

## RAINBOW TROUT (*Oncorhynchus Mykiss*) FRESHWATER RECIRCULATING AQUACULTURE SYSTEM: NUTRIENT FLOW MANAGEMENT WITH AQUAPONICS

Victor DUMAS\*, Laurent LABBE, Pablo PELISSIER

INRA, UE 0937 PEIMA (Experimental fish farming INRA of Monts d'Arrée), 29450 Sizun, France  
victor.dumas@inra.fr

Nutrient accumulation, solid or dissolved, in recirculating aquaculture systems (RAS) are a concern for the optimal rearing of fish. Since 2009, the research deployed at PEIMA on a semi-industrial rainbow trout outdoor RAS has focused on the study of nutrient flows inside RAS systems. To improve our control of nutrient flows, an aquaponic module was added and mass balance experiments of 50 days were carried out. The focus was to follow quantitatively total suspended solids, nitrogen and phosphorus. These experiments were conducted to determine the efficiency of specific treatment loops on nutrient flows and their suitability to RAS systems.

A main concern in RAS is the accumulation of total suspended solids (TSS) in the system. A treatment loop was implemented with a rotfilter with a 60 $\mu$ m mesh, a radial flow settler, a flocculation/filtration unit and a succession of vertical and horizontal flow filters of limestone gravel. This loop made it possible to go from 100mg/L in the backwash water of the rotfilter to <2mg/L of TSS in the outflow water of horizontal filters. Thus increasing the quality of recirculating water and reducing the release of TSS in the environment.

Another concern is the accumulation of dissolved components such as nitrogen and phosphorus. Much harder to extract than the solids components, it involved a treatment loop with a combination of biological transformation and extraction through an aquaponic system. Nutrient rich water coming from the fish was sent to a hydroponic system, which extracted the dissolved nutrients (see figure). The cleaned water was then sent back to the fish.

Overall the TSS treatment loop was able to minimize the impact of fish production on the environment and the effect of plants on dissolved components was minimal but it may be enhanced by working on the g of feed/m<sup>2</sup>/day ratio and the variety used : in this case, *Lactuca Sativa*. Furthermore the perspective of a combination of RAS technology, extensive eparation technics such as vertical and horizontal flow filters and hydroponics may be the solution to reduce the impact of landbased fish production.

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Inputs	Total Nitrogen	Total Phosphorus
- Feed	100%	100%
<b>Outputs</b>		
-Fish	38%	39%
-Salads	3%	4%
-Sludge	3%	13%
-Media Filters	5%	0%
-Effluent	41%	39%
-Loss	10%	5%

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