

Algae4Fish ATCZ221 Final Meeting – BEST

21st October 2022

Bernhard Drosig and Lisa Bauer

Overview of Tasks

- Characterization of digestates
- Development of digestate media
- Microalgae cultivation in digestate media
- Rotifer cultivation with different feeds
- Dissemination and communication



Characterization of Digestates

Raw material	Units	Waste of potato processing	Whey factory waste	Agricultural residues, silage	Food waste
TS	[%]	2.61	50.55	6.55	2.34
VS	[%]	1.25	6.12	4.83	1.33
pH	[-]	7.63	6.47	7.38	7.81
NH ₄ -N	[g/kg]	0.36	0.34	1.27	2.46
TKN	[g/kg]	1.29	4.18	3.33	3.34
P	[g/kg]	0.98	n.d.	0.50	1.09
VFA	[mg/L]	207	n.d.	683	129

Development of digestate-based cultivation media

Pre-tests

- Various pre-treatment methods tested for four different digestates

Selection of pre-treatments

- Two pre-treatment methods selected for each digestate

Microalgae cultivation

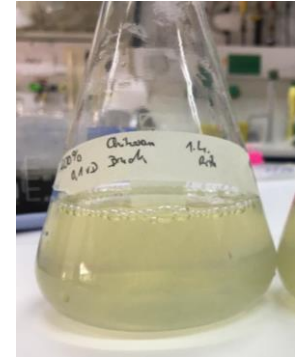
- Cultivation of *Chlorella* and *Trachydiscus* in the selected digestate-based media

Selection of protocols

- Selection of best suitable pre-treatment method for each digestate → **four different digestate-media developed**

Pre-Treatment of Digestates

- Dilution, centrifugation, sieving, filtration, flocculation
- Method of choice strongly dependent on digestate



Food waste digestate after dilution,
Chitosan addition and centrifugation



Sieving of dairy digestate
Subsequent centrifugation necessary

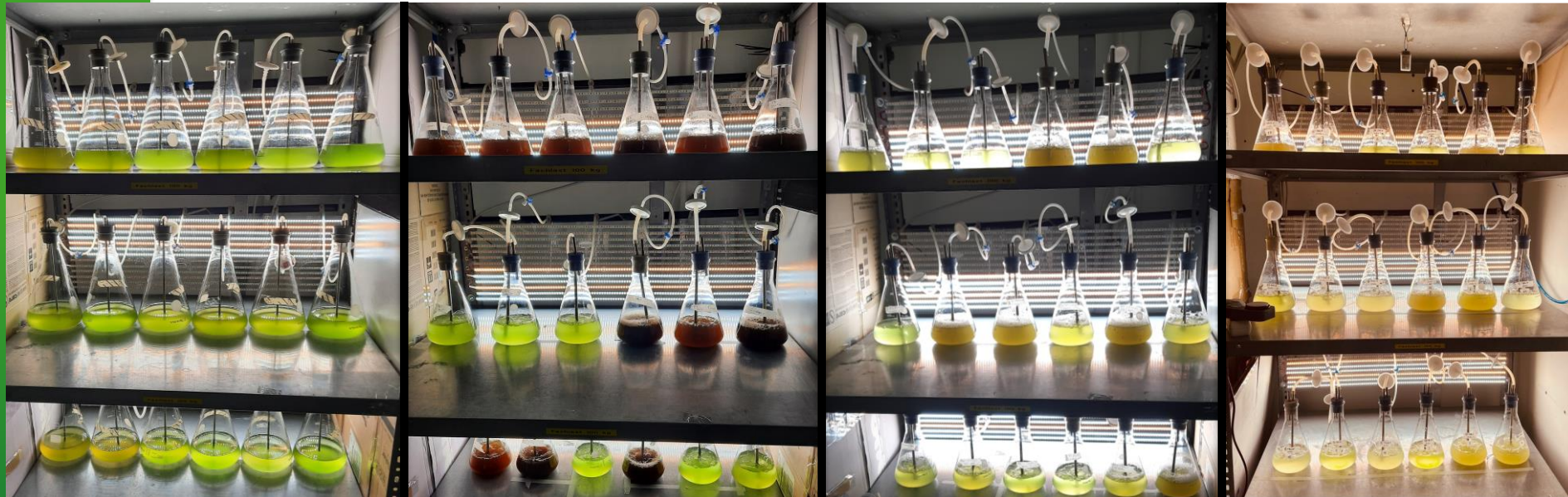


Energy crop digestate after
centrifugation – dark colour
remains even after dilution



Potato waste digestate after
centrifugation

Development of digestate-based cultivation media



Potato waste digestate

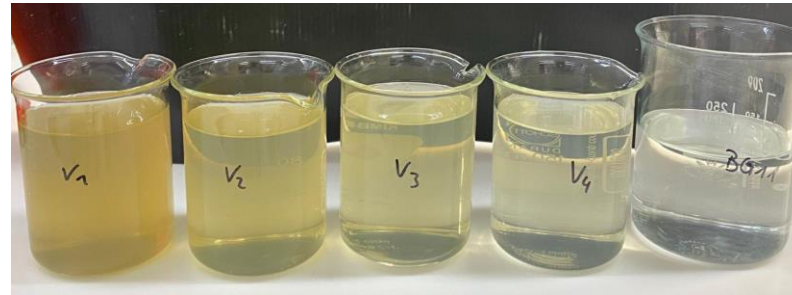
Energy crop digestate

Food waste digestate

Dairy digestate

Development of digestate-based cultivation media

- Pre-treatment protocol for four different digestates selected
 - Potato waste: Centrifugation - dilution
 - Dairy: Centrifugation - dilution
 - Energy crop: Dilution – chitosan addition – centrifugation
 - Food waste: Dilution – chitosan addition – centrifugation



Microalgae cultivation in digestate

- Five microalgae species tested (chosen by Algatech)
 - *Chlorella vulgaris*, *Trachydiscus minutus*, *Monoraphidium* sp., *Monodopsis*, *Vischeria helvetica*
- Cultivation in developed digestate-based media
- *Monoraphidium*, *Monodopsis*, *V. helvetica*
 - Very high dilutions necessary to achieve growth
 - Leads to low nutrient concentrations
 - Only low max. OD can be reached
- *C. vulgaris* and *T. minutus*
 - Best growth in dairy digestate
 - Energy crop digestate least suitable

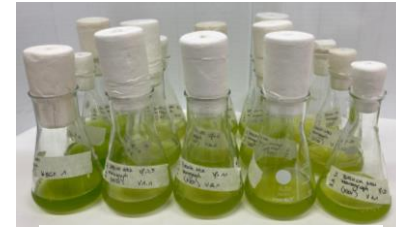
Microalgae cultivation in digestate



Monoraphidium in
energy crop digestate



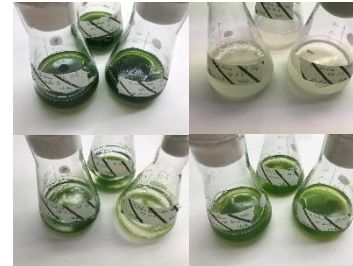
Monoraphidium in potato
waste digestate



Monoraphidium food
waste digestate



Monodopsis in dairy
digestate

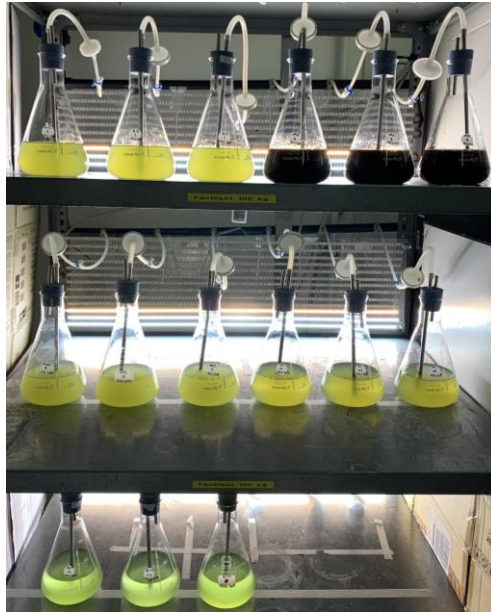


V. helvetica in dairy
digestate

Microalgae cultivation in digestate

- Five microalgae species tested (chosen by Algatech)
 - *Chlorella vulgaris*, *Trachydiscus minutus*, *Monoraphidium* sp., *Monodopsis*, *Vischeria helvetica*
- Cultivation in all four digestate-based media
- *Monoraphidium*, *Monodopsis*, *V. helvetica*
 - Very high dilutions necessary to achieve growth
 - Leads to low nutrient concentrations
 - Only low max. OD can be reached
- *C. vulgaris* and *T. minutus*
 - Best growth in dairy digestate
 - Energy crop digestate least suitable

Microalgae cultivation in digestate



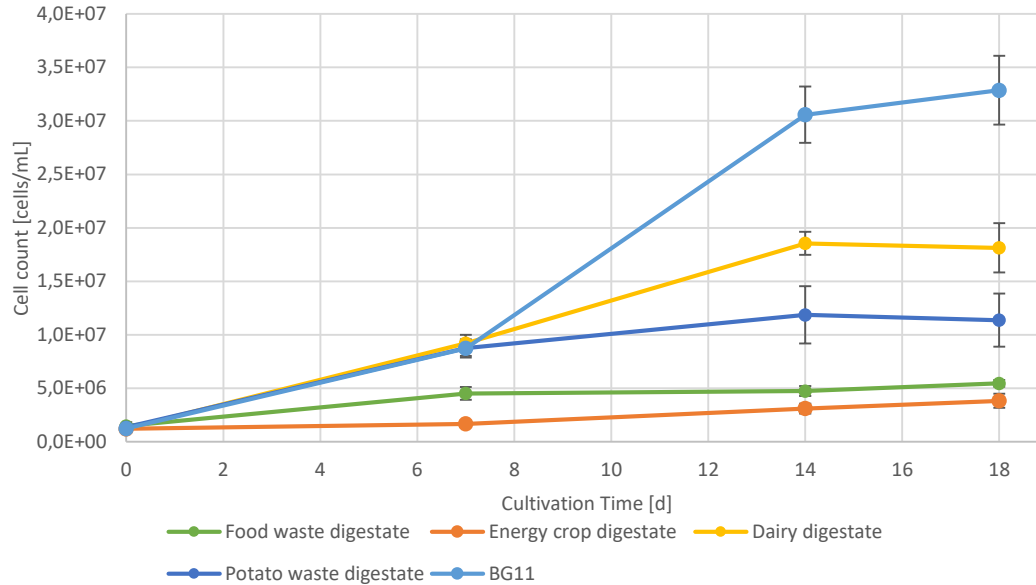
C. vulgaris in different digestate media. From top left to bottom right: Food waste, energy crop, dairy, potato waste digestate, BG11.



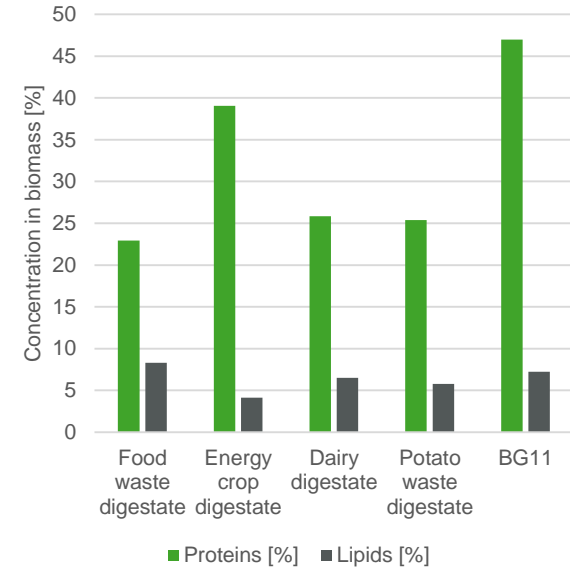
T. minutus in different digestate media. From top left to bottom right: Food waste, energy crop, dairy, potato waste digestate, BG11.

Microalgae cultivation in digestate

Chlorella vulgaris



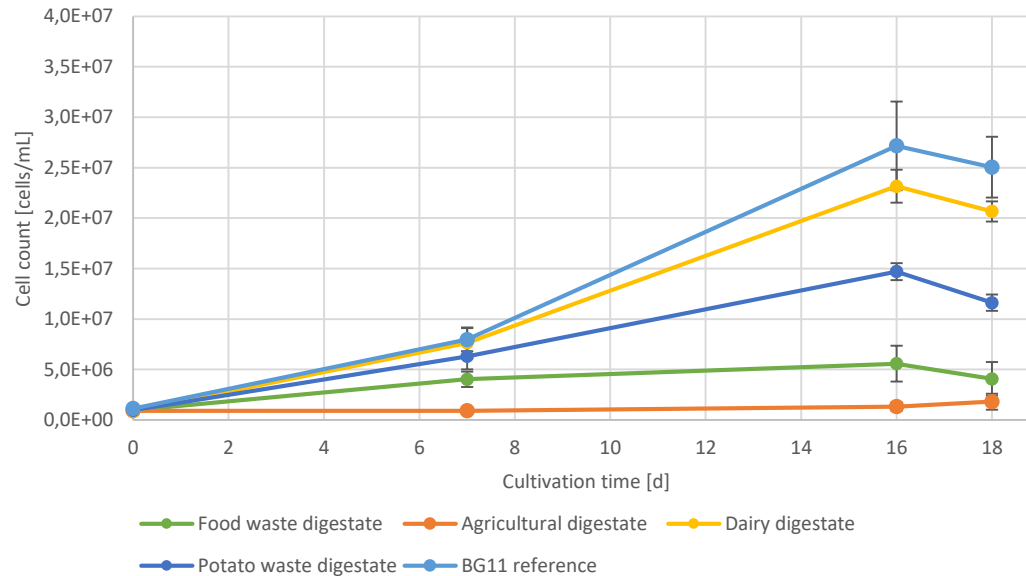
Growth curves of *C. vulgaris* in different digestate media.



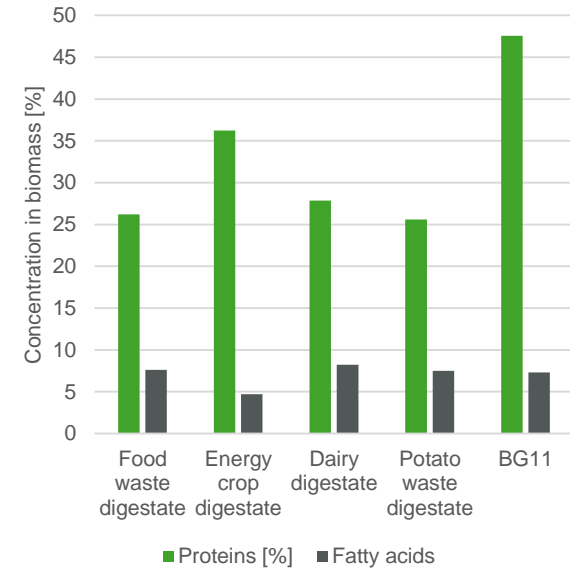
Biomass composition of *C. vulgaris* after growth in different digestate media.

Microalgae cultivation in digestate

Trachydiscus minutus



Growth curves of *T. minutus* in different digestate media.



Biomass composition of *T. minutus* after growth in different digestate media.

Rotifer Cultivation

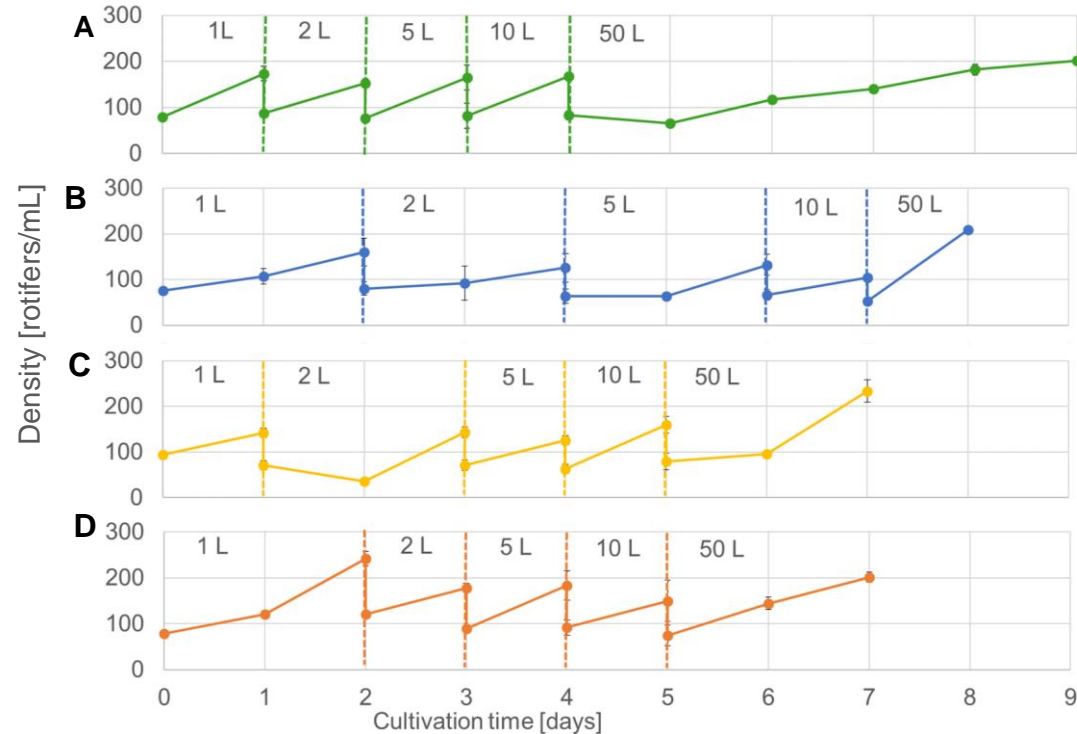
- Training and pre-experiments
 - Meetings with JU-FROV and BAW to learn rotifer cultivation
 - Pre-experiments in beakers
- Experiments in vessels up to 50 L
- High density system
 - Assembly and test run



Rotifer High Density System

Rotifer cultivation

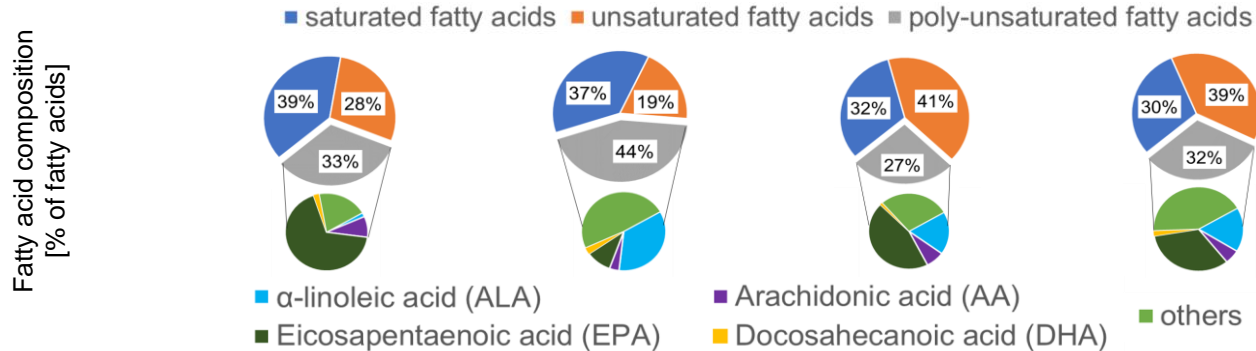
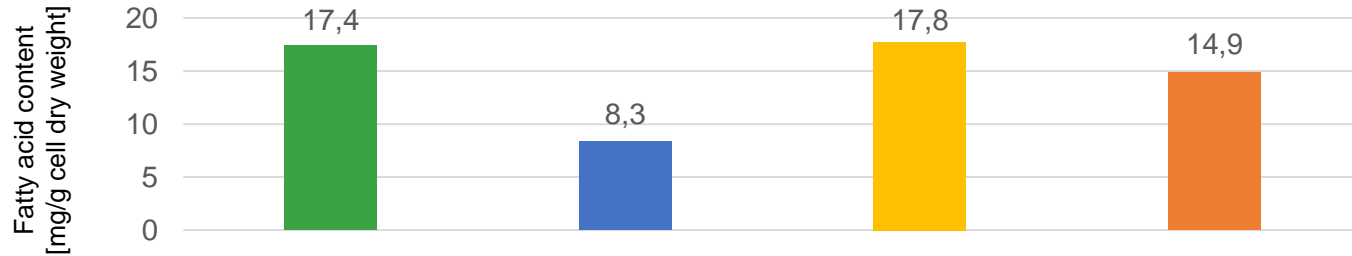
- Batch cultivation
- Feeding Nanno-paste and *Chlorella* grown on BG11 or digestate
- Doubling at 150-200 rotifers/mL
- Harvest at 200-250 rotifers/mL in 50 L
- Analysis of fatty acids



Density growth curves of *B. plicatilis*. Cultures were fed with: A: Nanno-paste. B: *C. vulgaris* grown on BG11. C: *C. vulgaris* grown on dairy digestate. D: *C. vulgaris* grown on potato waste digestate.

Rotifer cultivation

Feed:	Nanno-paste	<i>C. vulgaris</i> grown on BG 11	<i>C. vulgaris</i> grown on dairy digestate	<i>C. vulgaris</i> grown on potato waste digestate
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Fatty acid content and composition of *B. plicatilis* after different feedings.

Publications

- Review Paper at Applied Sciences
 - “Digestate as Sustainable Nutrient Source for Challenges and Prospects”



Review

Digestate as Sustainable Nutrient Source for Microalgae—Challenges and Prospects

Lisa Bauer¹, Karolína Ranglová^{2,3}, Jiří Masojedek^{2,4}, Bernhard Drosig¹

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Algae4Fish
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Interreg
Austria-Czech Republic



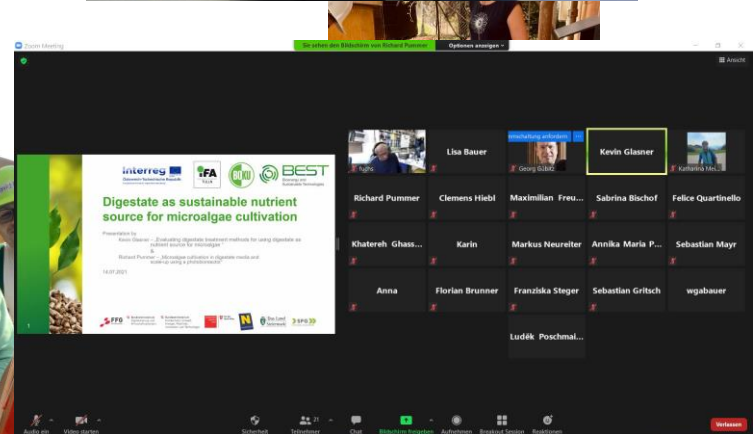
Utilising Biogas Digestate From Food Waste, Industrial Residues and Energy Crop Digesters as Nutrient Source for the Cultivation of Microalgae

Lisa Bauer, Kevin Glasner, Richard Pummer, Anna Kubetz, Wolfgang Gabauer, Bernhard Drosig, Katharina Meixner

www.atcz.eu

Communication

- Workshops
- Staff at biogas plants



Area 3 – Contact Data



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