

Integration of algae to improve nitrogenous waste management in recirculating aquaculture systems: a review

ABSTRACT

This review investigates the performance and the feasibility of the integration of an algal reactor in recirculating aquaculture systems (RAS). The number of studies related to this topic is limited, despite the apparent benefit of algae that can assimilate part of the inorganic waste in RAS. We identified two major challenges related to algal integration in RAS: first, the practical feasibility for improving nitrogen removal performance by algae in RAS; second, the economic feasibility of integrating an algal reactor in RAS. The main factors that determine high algal nitrogen removal rates are light and hydraulic retention time (HRT). Besides these factors, nitrogen-loading rates and RAS configuration could be important to ensure algal performance in nitrogen removal. Since nitrogen removal rate by algae is determined by HRT, this will affect the size (area or volume) of the algal reactor due to the time required for nutrient uptake by algae and large surface area needed to capture enough light. Constraints related to design, space, light capture, and reactor management could incur additional cost for aquaculture production. However, the increased purification of RAS wastewater could reduce the cost of water discharge in places where this is subject to levees. We believe that an improved understanding of how to manage the algal reactor and technological advancement of culturing algae, such as improved algal reactor design and low-cost artificial light, will increase the practical and economic feasibility of algal integration in RAS, thus improving the potential of mass cultivation of algae in RAS.