Culture of microalgae with ultrafiltered seawater: from a feasibility study to an industrial development

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CONTEXT

The culture of microalgae is essential for the production and maintenance of bivalves. One of the major challenges is to reduce cultivation costs while maintaining the reliability of microalgae forages over long time. The aim of this work is to use ultrafiltered (UF) seawater to cultivate them.

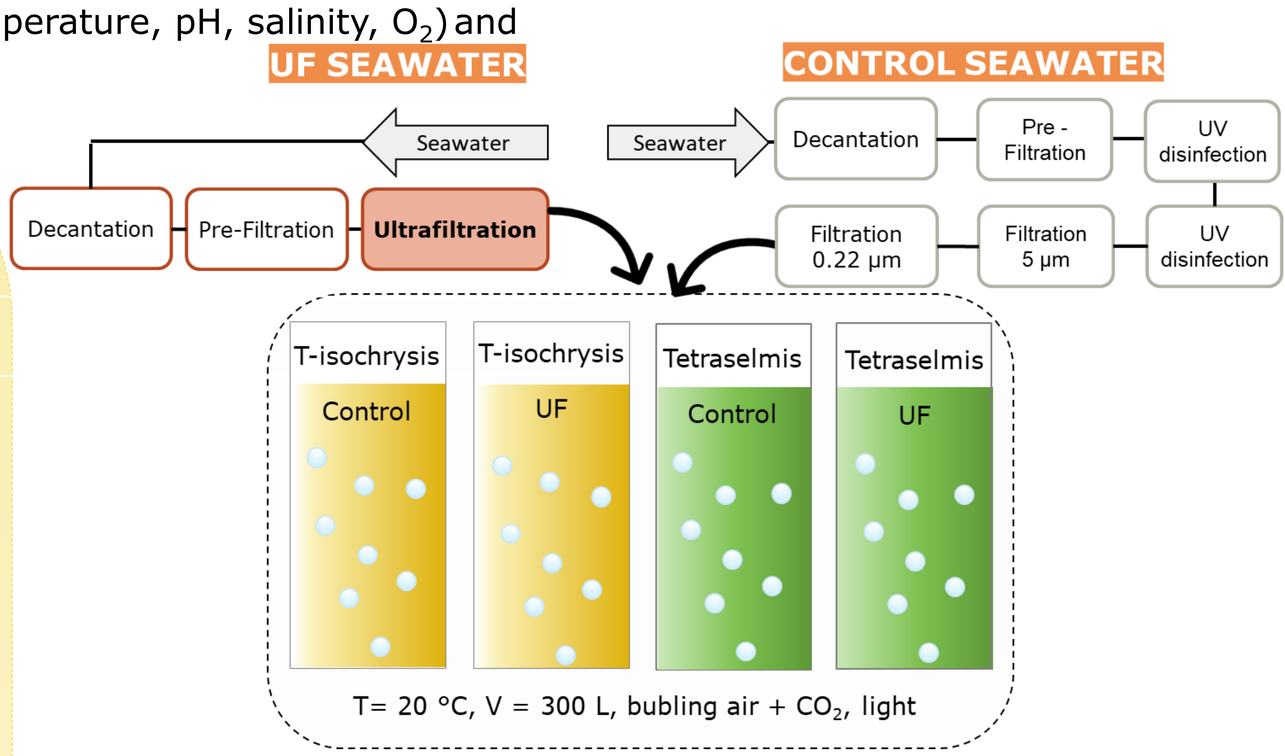
MATERIAL AND METHODS

Membranes: Aquasource hollow fibre PES membranes (0.02 µm), in-out configuration.

Pilot: Semi industrial unit, completely automated, able to treat **20 m³.d⁻¹**.

Microalage cultivation: Every day a volume of microalgae was withdrawned to feed oysters + refill of tanks with water

- Daily monitoring of**: microalgae concentration** + **water quality** (temperature, pH, salinity, O_2) and **microscopic observations**

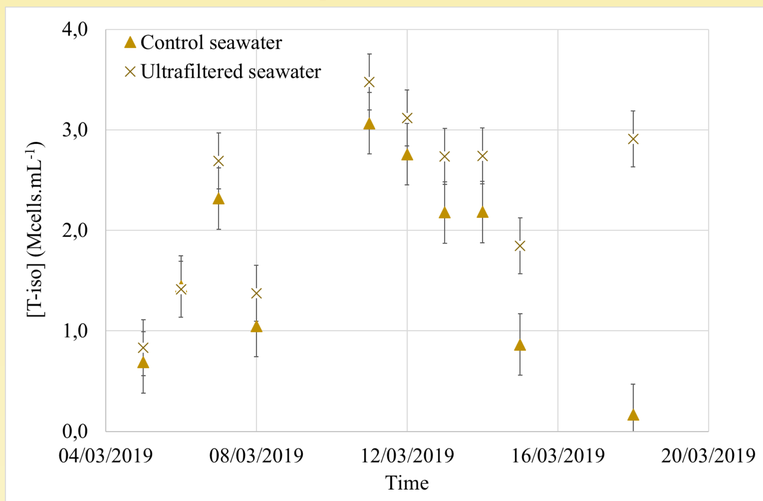


Microalgae cultivation – Water treatment steps

T-ISOCHRYSIS

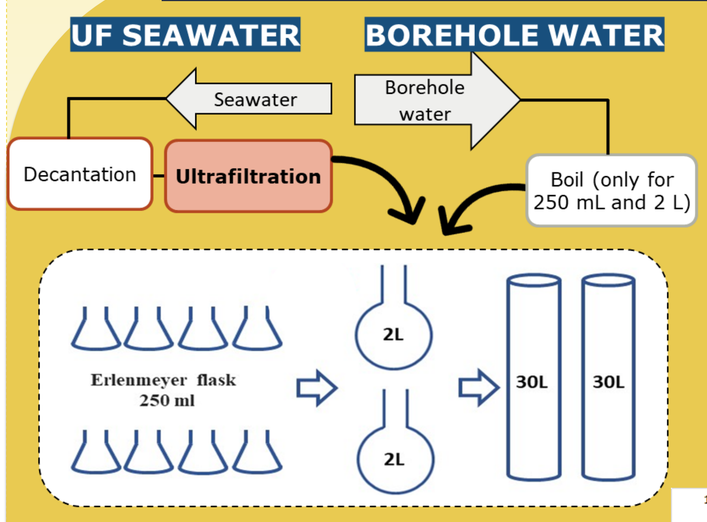
T-isochrysis **concentrations are higher in UF** seawater than control seawater: the gain is from **6 % to 30 %** over the 5 experiments.

→ Ultrafiltered water is adapted to cultivation of *T-isochrysis*



Evolution of T-isochrysis concentration vs. time

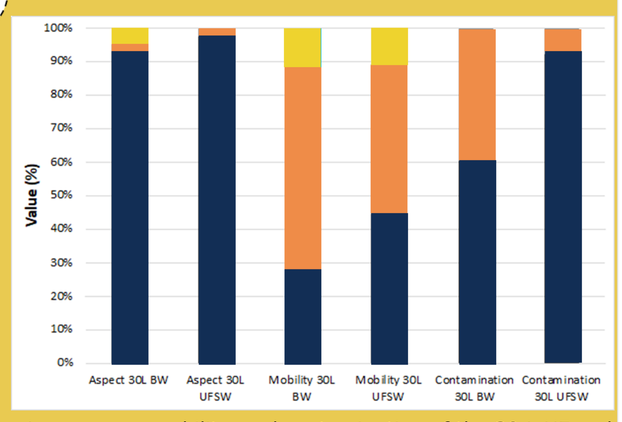
COMPARISON WITH BOREHOLE WATER



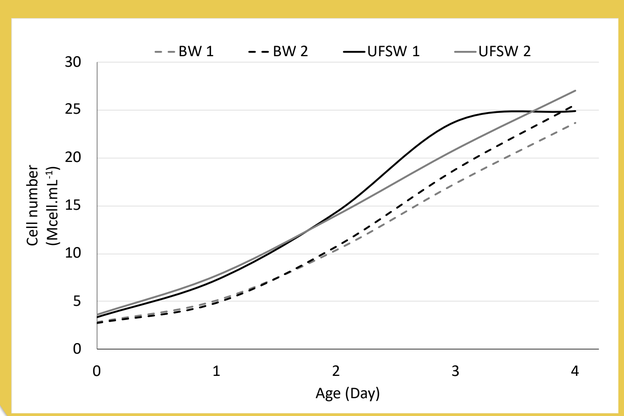
Comparison of T-iso cultivation in a shellfish **hatchery in batch culture** with **UF seawater (UFSW)** and **borehole water** (BW)

UF: greater mobility of the cultures and less contaminations

→ Confirmation that UF seawater is suitable for microalgae production



Appearance, mobility, and contamination of the 30 L UF and BW. Bleu = good, orange = average and yellow = crash of culture



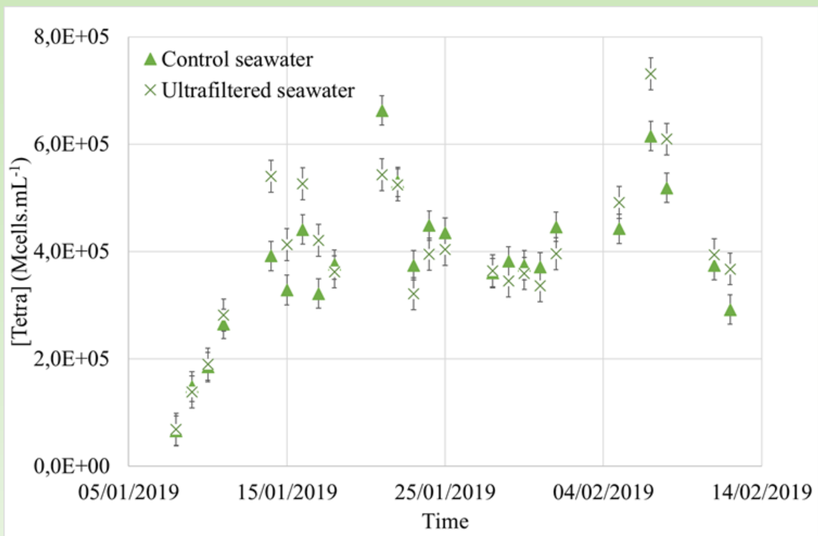
Average growth curve of T-Iso for the two replicates and the two types of water in a 2 L flask

Culture on UF shows a **shorter exponential phase of growth** (25%), thus limiting glassware and daily transplanting time.

TETRASELMIS

Tetraselmis concentrations are similar in both water qualities

→ Ultrafiltered water is adapted to cultivation of *Tetraselmis*



Evolution of Tetraselmis concentration vs. time

Parasites were observed in microalgae cultivated **in control seawater** but **none in UF** seawater

→ A protection of *Tetraselmis* toward parasites is obtained with ultrafiltration

Microscopic observations in control seawater

CONCLUSION

Ultrafiltered water has shown **efficiency for microalgae cultivation** with **rapid growth** and/or significant **reduction in contamination** compared to cultivation with control waters. These conclusions and the **ease of recovering water** (linked to the reduction in treatment stages) allowed a **transfer of technology**: the 300 L cultures carried out on the experimental platform (Ifremer) are now produced with ultrafiltered water since early 2019..

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