Algae4Fish ATCZ221
Final Meeting – BEST

21st October 2022

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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

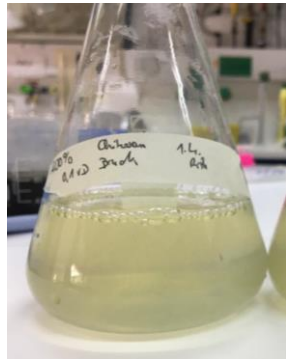
Raw material	Units	Waste of potato processing	Whey factory waste	Agricultural residues, silage	Food waste
TS	[%]	2.61	50.55	6.55	2.34
VS	[%]	1.25	6.12	4.83	1.33
pH	[-]	7.63	6.47	7.38	7.81
NH_4-N	[g/kg]	0.36	0.34	1.27	2.46
TKN	[g/kg]	1.29	4.18	3.33	3.34
P	[g/kg]	0.98	n.d.	0.50	1.09
VFA	[mg/L]	207	n.d.	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

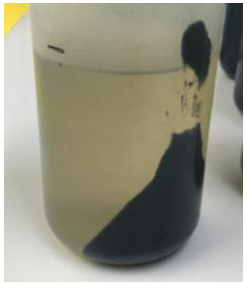
- Dilution, centrifugation, sieving, filtration, flocculation
- Method of choice strongly dependent on digestate



Food waste digestate after dilution, Chitosan addition and centrifugation

Sieving of dairy digestate
Subsequent centrifugation necessary

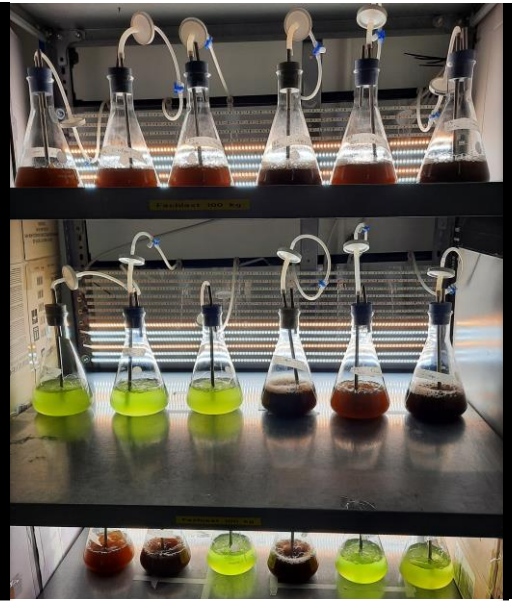
Energy crop digestate after centrifugation – dark colour remains even after dilution



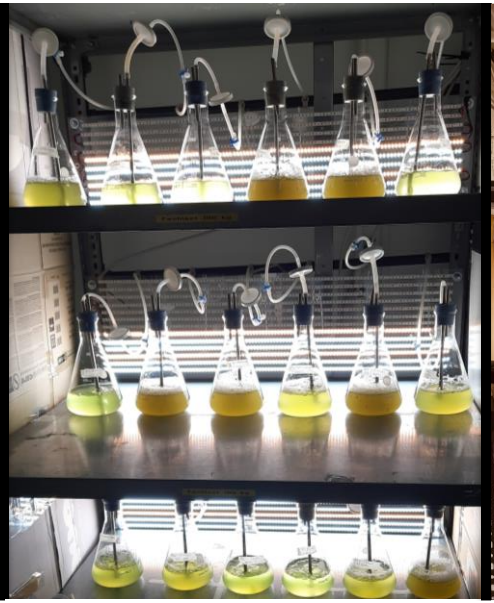
Potato waste digestate after centrifugation

Development of digestate-based cultivation media

Potato waste digestate



Energy crop digestate

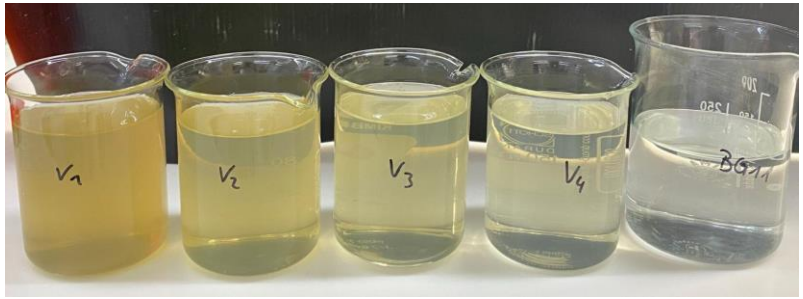


Food waste digestate

Dairy digestate

Development of digestate-based cultivation media

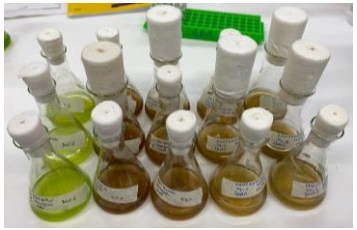
- Pre-treatment protocol for four different digestates selected
  - Potato waste: Centrifugation - dilution
  - Dairy: Centrifugation - dilution
  - Energy crop: Dilution – chitosan addition – centrifugation
  - Food waste: Dilution – chitosan addition – centrifugation



Microalgae cultivation in digestate

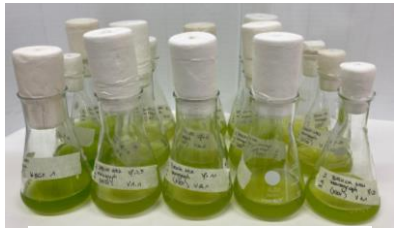
- Five microalgae species tested (chosen by Algatech)
  - *Chlorella vulgaris*, *Trachydiscus minutus*, *Monoraphidium* sp., *Monodopsis*, *Vischeria helvetica*
- Cultivation in developed digestate-based media
- *Monoraphidium*, *Monodopsis*, *V. helvetica*
  - Very high dilutions necessary to achieve 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



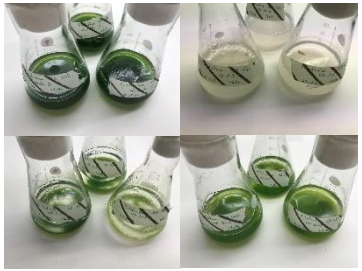
Monoraphidium in energy crop digestate

Monoraphidium in potato waste digestate



Monoraphidium food waste digestate

Monodopsis in dairy digestate

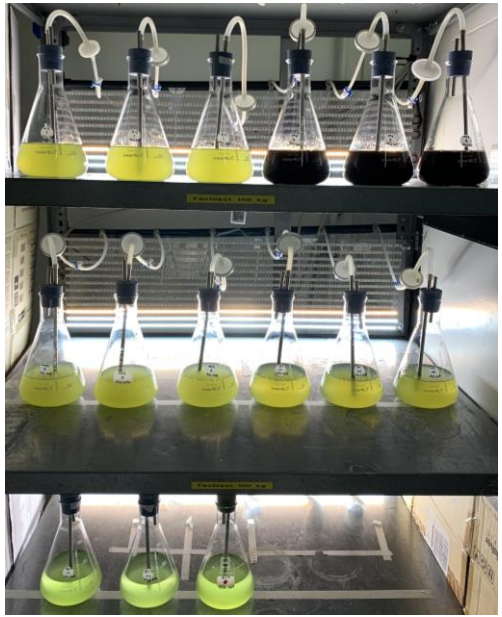


V. helvetica in dairy digestate

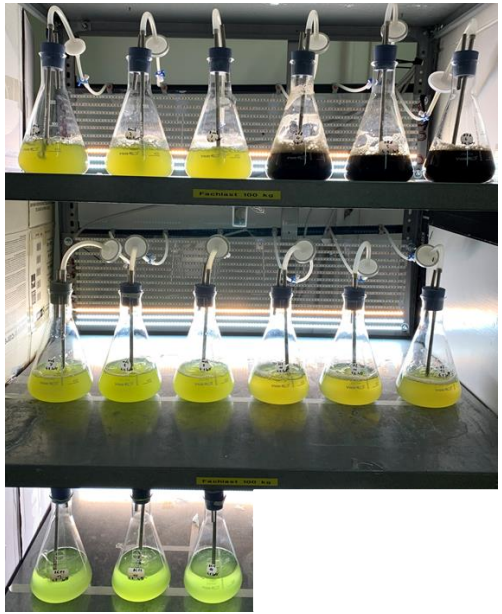
Microalgae cultivation in digestate

- 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



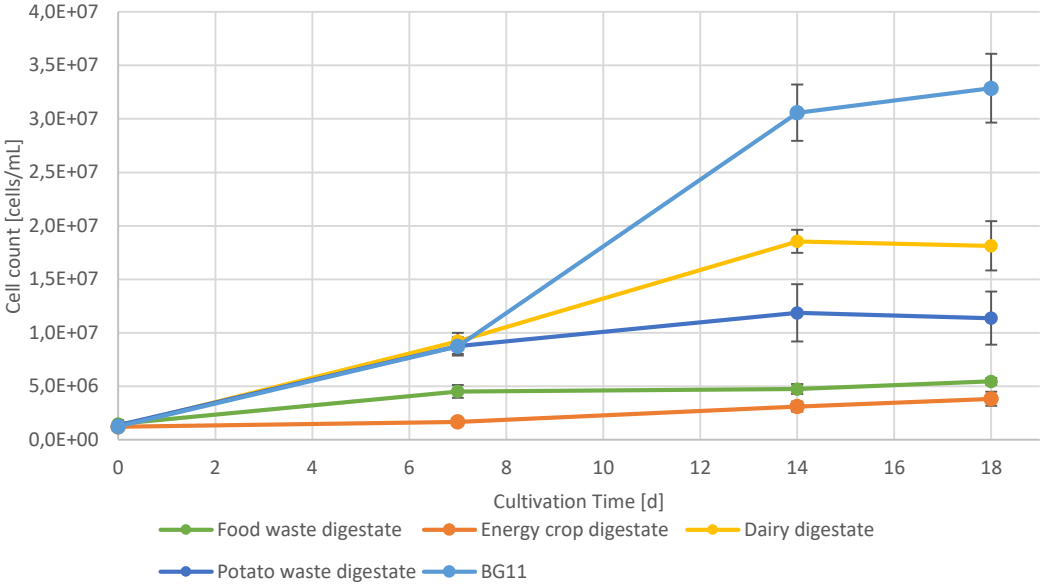
C. vulgaris in different digestate media. From top left to bottom right: Food waste, energy crop, dairy, potato waste digestate, BG11.



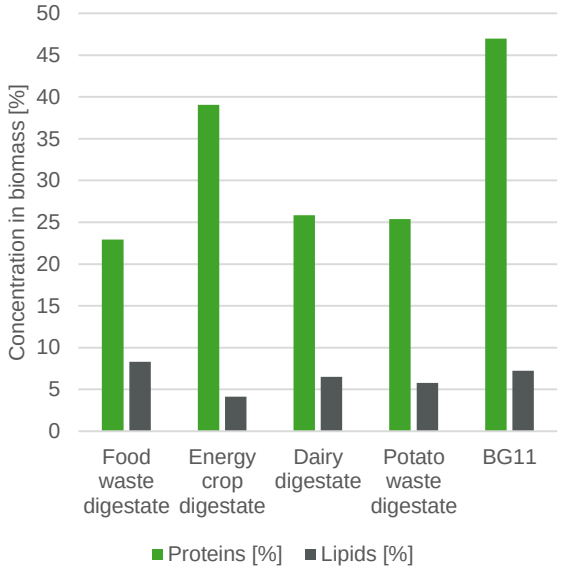
T. minutus in different digestate media. From top left to bottom right: Food waste, energy crop, dairy, potato waste digestate, BG11.

Microalgae cultivation in digestate

Chlorella vulgaris



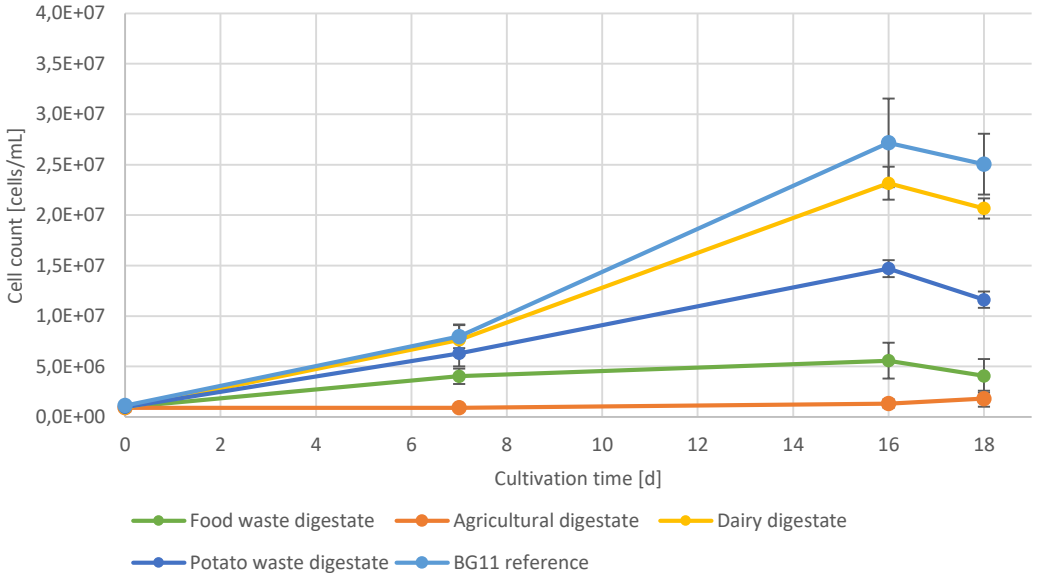
Growth curves of *C. vulgaris* in different digestate media.



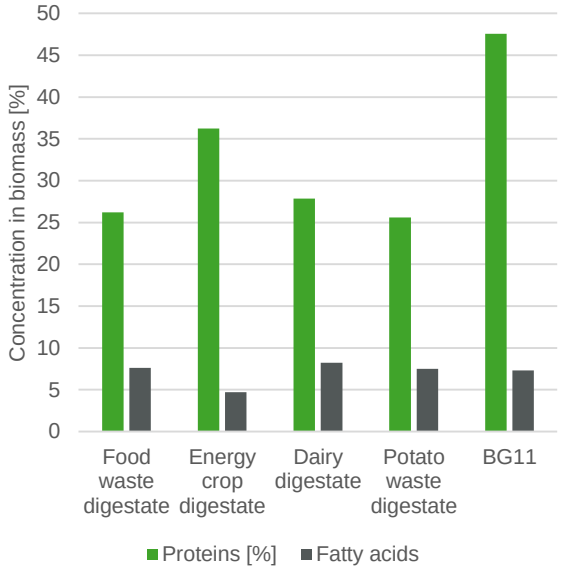
Biomass composition of *C. vulgaris* after growth in different digestate media.

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.

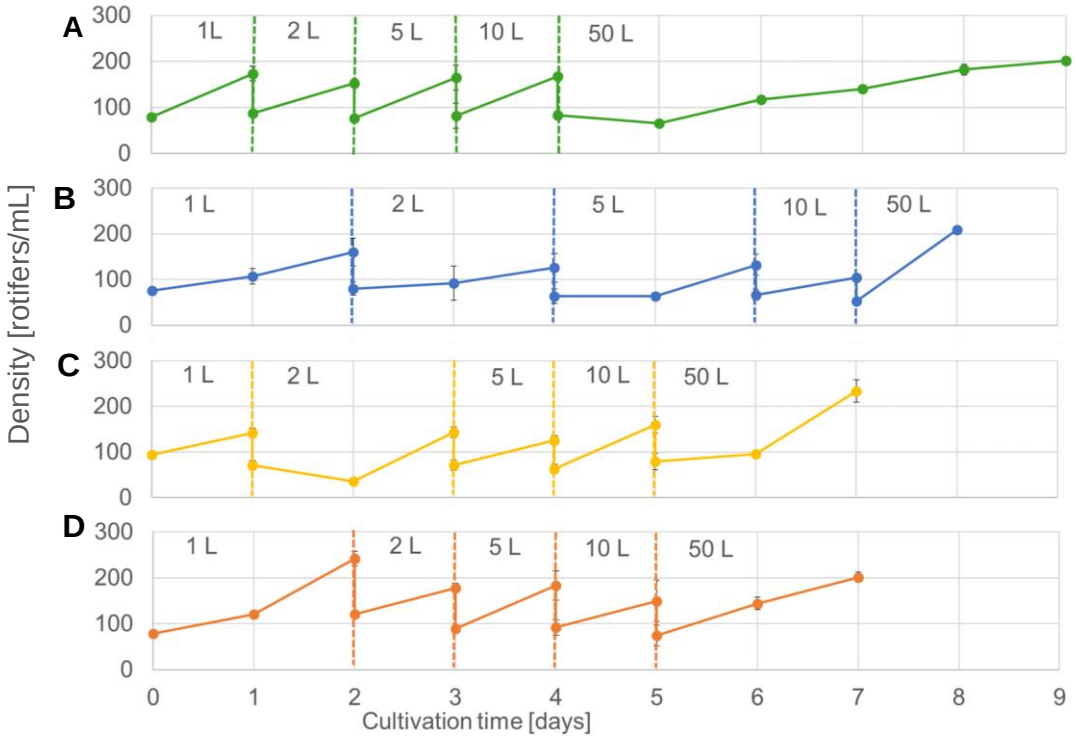
Rotifer Cultivation

- 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

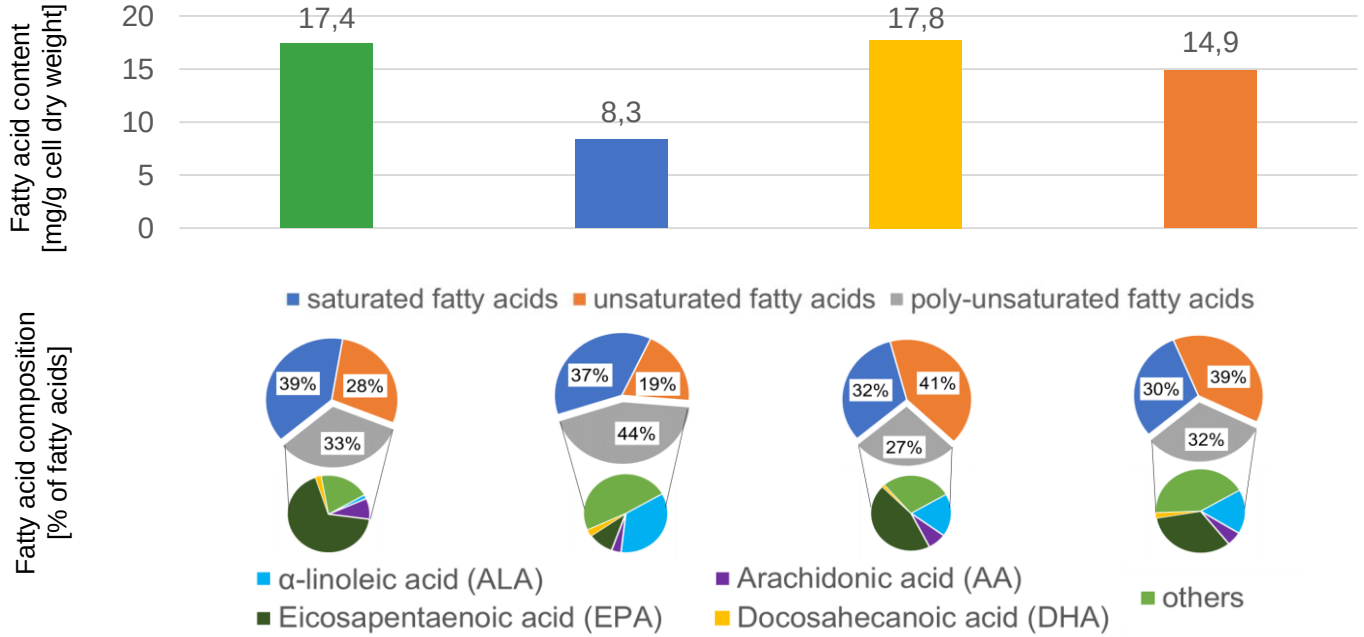
- Batch cultivation
- Feeding Nanno-paste and *Chlorella* grown on BG11 or digestate
- Doubling at 150-200 rotifers/mL
- Harvest at 200-250 rotifers/mL in 50 L
- Analysis of fatty acids



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	*C. vulgaris* grown on BG 11	*C. vulgaris* grown on dairy digestate	*C. vulgaris* grown on potato waste digestate



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”
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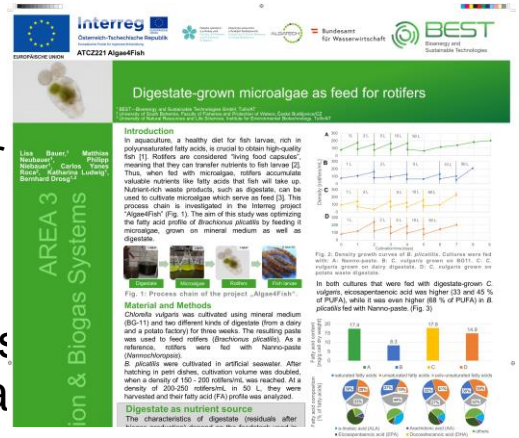
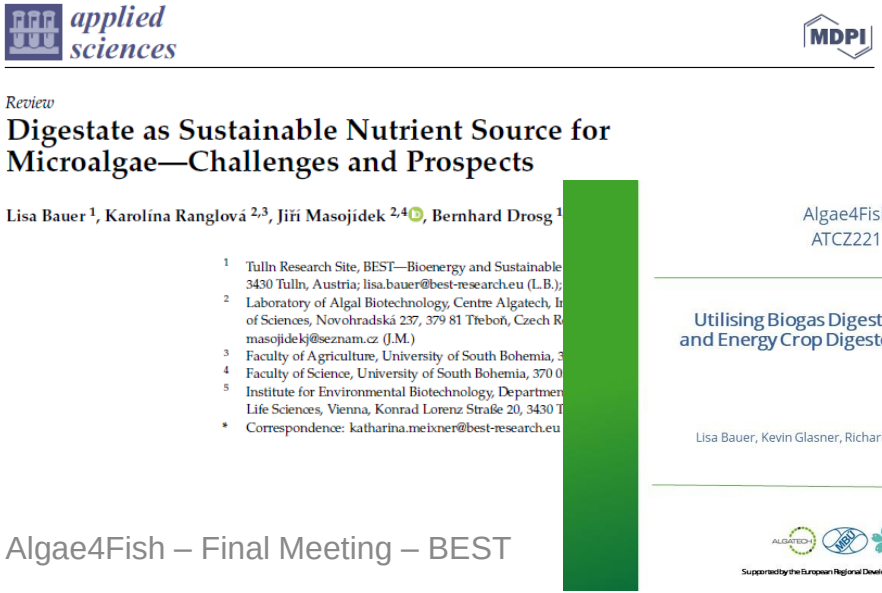
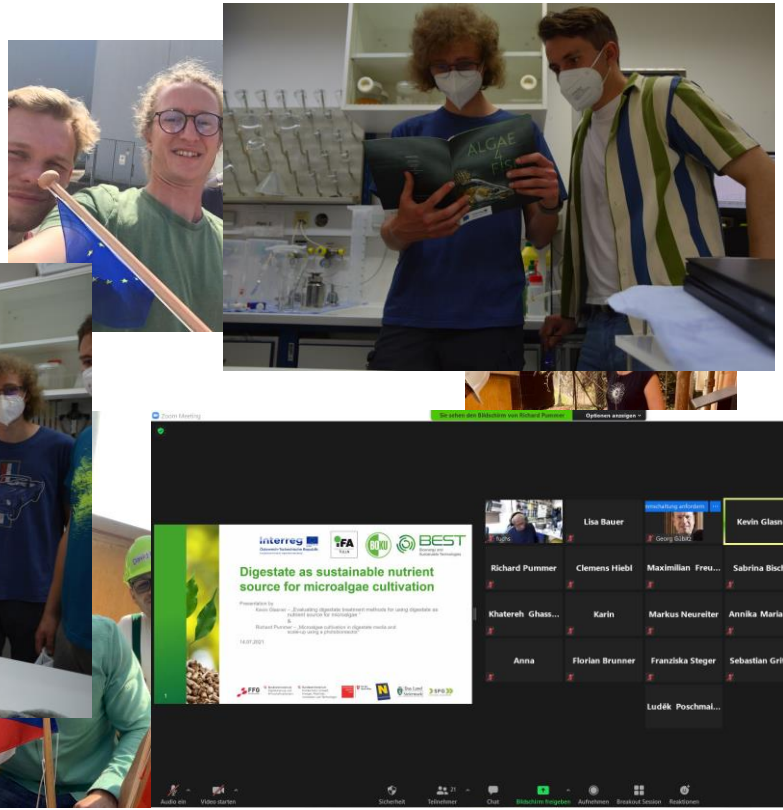


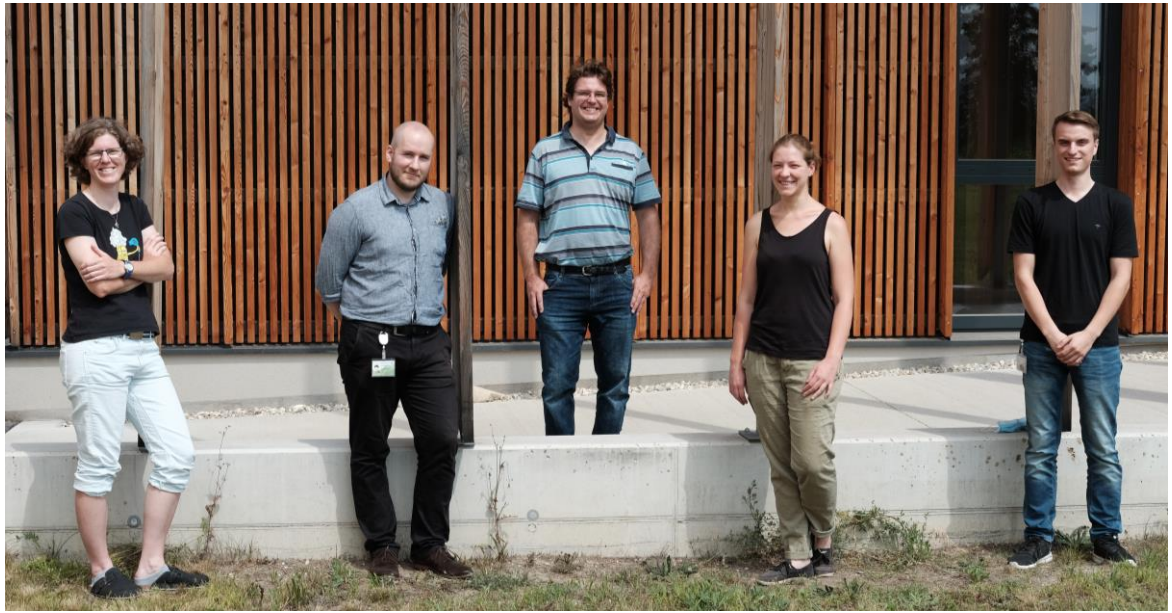


Communication

- Workshops
- Staff at biogas plants



Area 3 – Contact Data



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