant UK, ~ 1 MW
- 1 digester 5000 m³, HRT = 47 days,
OLR = 4,5 kg vs*m⁻³
- Dosage: 0,78 g C1 enzyme*t vs⁻¹



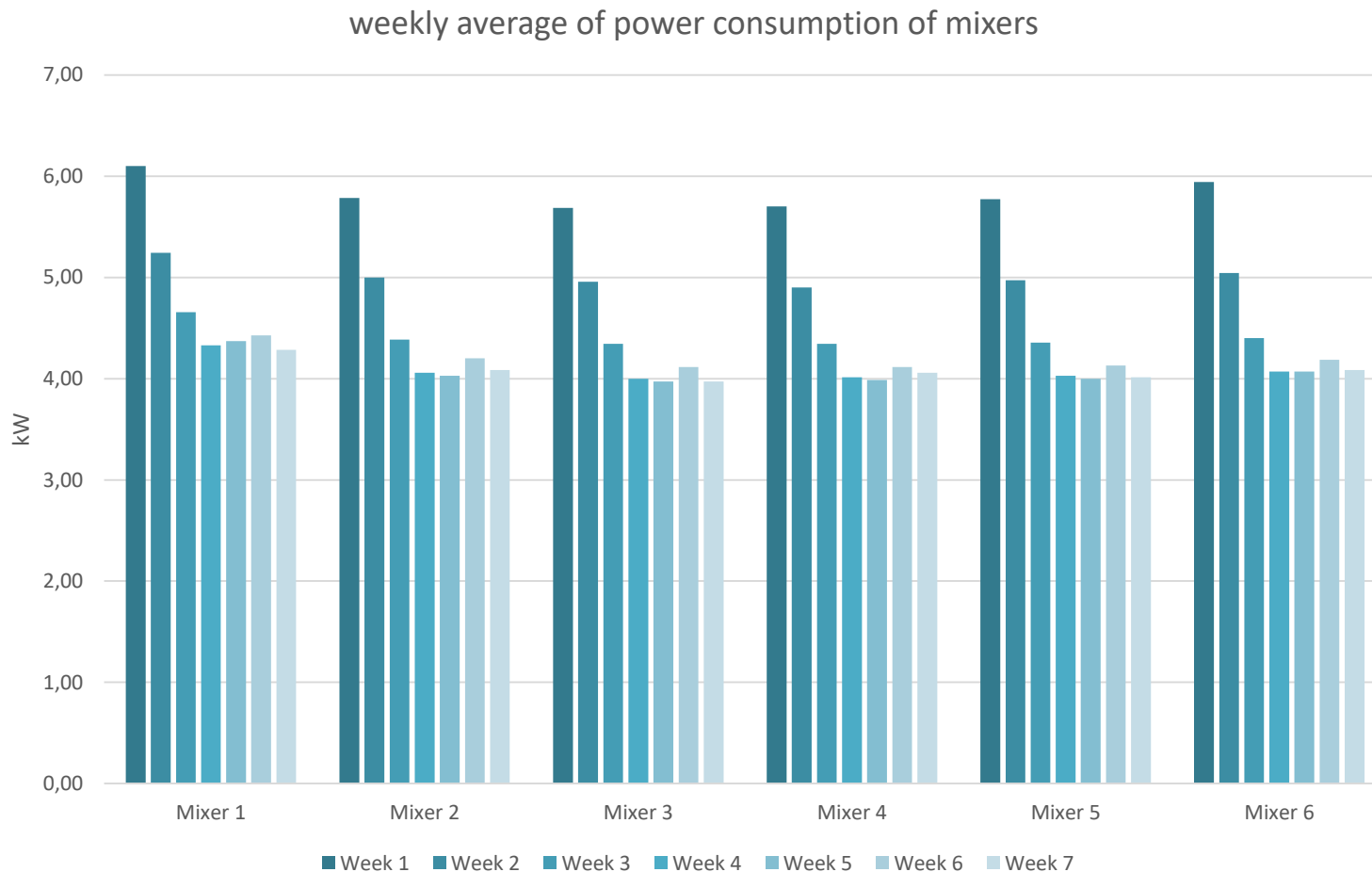


Results full-scale plant





Results full-scale plant





Results full-scale plant

- Overall optimisation of plant efficiency
- product is payed and in addition more money for the customer
- comparable results to other plants

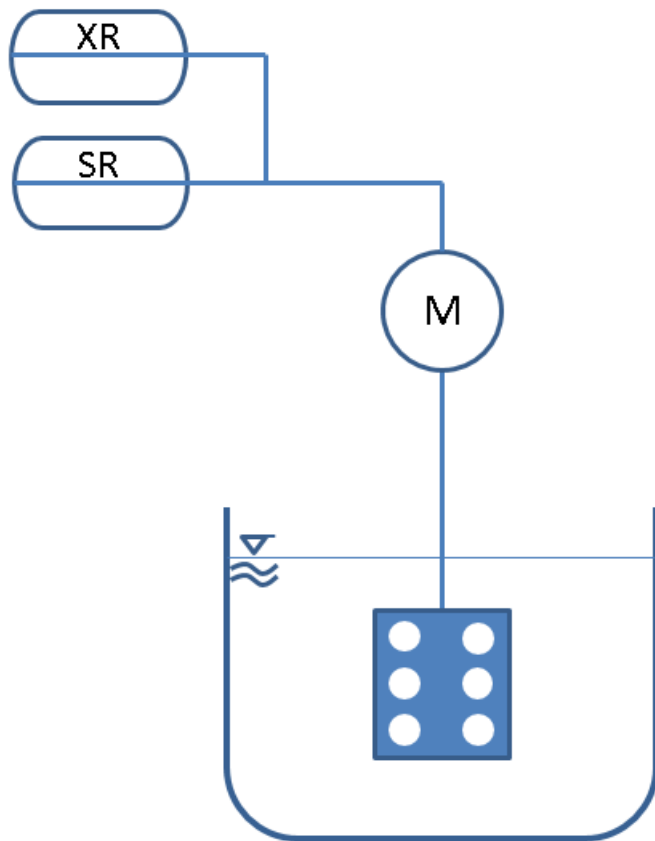


Viscosity testing full-scale plant

- Most observed effects on viscosity reduction
- external viscosity measurement → fewest plants have sufficient technical equipment



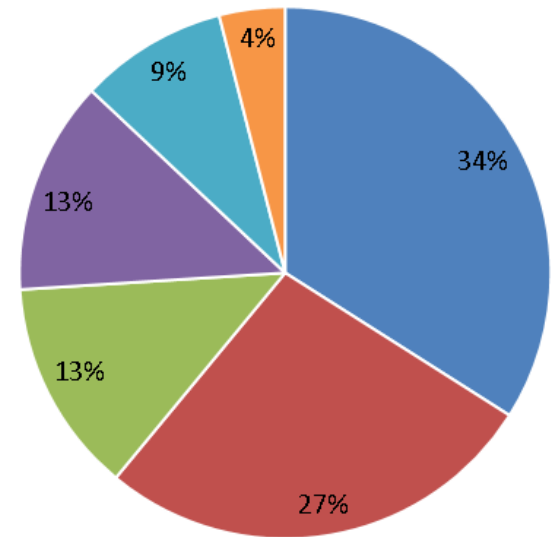
Viscosity testing full-scale plant





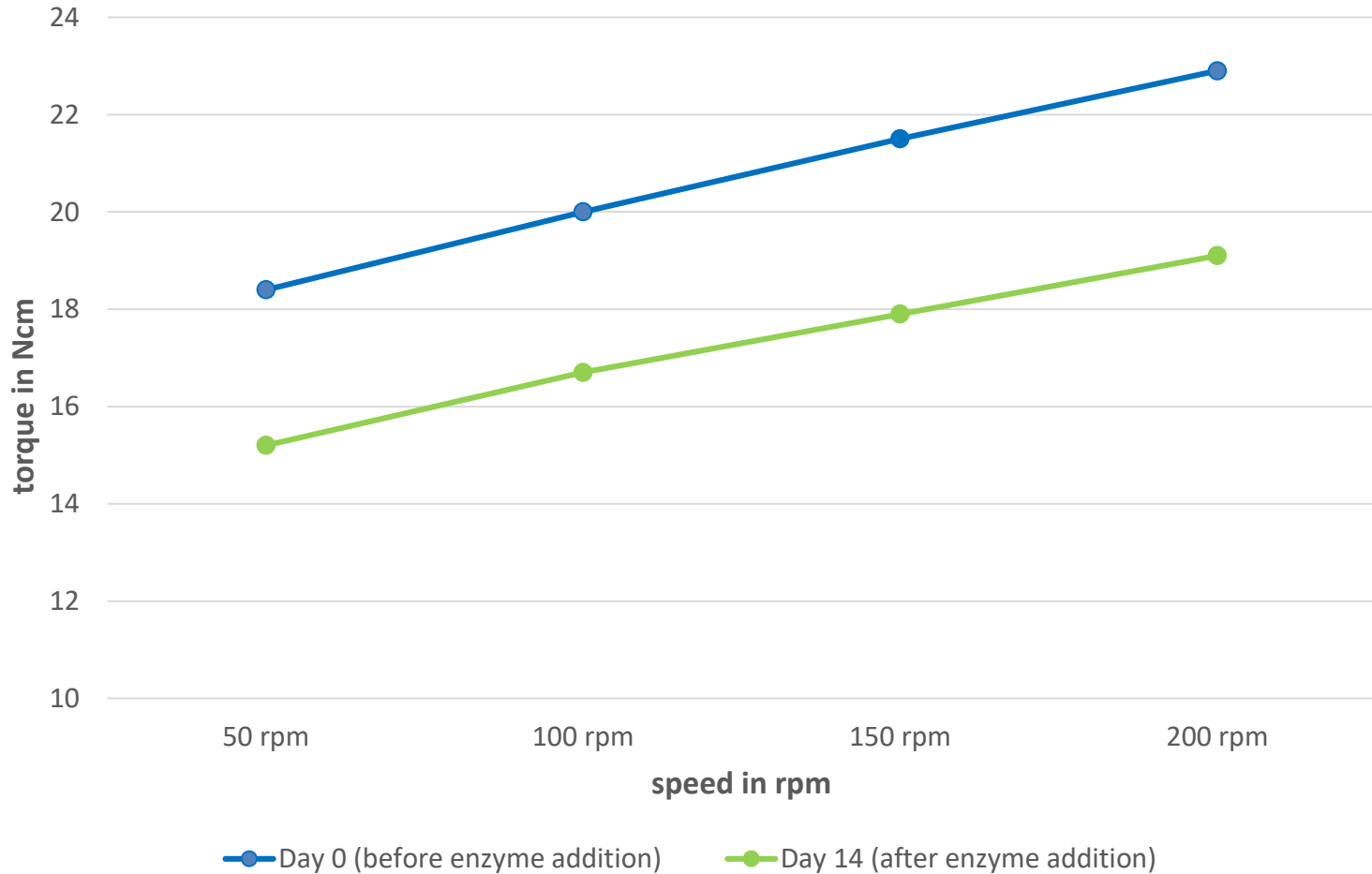
Results Viscosity Measurements

- Biogas Plant, Northern Germany, 250 kW
- 1 digester 1500 m³, HRT = 66 days,
OLR = 4.76 kg vs*m⁻³





Results Viscosity Measurements

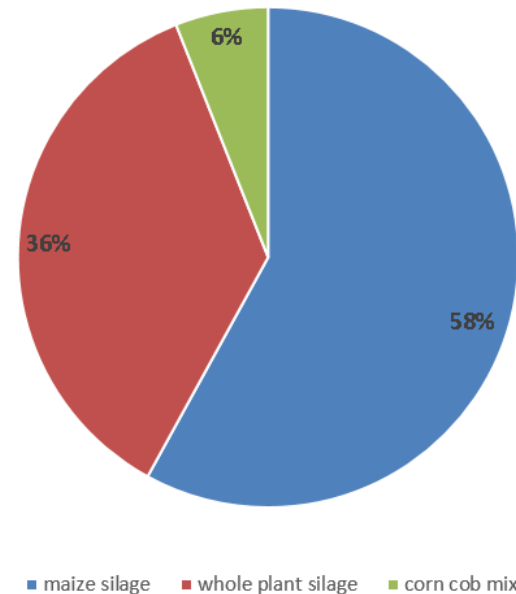


Ø: -16,8 % reduction of torque



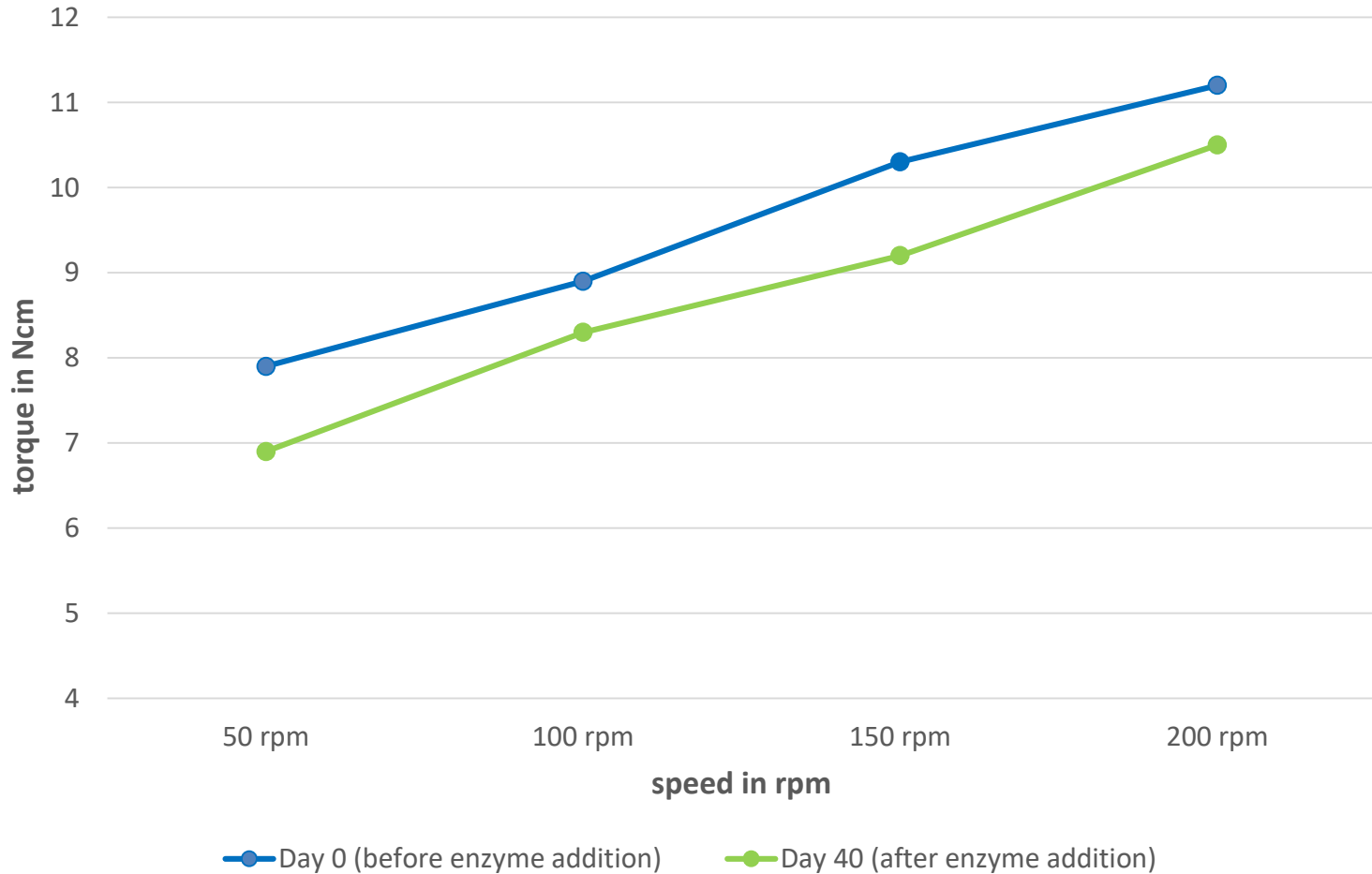
Results Viscosity Measurements

- Biogas Plant, Northern Germany, 500 kW
- 1 digester 2800 m³, HRT = 169 days, OLR = 2,5 kg vs*m⁻³
- Day 1-5: 471 g C1 enzyme*t vs⁻¹
- Day > 5: 94 g C1 enzyme*t vs⁻¹





Results Viscosity Measurements



∅: - 9,1 % reduction of torque



Acknowledgements



Demonstrating more efficient enzyme production to increase biogas yields

This project has received funding
from the European Union's Horizon 2020 Research and Innovation program
under Grant Agreement N. 720714



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