Improving Solids Dewatering Processes For Aquaculture

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Abstract

Intensive aquaculture systems utilize solids capture mechanisms such as settling basins and microscreen filters to remove uneaten feed, feces, and biofloc from fish culture water. Although effective in solids removal from fish production systems, backwashing of these mechanisms produces a waste stream that still contains too much water to remain cost-competitive for most traditional manure disposal methods. However, further treatment of the semi-concentrated solids in the backwash flow, along with their associated nutrients and biological oxygen demand is necessary to attain strict effluent discharge standards. Techniques used to further dewater solids in these backwash flows include gravity thickening settlers (i.e., settling cones), belt filters, membrane biological reactors, and filtration through geotextile bags. In addition, use of coagulation and flocculation amendments can enhance formation of larger aggregates and bind the floc produced into a dense and more readily settleable or filterable form.

In this research, three solids thickening processes were individually evaluated utilizing the waste stream produced in recirculating aquaculture systems equipped with microscreen rotating drum filters and radial flow settlers for solids separation. Backwash flows applied to each technology assessed ranged from 0.1-0.2% solids. An off-line settling cone was assessed for solids removal when loaded at a surface loading rate of 2,230 L/day/m^2 using intermittent backwash flows and with no coagulation / flocculation aid amendment. Geotextile bag filters operated at a mean hydraulic loading rate of 60-70 L/day/m^2 (bag area) and amended with alum (50mg/L) and polymer (25mg/L) were evaluated. And, an inclined belt filter with 300 µm openings operated to process approximately 7,870 L/day (considerably below its hydraulic capacity) of drum filter backwash and amended with alum (50 mg/L) and polymer (25 mg/L) was assessed. Results indicate that all processes removed 94-96% of the TSS applied. The belt filter produced the cleanest discharge and highest treatment efficiencies; however, belt filter operation was more complicated and time consuming than the other processes. The thickening cone leached less TAN and dissolved reactive phosphorus than the geotextile bags; i.e., the cones capture more TN and TP than the geotextile bags.