SIMILARITIES BETWEEN MICROBIAL AND PERIPHYTIC BIOFILMS IN RECIRCULATING AQUACULTURE SYSTEMS

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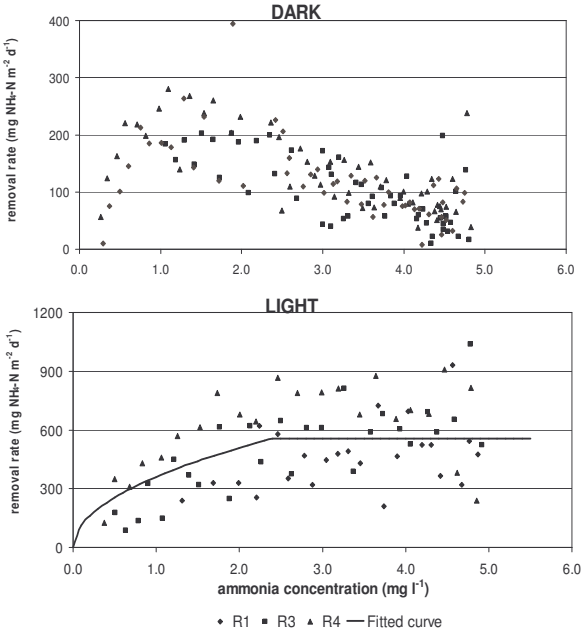
Periphyton mats have a lot in common with biofilms and therefore could also carry out tasks performed by biofilms. In recirculating aquaculture systems, the first goal of bacterial biofilters is the removal of ammonia and nitrite. In trickling biofilters ammonia removal rates vary between 0.33 and 0.54 g TAN m^{-2} d^{-1}. Similar removal rates were obtained by periphyton mats grown on bamboo poles (Figure 1) under light conditions. Under dark circumstances 0.14 – 0.17 g TAN m^{-2} d^{-1} was removed by the periphyton mats. Assuming a 12 hour light, 12 hour dark light regime, potentially the periphyton mat can remove 430 mg TAN m^{-2} d^{-1}.

Figure 1: Ammonia removal rate under dark and light conditions with periphyton mats grown on bamboo.



By trapping organic and mineral matter biofilms and periphyton mats have a clarifying effect on the water column. The 3-dimensional canopy of periphyton mats effectively traps particulate matter and breaks it down with great efficacy due to the tight coupling between autotrophs, heterotrophs and nitrifyers in the mat. In ponds, periphyton mats distributed homogenously through the water column negatively contributed to the overall pond oxygen budget. Therefore, in recirculating systems, periphyton mats should be well aerated, specially under dark conditions.

The sedimentation unit and bacterial biofilter in a conventional-RAS were replaced by a periphyton mat (Figure 2). The periphyton-based-RAS performed equally well as the conventional-RAS, maintaining good water quality, while having less need for water renewal due to high NO_3 levels. More nutrients were retained in the periphyton-based-RAS.

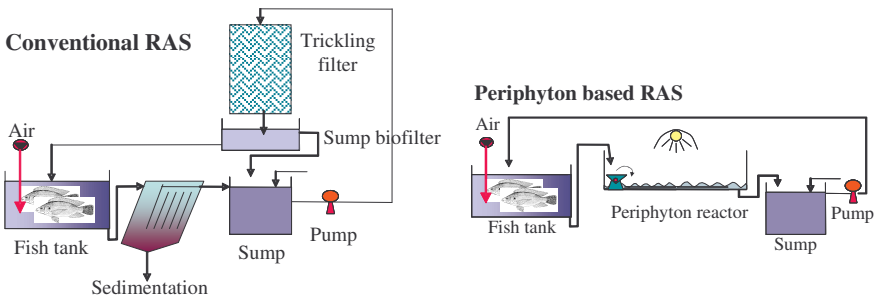


Figure 2: layout of a conventional and periphyton-based recirculation system.