

COUPLED GEOTEXTILE DEWATERING AND ACTIVATED SLUDGE TREATMENT OF BIOSOLIDS DISCHARGED FROM A RECIRCULATING AQUACULTURE SYSTEM

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Common techniques for removal of solids from recirculating aquaculture system (RAS) process water include gravity settling units, granular media filters, and rotating microscreen drum filters. Discharge and underflow produced from these solids collection devices produces a waste stream that requires dewatering to reduce biosolids volume. Further, this wastewater often necessitates biological and/or chemical nutrient removal prior to discharge or reuse. Waste treatment technologies used in the aquaculture industry designed to accomplish both solids dewatering and nutrient removal include constructed wetlands, inclined belt filters, gravity thickening settlers, geotextile bag (GTB) filters, sequencing batch reactors, and membrane biological reactors. Each technology has specific strengths and weaknesses in terms of solids and nutrient removal efficiency. And, capital and operating costs can vary significantly between the treatment options.

GTB filters are seeing some application dewatering aquaculture wastewater. Although quite effective in reducing the volume of biosolids from fish culture waste (final TSS > 20%), significant leaching of nutrients and cBOD₅ in the filtrate has been observed. In this experiment, three systems of replicated GTB filters coupled with sequencing batch reactors (SBR) were operated to reduce sludge volume and biologically treat dewatered filtrate (test condition). Each GTB filter was hydraulically loaded on an hourly basis allowing the filtrate to flow into the SBR. An activated sludge process was maintained as the aerated conditions in the SBR facilitated nitrification and suspension of the activated sludge. A return activated sludge loop pumped solids hourly (2x influent flow rate) from the SBR back to the GTB utilizing the GTB as an anaerobic reactor facilitating denitrification and biological phosphorus uptake. In addition, three replicated GTB were operated without an activated sludge process at an identical influent loading rate as a control condition. Results indicate that TSS removal was comparable under test and control conditions, but that TN, TP, and cBOD₅ removal was much better under test than under control conditions (Table 1). Also, leaching of TAN and dissolved reactive phosphorus (DRP) was much lower under test conditions. Results indicate the potential for combining the dewatering capacity of geotextile bags with an aerobic activated sludge process to significantly increase capture of nitrogen, phosphorus, and cBOD₅ while dewatering biosolids.

	TSS	cBOD ₅	TN	TAN	NO ₃	NO ₂	TP	DRP
Test (Geobag+Activated Sludge)								
Influent	1511 ± 99	477 ± 41	98 ± 8	2 ± 2	17 ± 3	0.6 ± 0.1	48 ± 4	2.2 ± 0.2
Effluent	41 ± 3	25 ± 3	27 ± 2	7 ± 1	15 ± 1	2.0 ± 0.2	6 ± 0	5.1 ± 0.2
Removal Efficiency (%)	97	95	72	-367	12	-230	88	-132
Control (Geobag Only)								
Influent	1467 ± 240	835 ± 123	92 ± 15	4 ± 1	3 ± 1	0.5 ± 0.1	35 ± 7	2.1 ± 0.3
Effluent	74 ± 14	460 ± 106	70 ± 18	48 ± 13	1 ± 0	0.1 ± 0.1	13 ± 3	13.8 ± 3.7
Removal Efficiency (%)	95	45	24	-1216	67	80	63	-569

Table 1 – Influent and effluent water quality under test and control conditions.