ABSTRACT

Nitrification performance of three, fluidized-bed filters was investigated. Each filter contained 10 L of plastic bead medium (near neutral specific gravity and 2-4 mm diameter and length) and was loaded under conditions of various flow rates and ammonia levels. Bead settled depth and biofilter diameter (12.7, 15.2 and 17.8 cm) were the factors differing among the filters. The experiments were conducted with three replicate recirculating systems. Each system included one of the three different biofilter types, connected in parallel to a reservoir containing 500 L of water. Systems were allowed to acclimate using a synthetic nutrient substrate, which was followed by a comparative analysis of biofilter performance. To evaluate filter performance, ammonia inflow concentration, ammonia loading rates, nitrite, nitrate, temperature, pH, dissolved oxygen levels, hardness, alkalinity and flow rates were monitored. Initially, four different flow rates, ranging from 6 Lpm–12 Lpm, were tested at constant ammonia feed level (8.4 g/day). Here, biofilter D_3 (17.8 cm diameter) showed the best ammonia removal performance at a flow rate of 6 Lpm, followed by the performance of D_1 (12.7 Lpm) and D_2 (15.2 Lpm). The difference in ammonia and nitrite removal performance decreased among the biofilters, as flow rate increased. An increase in flow rate also lowered ammonia level in the systems at a constant ammonia loading, but did not affect the nitrite concentration. Five different ammonia feed rates, ranging from 8.4 – 16.8 g/day, were tested in the second part of the study, at a constant flow rate of 12 Lpm in each column. Different ammonia and nitrite removal performance was observed between biofilter sizes. Ammonia accumulated in the tanks as ammonia loading increased, but nitrite concentration remained relatively constant. The results indicated that nitrification performance improved by 17 % as the applied flow rate was increased. Ammonia concentration decreased slightly, from 0.6 mg/L to 0.5 mg/L. The performance appeared to be limited at higher ammonia loadings, at which time ammonia concentration increased from 0.5 to 0.99 mg/L. Data on biofilm development indicates a reduction in biofilm thickness as flow rate was increase, and significant biofilm accumulation as ammonia supply increased. The results of this work were compared to performance data generated using a steady state biofilm model, developed by Rittmann and McCarty

(1980). The model predicted higher values of biofilm thickness (L_f) than those seen in this study.

Fluidized bed filters with plastic bead medium proved to be effective in removing ammonia and nitrite from a synthetic aquaculture water.

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