Treatment and reuse of effluents within oyster farm

Clémence Cordier [a]*, Christophe Stavrakakis [b]*, Philippe Moulin [a]*

[a] Laboratoire de Mécanique, Modélisation et Procédés Propres (EPM-M2P2-CNRS-UMR 7340), Aix-Marseille Université, Europôle de l'Arbois, BP 80, Bat. Laennec, Hall C, 13545 Aix-en-Provence cedex 04, France

[b] Plateforme expérimentale Mollusques Marins, Station Ifremer de Bouin, Polder des Champs, 85230 Bouin, France

CONTEXT

Shellfish profession is jeopardized by water quality problem that concerns **inlet**, with the need to protect the animals from pathogens contaminations, and **effluents** which could be harmful for the environment with the potential presence of pathogens and high levels of organic matters. In this study, ultrafiltration (UF) was tested to (i) treat a real effluent from an oyster breeding, and (ii) use ultrafiltered water to feed an oyster spat.

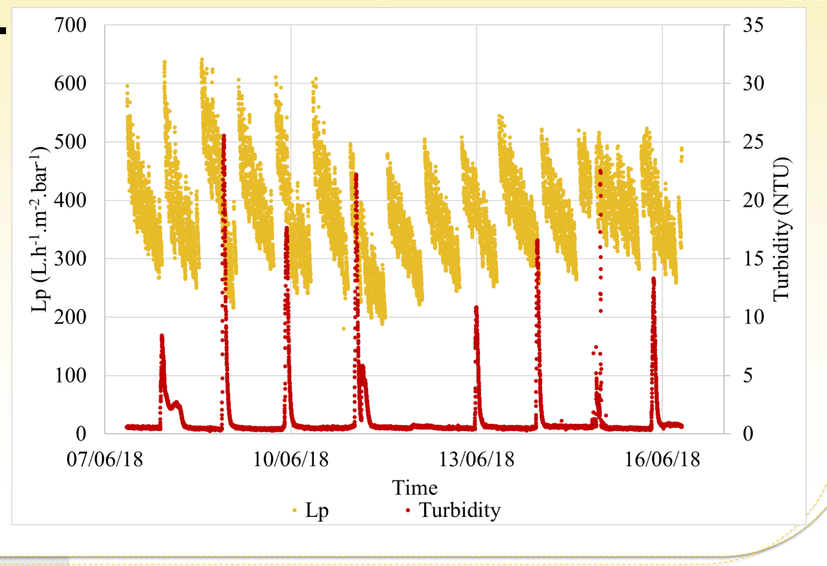
MATERIAL AND METHODS

Membranes: Aquasource hollow fibre PES, ultrafiltration membranes (0.02 µm), in-out configuration.
Pilot: Semi industrial unit, completely automated, able to treat **20 $m^3.d^{-1}$**. 3 cleaning procedures to eliminate fouling: classical backwash, air-backwash and **chemical cleanings (CEB)**. **Conditions of filtration:** **J = 60 $L.h^{-1}.m^{-2}$** and **$t_{filtration}$ = 60** or **30 min**

Effluent: Discharge from six breeding tanks of adult oysters *Crassostrea gigas* containing **faeces**, **pseudo faeces, shell debris** and **microalgae cells**. Each tank was continuously supplied with seawater (filtration 25 µm + UV disinfection) drained by overflow, emptied and rinsed with fresh water once a day.

IMPACT ON HYDRAULIC PERFORMANCES

The presence of faeces, pseudo faeces and microalgae lead to a significative fouling of the membranes. A CEB every 12 h was necessary. **These conditions are sustainable in terms of conditions of treated water production and energy consumption.**

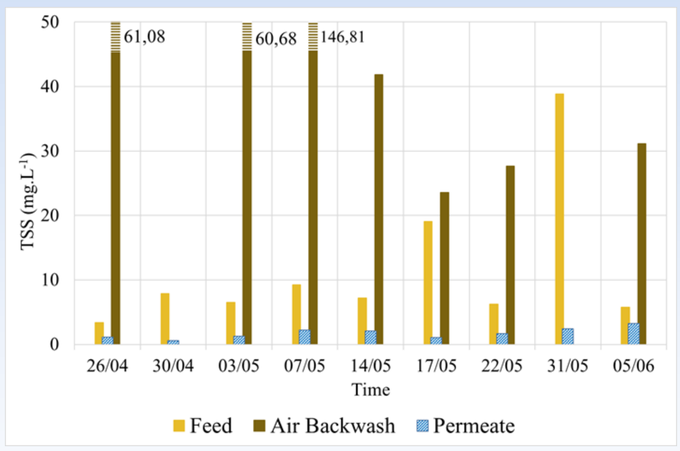


Evolution of permeability (Lp) and turbidity of the effluent vs. time – J = 60 $L.h^{-1}.m^{-2}$ and $t_{filtration}$ = 60 min

Process configuration of treatment of effluents and use of permeate to feed a spat

QUALITY OF TREATED WATER

Total Suspended Solids (TSS): TSS concentration in permeate is around 2.0 $mg.L^{-1}$, whatever the TSS concentration in the feed. The results for air-backwash highlight the cleaning performance of this procedure.



Evolution of TSS concentrations in the effluent before, after filtration 'permeate) and water from air-backwashes

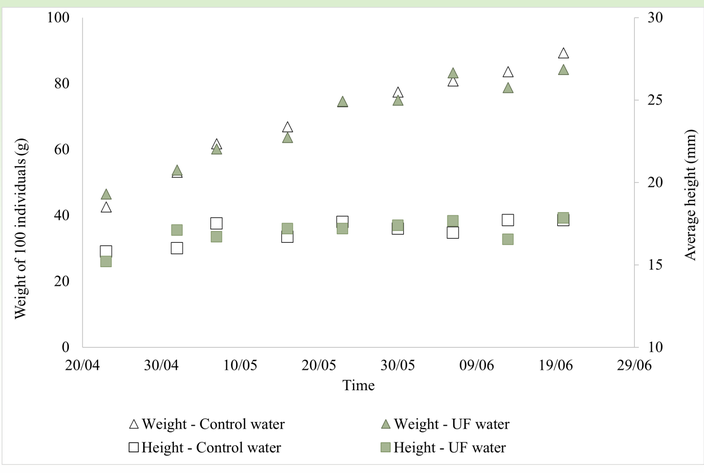
	Total Bacterial Load (UFC.mL-1)			*Vibrio* (UFC.mL-1)		
Date	Effluent	**Permeate**	Control	Effluent	**Permeate**	Control
06/01	7740	**12**	58	38	**0**	0
06/05	1660	**0**	14	50	**0**	0

Bacterial concentrations (total flora and Vibrio)

Bacterial concentration: No *Vibrio* is detected in permeate (ultrafiltered effluent). The efficiency of the **UF process** to remove this potential pathogenic bacteria is validated. Similar results are obtained with total bacteria.

EVOLUTION OF SPAT GROWTH

The spat characteristics were followed every day during 2 months. The evolution of height highlight that growth is similar for UF and control spats.
→ Ultrafiltered effluent offers growth performances identical to classical seawater



Evolution of oyster spat growth

CONCLUSION

Ultrafiltration showed its capacity to **remove TSS and bacterial pollution**. The use of the ultrafiltered effluent led to rearing capacity identical to classical water. Indeed, the physico-chemical and bacterial parameters were comparable in the two waters, leading to a similar development of oysters. Ultrafiltration is then efficient to treat effluent from oyster farms and to produce a treated water showing a **quality adapted to feed juveniles** which are very sensitive species. Considering these results, the possibility of **reuse effluents from breedings to supply others by ultrafiltration** seems a feasible solution.

*Member of Club Français des Membranes