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Performance of foam fractionator in seawater recirculating system

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Introduction

Typically, closed production system units are subject to an accumulation of fine suspended solids and dissolved organics (Weeks et al., 1992). Foam fractionation process is believed to be most effective in marine application for solids removal. In present experiment, the performance of foam fractionator for removal of solids, protein, and other dissolved materials was evaluated at different foam overflow heights and air flow rates in a pilot-scale recirculating aquaculture system for culture of Korean rockfish.

Materials and methods

The recirculating system consists of a circular culture tank, bead filters, sand filter, and foam fractionator. From the sump, water is directly pumped to foam fractionator. Around 30-kg Korean rockfish was cultured. Foam fractionator is made of acrylic pipe with a diameter of 20 cm and height of 120 cm. This foam fractionator was evaluated at fixed HRT of 2 minutes and different SAVs and foam overflow heights.

Results and discussion

Foam overflow rates decreased with the increase of foam overflow heights at each SAV treatment. The foam overflow rates were higher for high SAV treatment than low SAV treatments when compared at the same overflow height. The effects of foam overflow heights on foam overflow rate were greater for higher SAV treatments than those at lower SAV treatments. The foam overflow rates were quite higher for lower overflow height treatment than those at higher overflow height treatment and this is

especially evident for higher SAV treatment. The calculated daily removals of these variables were greatly affected by the foam overflow rates. These results indicated that using minimal overflow heights may produce foam condensate that may only be marginally more concentrated with variables than the culture water and high overflow heights may produce extremely concentrated foam condensates, but the foam production rate may be extremely low. For practical application of foam fractionator in aquaculture systems, one could select the operating factors to satisfy their desired result, as minimizing the wastewater volume or maximizing variables removal.

Table 3. Foam overflow rate and the calculated removal rate of different water quality variables.

Trial Parameter		Variables			
SAV (cm/sec)	FOH (cm)	TSS (g/day)	Protein (g/day)	PO_4-P (g/day)	FOR (ml/min)
0.743	1	5.67	0.92	0.48	6.8
0.743	3	3.07	0.60	0.34	3.0
0.743	5	1.93	0.37	0.22	1.4
0.743	7	1.29	0.19	0.09	0.6
1.114	1	7.10	1.47	0.75	9.2
1.114	3	4.73	1.23	0.66	5.0
1.114	5	3.60	0.88	0.49	3.8
1.114	7	1.79	0.37	0.17	1.6
1.486	1	10.94	2.78	2.25	36.2
1.486	3	5.01	1.44	1.11	12.4
1.486	5	3.76	1.10	0.54	7.1
1.486	7	2.15	0.56	0.33	2.5

References

Weeks, N.C., M.B. Timmons and S. Chen. 1992. Feasibility of using foam fractionation for the removal of dissolved and suspended solids from fish culture water. Aquacultural Engineering, 11, 251~265.