Turning Wastewater from the Tuna Canning Industry into Protein-Rich Biomass through the Culture of Marine Microorganisms

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CONTEXT AND OBJETIVE

Correct management of fish canning industry effluents is essential to avoid environmental impact, nutrient loss, and to achieve circularity within the sector. Brines, in particular, are difficult to treat using conventional methods due to their high salinity and organic load. As an alternative, halophilic microorganisms capable of degrading organic matter and utilizing it for growth offer an opportunity to valorize brines.

Objective: This study explores the feasibility of integrating brines from tuna canning plants into the cultivation of Thraustochytrids to produce protein-rich biomass that can be introduced into the agri-food sector's value chain.

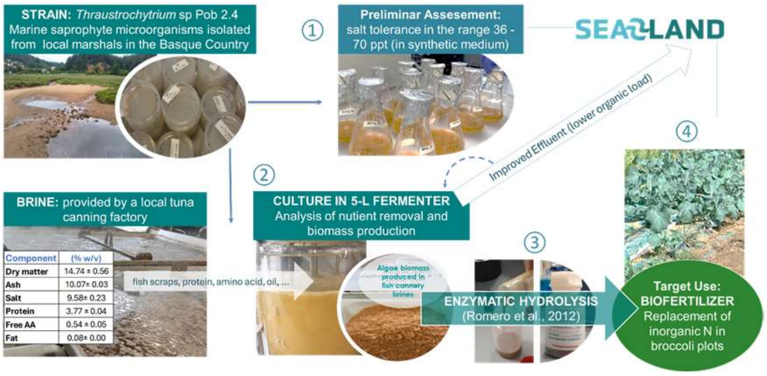
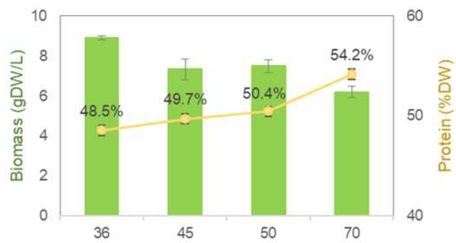


Figure 1. Graphical scheme of the study.

RESULTS

1. Effect of salinity on biomass and protein production



	Salinity (ppt)			
	36	45	50	70
Protein (g/L)	4.34±0.02	3.64±0.01	3.78±0.04	3.36±0.00

Figure 2. Effect of salinity on biomass production (g DW/L) and protein content (%DW). Results show the strain was able to grow at salinity up to 70 g/L without detrimental effect on the volumetric protein production (g/L), demonstrating its potential for the proposed approach.

2. Culture in 5-L fermenter using brine-based medium

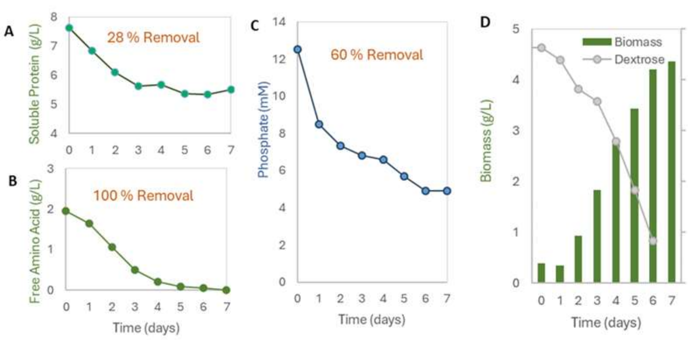


Figure 3. Nutrients consumption and growth pattern and dextrose uptake during the culture process in 5-L fermenters. (**A-C**) Curves demonstrate that SP, FAA and phosphate provided by brine were removed by 28%, 100% and 60%, respectively. (**D**) Biomass production reached 4.5 g DW/L in 7 days, in a process that is not yet optimized.

3. Chemical features of biomass and enzymatic hydrolysate

Table 1. Elemental composition of the produced biomass.

Element	C	N	S	Na	K	P	Ca	Mg	Zn	Mg
% (DW)	45,2	7,0	2,1	1,9	1,2	1,03	0,31	0,11	0,01	0,01

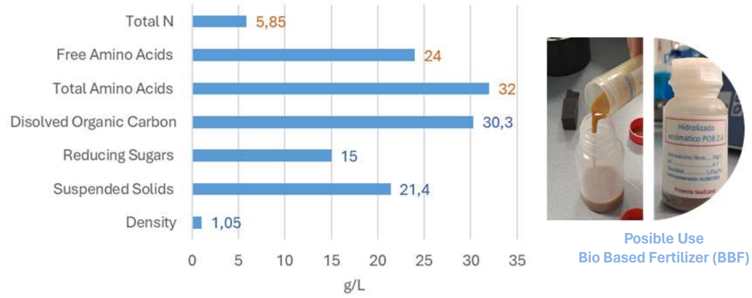


Figure 4. Chemical parameters of the hydrolysate obtained after the enzymatic hydrolysis of biomass produced in brine-based medium.

4. Preliminary Agronomic Assay

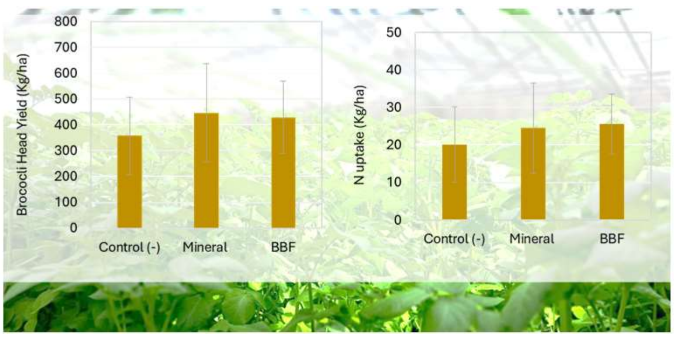


Figure 5. Yielding and N uptake in broccoli crops fertilized with BBF (10% of total N from hydrolysate) compared to 100% Mineral nitrogen.

CONCLUSIONS and FUTURE PROSPECTS

This study demonstrates the possibility of using brines from fish canning plants to cultivate Thraustochytrids. The process effectively removes nutrients from the brine, offering a sustainable solution for saline wastewater management and promoting circular economy principles by yielding protein-rich biomass suitable for agrifood applications.

SEA2LAND project is a collaborative Innovation Action(IA) funded by the EU in the frame of the Horizon 2020 programme. The project aims to provide solutions to help overcome challenges related to food production, climate change and waste reuse. Based on the circular economy model, SEA2LAND promotes the production of large-scale fertilisers in the EU from own raw materials. This solution is expected to reduce the soil nutrient imbalance in Europe. Website: www.sea2landproject.eu

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