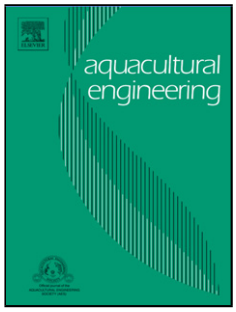

Title: Particle surface area and bacterial activity in recirculating aquaculture systems

Author: Per Bovbjerg Pedersen Mathis von Ahnen Paulo Fernandes Christopher Naas Lars-Flemming Pedersen Johanne Dalsgaard

PII: S0144-8609(17)30009-2
DOI: http://dx.doi.org/doi:10.1016/j.aquaeng.2017.04.005
Reference: AQUE 1900

To appear in: *Aquacultural Engineering*

Received date: 23-1-2017
Revised date: 13-4-2017
Accepted date: 13-4-2017

Please cite this article as: Pedersen, P.B., von Ahnen, M., Fernandes, P., Naas, C., Pedersen, L.-F., Dalsgaard, J.,Particle surface area and bacterial activity in recirculating aquaculture systems, *Aquacultural Engineering* (2017), http://dx.doi.org/10.1016/j.aquaeng.2017.04.005

Particle surface area and bacterial activity in recirculating aquaculture systems

Per Bovbjerg Pedersen[a], Mathis von Ahnen[a], Paulo Fernandes[a], Christopher Naas[a,b], Lars-Flemming Pedersen[a], Johanne Dalsgaard[a]

[a] Technical University of Denmark, DTU Aqua, Section for Aquaculture, The North Sea Research Centre, P.O. Box 101, DK-9850 Hirtshals, Denmark.

[b] Institute of Animal Breeding and Husbandry, Faculty of Agricultural and Nutritional Sciences, Christian-Albrecht-Universität zu Kiel, Germany.

Corr. Author Email address: pbp@aqua.dtu.dk

Highlights:

- It is demonstrated across systems that available particle surface area correlates positively with bacterial activity
- Bacterial activity reflects recirculation intensity
- In intensive RAS the relationship is less obvious, presumably due to accumulation of colloidal particles and/or free-living bacteria
- BactiQuant® Water proved to be applicable for fast, culture-independent determination of bacterial activity in RAS water

Abstract

Suspended particles in recirculating aquaculture systems (RAS) provide surface area that can be colonized by bacteria. More particles accumulate as the intensity of recirculation increases thus potentially increasing the bacterial carrying capacity of the systems. Applying a recent, rapid, culture-independent fluorometric detection method (Bactiquant®) for measuring bacterial activity, the current study explored the relationship between total particle surface area (TSA, derived from the size distribution of particles >5 µm) and bacterial activity in freshwater RAS operated at increasing intensity of recirculation (feed loading from 0.043 to 3.13 kg feed·m^{-3} make-up water). Four independent sets of water samples from different systems were analyzed and compared including samples from: i) two individual constructed wetlands treating the effluent system water from two commercial, freshwater rainbow trout (*Oncorhynchus mykiss*) farms of different recirculation intensity; ii) an 8.5 m^3 pilot scale RAS; and iii) twelve identical, 1.7 m^3 pilot scale RAS assigned one of four micro-screen treatments (no micro-screen, 100, 60, or 20 µm mesh size micro-screens) in triplicate. There was a strong, positive, linear correlation ($p<0.05$) between TSA and bacterial activity in all systems with low to moderate recirculation intensity (i.e. feed loading ≤ 1 kg feed·m^{-3} make-up water). However, the relationship apparently ceased to exist in the systems with highest recirculation intensity (feed loading 3.13 kg feed·m^{-3} make-up water; corresponding to 0.32 m^3 make-up water·kg^{-1} feed). This was likely due to the accumulation of dissolved nutrients sustaining free-living