

Ultrafiltration membrane removal of viruses and bacteria

RESEARCH QUESTION:

Does an ultra-membrane filtration eliminate pathogens in water spiked with virus and bacteria?

DURATION: 2022

SALINITY TESTED: Salt water

In this study we evaluate the performance of a capillary polyethersulfone ultrafiltration membrane to remove two benchmark waterborne fish pathogens:

- The infectious pancreatic necrosis virus - IPNV, which is an unenveloped icosahedral virus.
- The bacterium *Aeromonas salmonicida*, which is a Gram-negative, facultative anaerobic bacilli.

The capillary membrane consisted of 63 fibres, each fibre had 7 capillaries with an inner diameter of 0.9 mm (dizzer® modules with Multibore® 0.9 membrane, Inge GmbH, Germany) and was 50 cm in length measuring a total area of 0.5 m². The membrane material was polyethersulfone and the pore size was approx. 20 nm. The membrane was operated as inside-out filtration, i.e., pressured water and particles were forced into the membrane fibres capillaries where water and particles smaller than 20 nm escape forming the membrane permeate which flowed to a cylindrical tank number 2. Standard commercial operation settings were used in the tests, such as pressure < 1 bar and flux ~50 L/h/m².

HIGHLIGHTS:

- The filtration of IPNV and *A. salmonicida* suspensions using a 20 nm capillary polyethersulfone membrane completely removed the microorganism.
- Water temperature did not affect membrane removal efficiency in the tested range (4 - 19 °C), though lower temperatures resulted in higher membrane water pressure.
- Both classical microorganism detection techniques, i.e., virus titres and bacteria plating, and the advanced detection technique RT-qPCR returned the same findings.

RECOMMENDATION:

- The results from this bench-scale study are encouraging for the application of ultrafiltration membrane technology in aquaculture water treatment to prevent virus and bacteria outbreaks.
- An estimation of a membrane area to treat a water flow of for example 50 m³/h, using the tested conditions, i.e., flux 50 L/h/m², is 1000 m².
- Further studies should validate this ultrafiltration membrane technology results in commercial aquaculture conditions, including the needs for backwash water treatment.

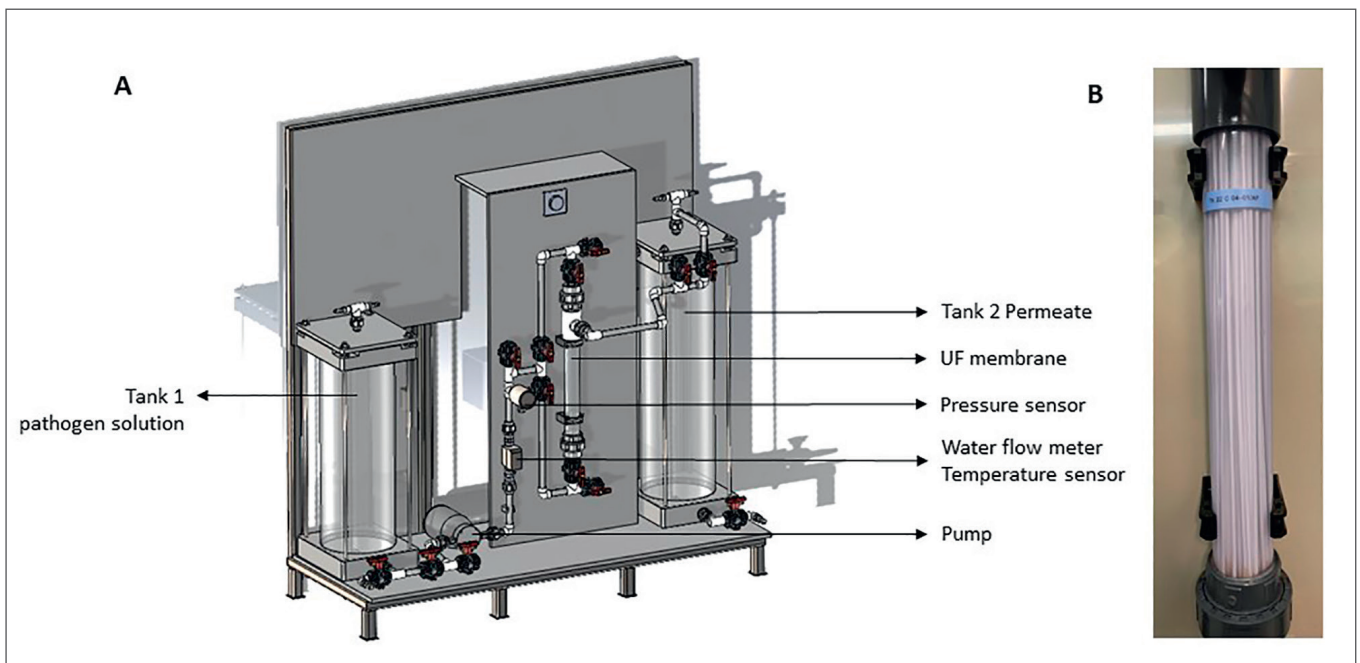


READ MORE:

Mota, V.C., Brenne, H., Kojen, M., Marhaug, K.R., Jakobsen, M.E., 2022. Evaluation of an ultrafiltration membrane for the removal of fish viruses and bacteria in aquaculture water. *Frontiers in Marine Science*. 9, 2554.

D8.2INTAKE2022_Power-point summary on the efficiency of ultra-membrane filtration in water spiked with virus and bacteria

The factsheet is not yet ready for implementation. More testing under commercial conditions is needed.



Sketch of the ultrafiltration membrane bench-scale unit (A) and picture of the membrane tested (B).