

INTERIM DESIGN CRITERIA FOR WARMWATER RECIRCULATING SYSTEMS EMPLOYING FLOATING BEAD FILTERS AND BLOWN AIR

Ronald F. Malone* and Aurelio A. DeLosReyes, Jr.

Department of Civil and Environmental Engineering
Louisiana State University
Baton Rouge, LA 70803-6405

Reconditioning of water in recirculating fish culture systems entails four key processes: (1) solids capture, to remove fecal waste, uneaten feed, and excess bacterial biomass; (2) biological filtration, primarily nitrification to convert the toxic ammonia and intermediate form nitrite to nitrate; (3) gas exchange, to ensure sufficient oxygen supply for fish and biological filtration, and to strip carbon dioxide; and (4) ion balance, primarily to maintain alkalinity, and prevent the build up of nitrate and dissolved organics. As a sole filtration unit, floating bead filters greatly reduce recirculating system complexity, and have very good potential to reduce cost. They are designed to simultaneously accomplish solids capture and biological filtration in a compact unit, requires little maintenance, and are suitable for automation. The success of recirculating systems employing bead filters relies on providing suitable filter size, adequate air supply for aeration and degasification, and proper system management.

It is recommended that pH be maintained at ≥ 7.5 , alkalinity at ≥ 100 mg CaCO_3/L , and in-tank dissolved oxygen (DO) at a minimum of 5-6 mg/L. pH and alkalinity can easily be managed through the addition of sodium bicarbonate (baking soda). The interim design and operational recommendations are presented in Table 1. The values are based on many years of experience in the design and operation of bead filter recirculating systems used to support a variety of warmwater species. The feed loading rate considers the effects of substantial solids capture which impedes nitrification by exerting an internal organic and ammonia load, and ultimately by reducing flow through the filter. It also reflects the *in situ* nitrification rate that is observed in these systems. The recommended DO level, recirculation rate, and air supply assures not only sufficient oxygen for the fish but also adequate oxygen delivery to the filter.

Table 1. Interim design criteria for recirculating systems employing bead filter.

<u>Item</u>	<u>Criteria</u>
Floating Bead Filter	62 L/kg feed/day (1.0 ft ³ /lb feed/day)
Recirculation Rate	0.7-1.4 Lpm/m ³ beads (5-10 gpm/ft ³ beads)
Air Supply	62-124 Lpm/kg feed/day (1-2 cfm/lb feed/day)
Fish Density	30-60 kg fish/m ³ (0.25-0.50 lb fish/gal)



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