

Salinity acclimation strategies for RAS bioreactors

RESEARCH QUESTION:

Research question: Salinity changes can negatively impact nitrifying bioreactors in RAS. This can lead to ammonia and/or nitrite accumulation, that can be toxic to the fish. In this PhD, we developed strategies for salinity change so that salinity changes can be made in a safe manner in RAS. The study was conducted using lab-scale moving bed biofilm reactors without any fish in the setup, but the startup strategies have already been implemented in commercial RAS.

DURATION: 2017-2020

SALINITY TESTED: Fresh water, brackish water, salt water.

HIGHLIGHTS:

- The first increase in salinity from freshwater to 10-12 ppt or above is most challenging for a bioreactor and can lead to a drastic drop in nitrification.
- Changing the salinity in large increments appears more practical than changing the salinity in small increments
- Bioreactors must be made tolerant to salinity change BEFORE the introduction of the fish.
- Nitrite accumulation may be observed several days after a salinity increase.
- 1. Exposing the bioreactor to seawater in the startup phase (at least 2 weeks) and returning to freshwater before the introduction of the parr.
- 2. Startup in brackish water (12 ppt) followed by a freshwater phase before the fish are introduced.
- 3. Startup in freshwater with seeding with brackish water biofilm (12 ppt).
- Bioreactors that are to be operated at a constant high salinity (>12 ppt) can be started up directly at the operational targeted salinity.
- Nitrite oxidation can be challenging at high salinities. Thus, nitrite concentration should be closely monitored during and after salinity changes to ensure that it is within the toxic limits for the fish.

RECOMMENDATIONS:

- The following startup strategies can safeguard the salinity tolerance of the biofilter and should be implemented before putting the first batch of fish in. These strategies are for a RAS where the salinity must be changed during production to accommodate parr and smolt.



READ MORE:

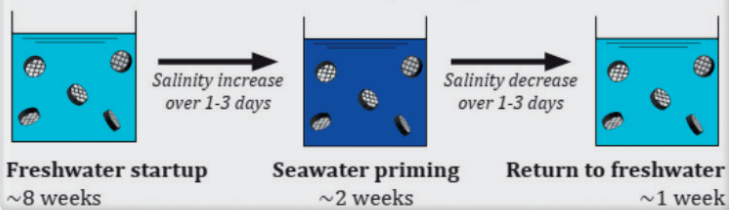
Salinity Acclimation Strategies in Nitrifying Bioreactors: <https://www.frontiersin.org/articles/10.3389/fmars.2022.867592/full>

Sharada Navada Thesis, section 3.4 Industrial application: <https://ntnuopen.ntnu.no/ntnu-xmlui/handle/11250/2729848>

The factsheet is ready for implementation, but with the note that the testing has not been done for all industrial relevant conditions.

Bioreactor startup

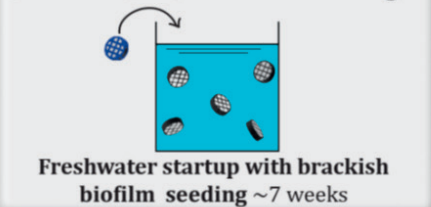
STRATEGY A - Osmotic stress priming



STRATEGY B - Brackish startup



STRATEGY C - Brackish seeding



Fish production in RAS

