PD - 8

Solids removal by foam fractionator in simulated seawater aquarium system

Lei Peng and Jae-yoon Jo
Department of Aquaculture, Pukyong National University

Introduction

The success of recirculating system depends largely on the treatment efficiency of waste generated in the system. Fine solids were suspected to be responsible for fish kill in a recirculating system. Clogging of biofilter may be induced by high solids concentration in recirculating systems. Also, the solids could generate more ammonia nitrogen and oxygen demand if not removed out of recirculating system as soon as possible (Weeks et al., 1992). Here in this experiment, the total suspended solids removal efficiency of an air drift foam fractionator was evaluated in a simulated wastewater system. The obtained data would be helpful for selecting the operation parameters in application foam fractionation in seawater aquaculture systems.

Materials and methods

This system consisted of 300-liter plastic culture tank, recirculating pump, foam fractionator, air distribution system, and foam collection facilities. The foam fractionator is made of acrylic pipe with a diameter of 20 cm and height of 120 cm. The solids removal rates were evaluated at different air flow rates, HRTs, and foam overflow height. Also, the TSS removal rates were tested at different initial protein concentrations. Selected combinations were tested in present experiments and were conducted on a batch model.

Results and discussion

The TSS concentrations of the collected foam condensates in present experiment were about 17.8-32.7 times of the initial TSS concentrations in

the culture tank water. These results show that TSS enrichment in foam condensate can be substantial. Different HRTs have significant effects on foam flow rate and thus the time consumption for removal of TSS in culture tank water. TSS concentrations in foam condensates were higher at lower HRT. However, the effects of HRT on TSS concentrations in the foam condensates were not as profound as the effects of superficial air velocities. Non-complete removal of solids was found for the treatments tested. This partially would be due to the low protein concentration of the synthesized culture tank water. Performance characteristics of foam fractionator are highly depended on the operating factors including superficial air velocity, hydraulic residence time, and foam overflow height. Total suspended solids removal rates increased with the increase of superficial air velocity and decrease of hydraulic residence time. High initial protein concentrations induced high TSS removal rate in the bulk solution. Foam condensate production decreased and concentration increased as foam overflow height increased.

Table 1. Summary of condensates analysis

HRT (min)	SAV (cm/sec)	TSS concentration (mg/l)	Time consumed (hours)	Flow rate (ml/min)
6	1.486	2790	5.4	12
2	1.486	2135	2.5	32.6
3	1.486	2305	3	25.4
3	1.114	2625	3.9	16
3	0.743	3920	5.6	6.8

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.