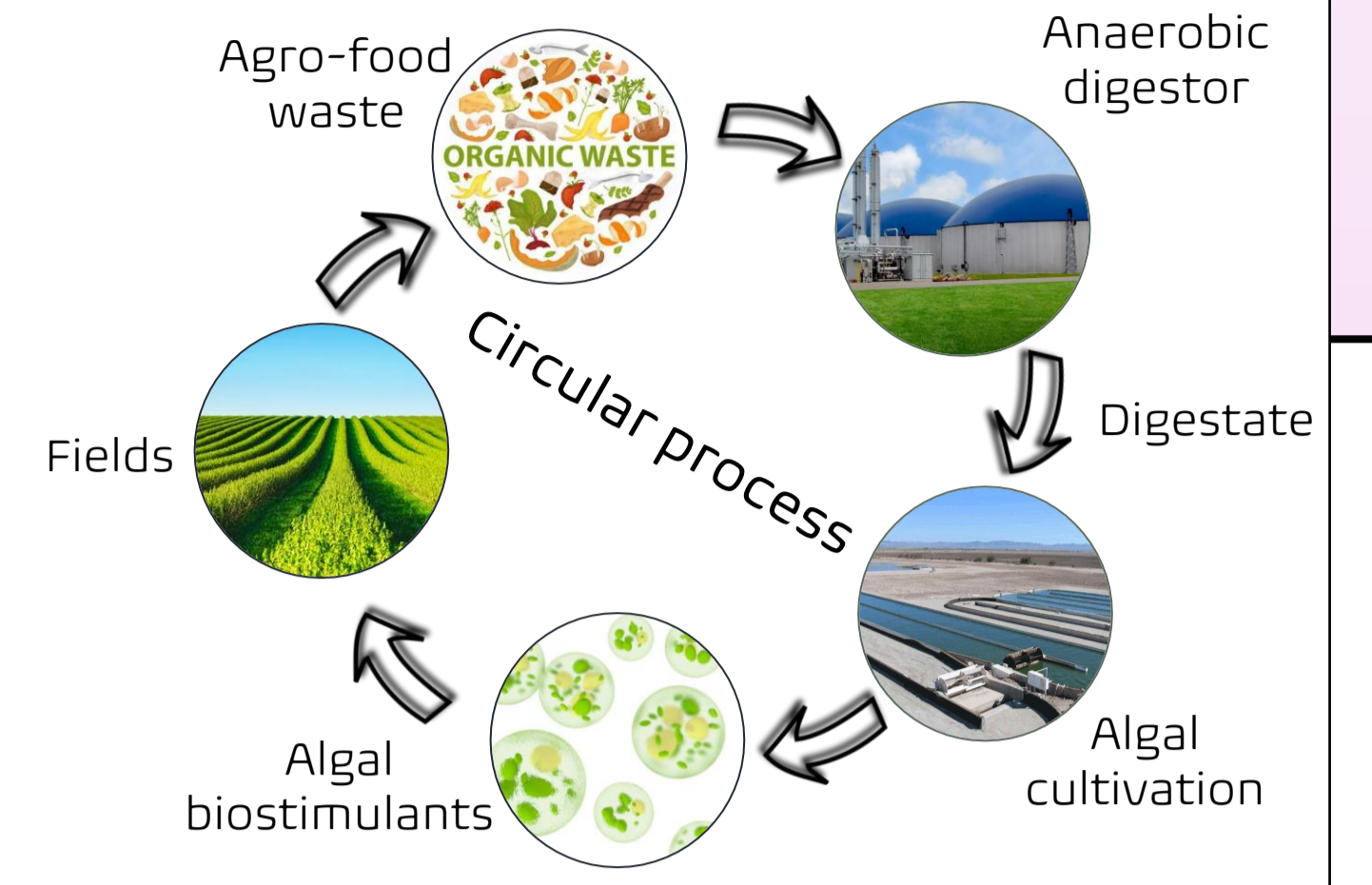


# A winding road for a circular process. Exploiting algal biotechnology for the remediation of digestate and the production of bio-stimulants

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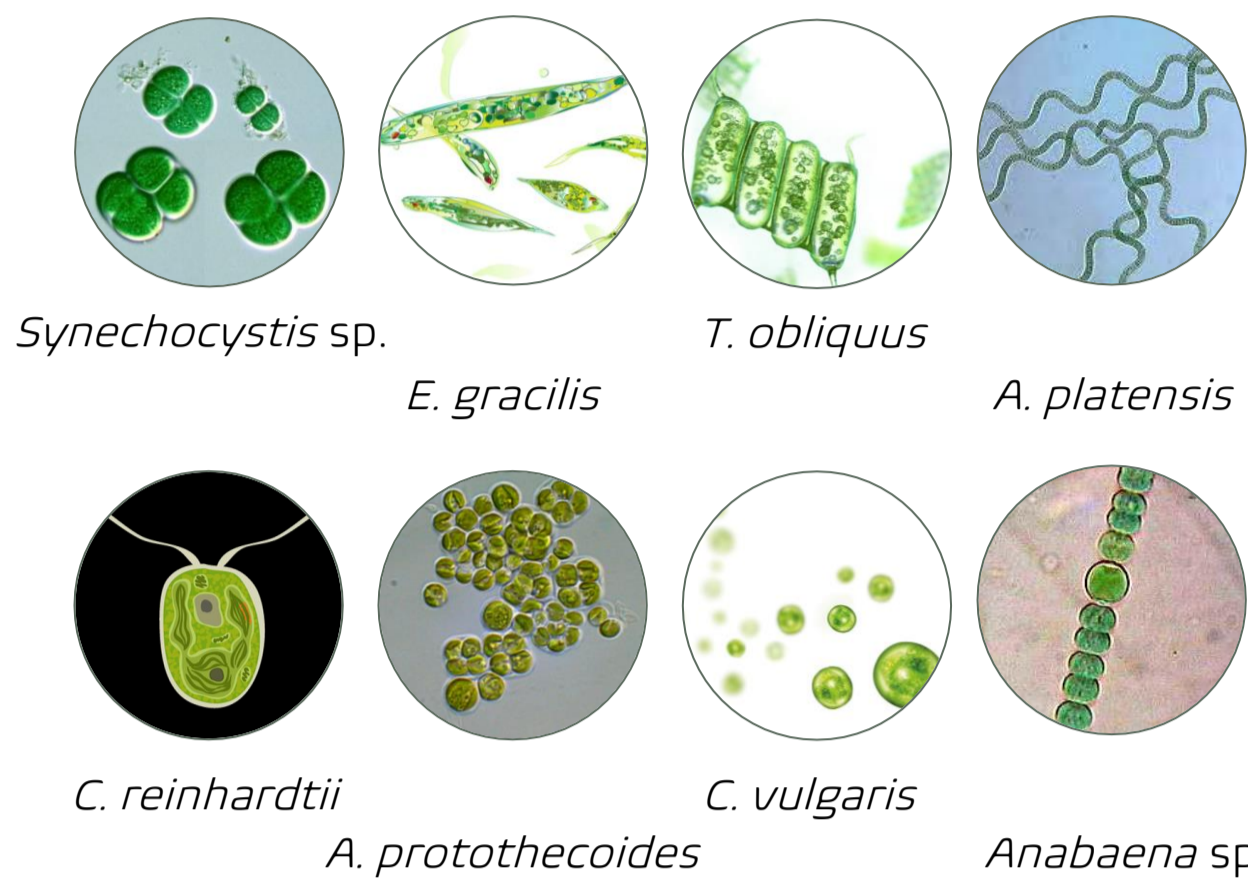
PhD goal



How to read the poster

Follow the red line! →

1st YEAR



Algae were screened by growing them in a **synthetic digestate**. Physiological parameters, growth performance and remediation yield were evaluated

A **score matrix** based on five parameters was used to select the most suitable algae

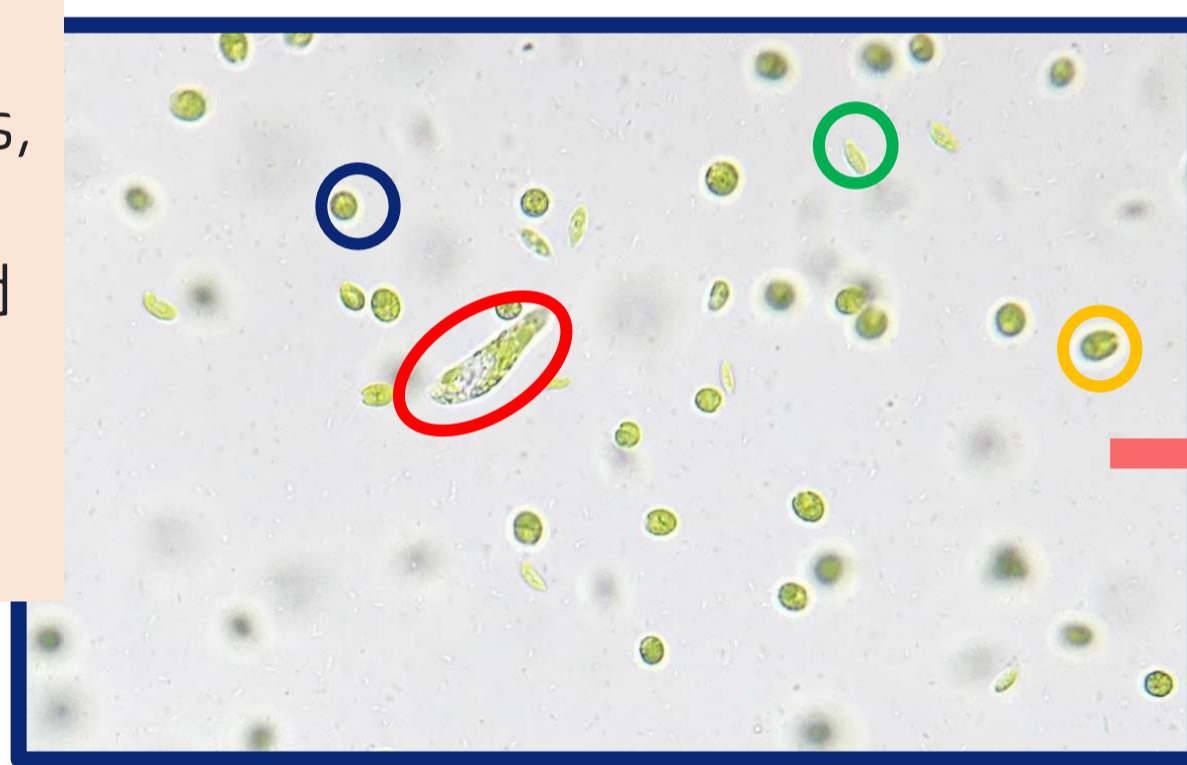
250 mg L<sup>-1</sup> NH<sub>4</sub>Cl  
150 mg L<sup>-1</sup> Na<sub>2</sub>PO<sub>4</sub>  
465 mg L<sup>-1</sup> Na-acetate  
Trace elements

Species	μ	Productivity	Maximum density	Removal		Average Score (Score position)
				Nitrogen	Phosphorous	
<i>Auxenochlorella protothecoides</i>	0,736	0,944	0,954	0,920	0,926	0,896 (1)
<i>Tetrademus obliquus</i>	0,728	0,450	0,544	1,000	0,612	0,667 (4)
<i>Chlamydomonas reinhardtii</i>	1,000	1,000	1,000	0,939	0,369	0,862 (2)
<i>Euglena gracilis</i>	0,341	0,530	0,806	0,963	1,000	0,728 (3)
<i>Chlorella vulgaris</i>	0,589	0,327	0,355	0,977	0,500	0,549 (5)
<i>Synechocystis sp</i>	0,412	0,156	0,338	0,832	0,419	0,431 (7)
<i>Anabaena sp</i>	0,000	0,000	0,000	0,000	0,000	0,000 (8)
<i>Arthrospira platensis</i>	0,562	0,458	0,491	0,555	0,184	0,450 (6)

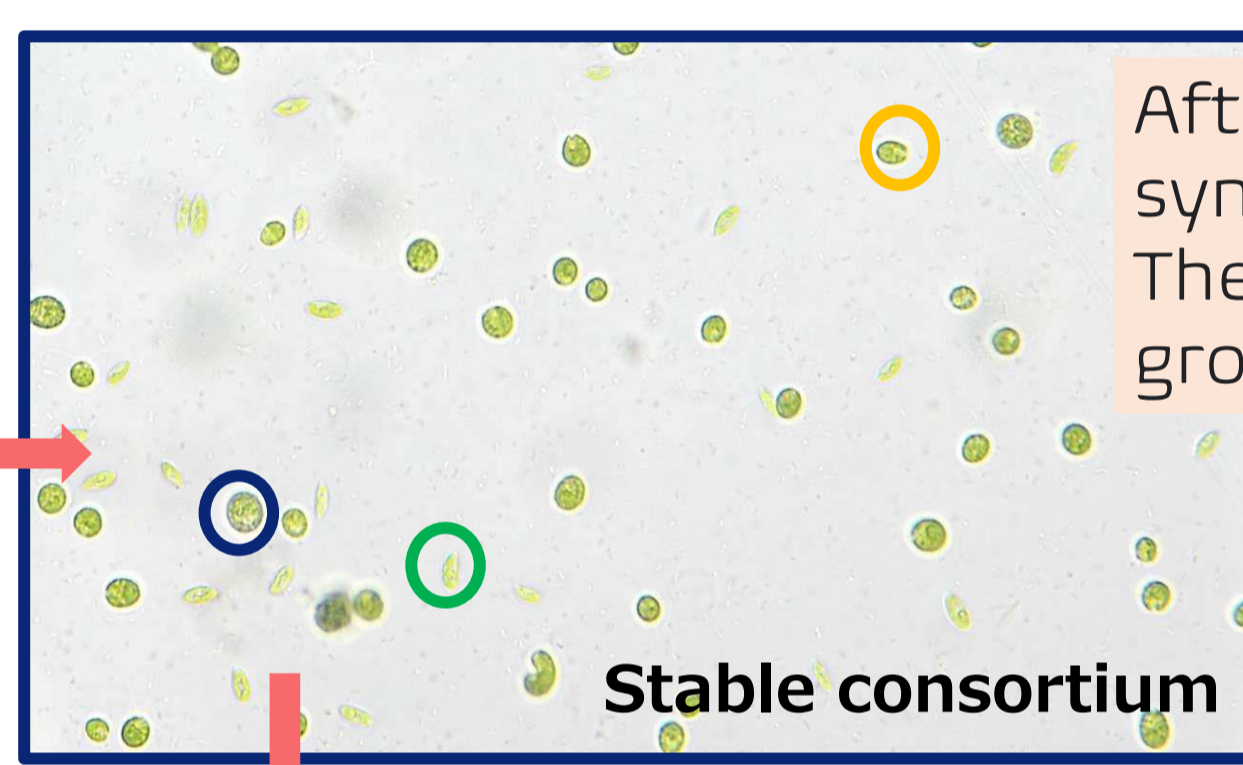
Based on literature research, 8 species were selected for the first algal screening. All the species were:  
1) freshwater species;  
2) tested for wastewater remediation;  
3) tested as biostimulants

Since an algal **consortium** usually has a better fitness and a higher resilience to external perturbances, the consortium here displayed was created from equal contribution of the single species

Consortium



CONSORTIUM



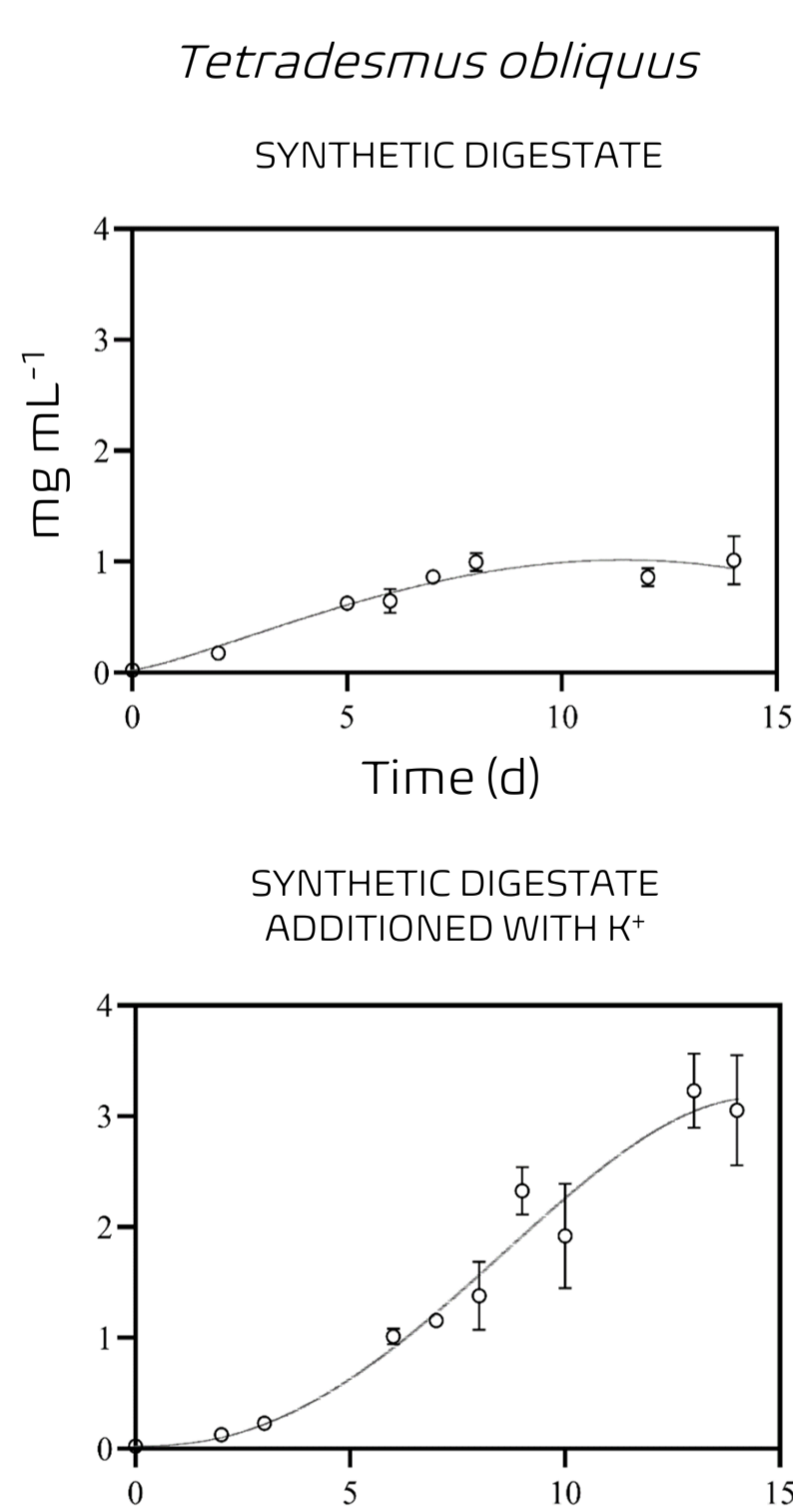
After few weeks of acclimation in a synthetic digestate *E. gracilis* was lost. The other three species had similar growth parameters and size



Best 4 species based on score matrix result

2nd YEAR

Since NH<sub>4</sub><sup>+</sup> may use K<sup>+</sup> channel to enter the cell, K<sup>+</sup> concentration was increased in the medium to verify if it could counter ammonia toxicity.

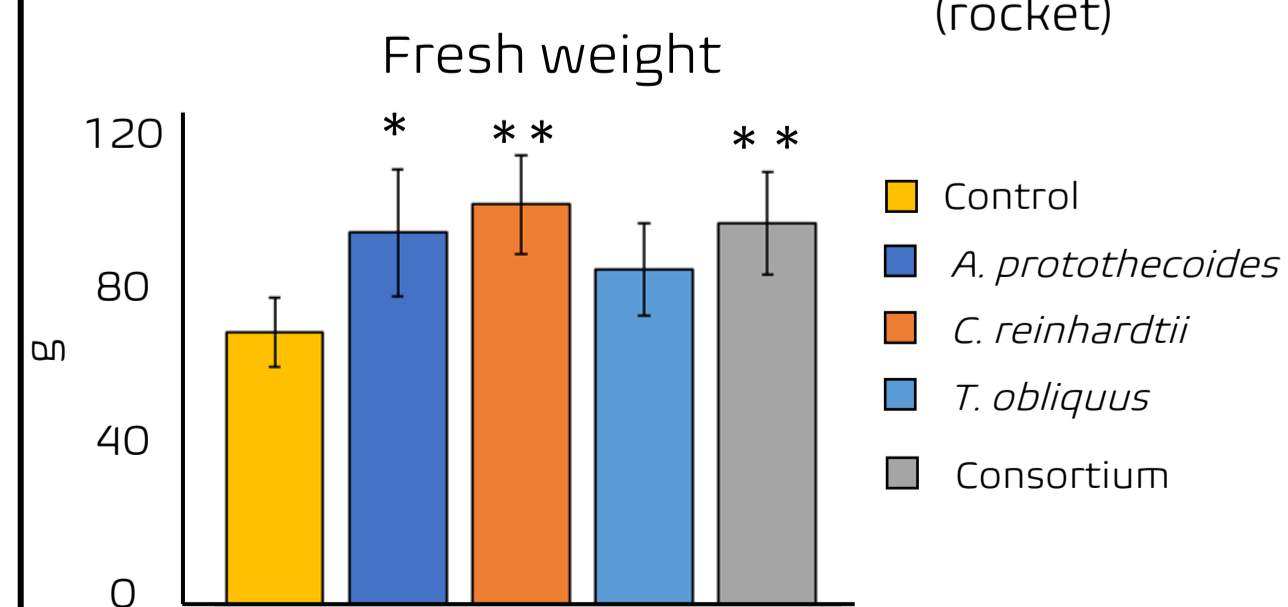


Response to K<sup>+</sup> addition was species-specific. In *T. obliquus* a better growth was achieved. The hypothesis is a different affinity of potassium channel to NH<sub>4</sub><sup>+</sup> in the four species

Biostimulant application was carried out using liquid extracts of the consortium and each single species

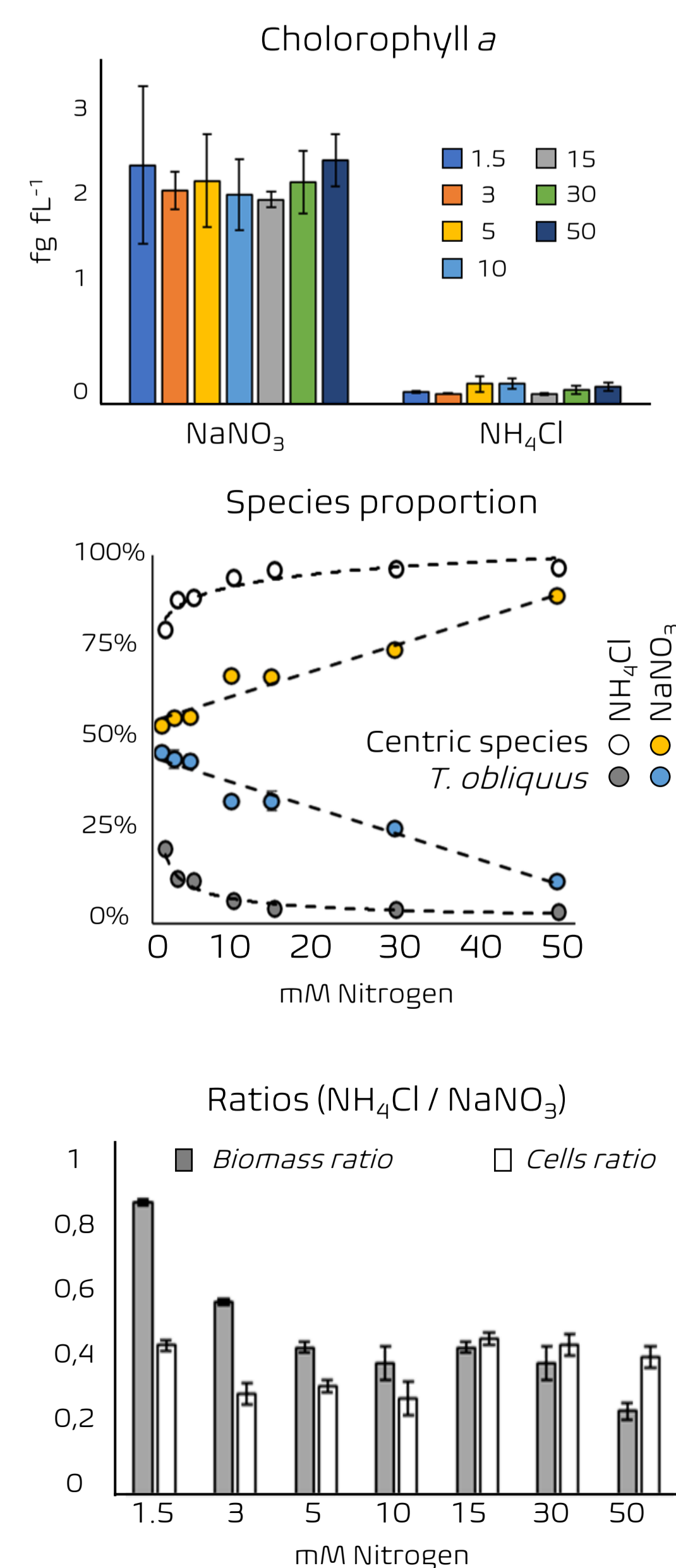


In collaboration with **DiSAA** UNIVERSITÀ DEGLI STUDI DI MILANO

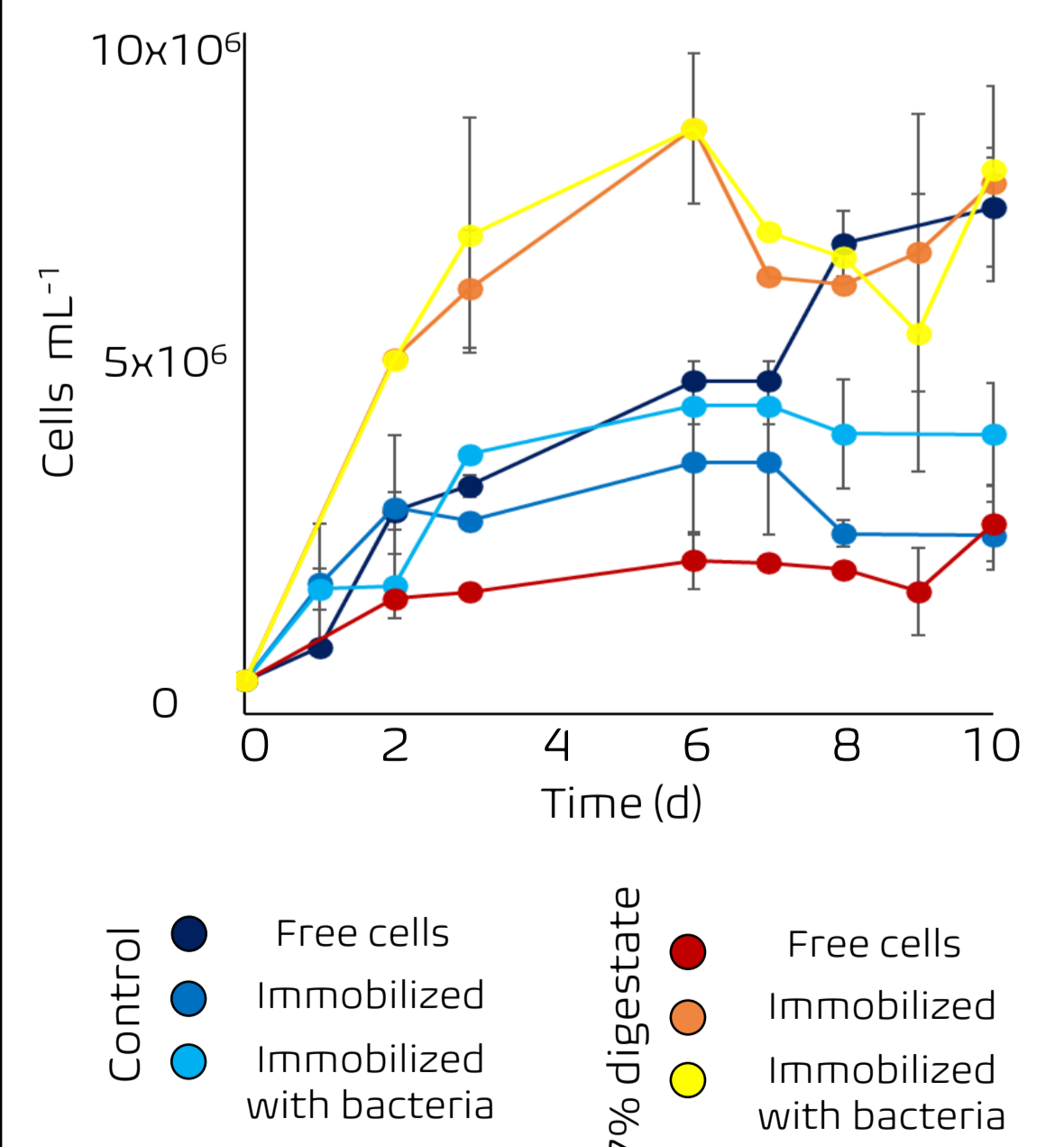


Compared to control plants, rockets treated with algal extracts were significantly bigger.

NH<sub>4</sub><sup>+</sup> / NH<sub>3</sub> toxicity was assessed for concentration of nitrogen ranging from 1.5 to 50 mM



Experiments regarding consortium growth in serial dilution of digestate showed that maximum cell density was highly affected by digestate concentration. **7% dilution** was chosen for further experiments as best compromise between dilution and algal growth



Immobilization onto alginate beads increased both growth rate and algal density. Co-cultivation with *Azospirillum brasilense*, a PGPB bacteria, was not successful.