Aquaponic application in a marine hatchery system

Abstract

Seaweeds of various species have been studied as nutrient biofilter for treating effluents from enclosed mariculture system since mid 1970's. This study was conducted to determine the Euchuema spinosum (also known as E. den- ticulatum) effectiveness in reducing NH3+NH4+, NO2- and NO3- concentrations in the waste water of marine fish hatchery flow-through system. Four rectangular treatment tanks (0.5 x 0.55 x 0.5 m) were used in the experiment for 30 days. Each treatment tank planted with two E. spinosum cuttings with initial wet biomass of 50.28 ± 0.24 g and the waste water from the tank holding L. calcarifer juveniles flowed into each treatment tank using PVC pipe (ID = 25 mm) with an average flow-rate of 0.05 ± 0.01 L sec-1. The first treatment tank contained only seaweed (Swd) cut- tings, while the second and the third tanks were added with 8 kg substrate. The two substrates used were sand (S) and coral rubble (CR) with respectively sizes of 0.2 to 0.5 mm and 10 to 25 mm. A combination substrate of S+CR was added into the fourth treatment tank. Results showed that the water temperature ranged from 29.15 ± 0.86 to 29.31 ± 0.76 oC, pH ranged from 8.16 ± 0.13 to 8.22 ± 0.19 and salinity ranged from 30.135 ± 0.087 to 30.145 ± 0.091. The variance analyses of interaction factors (four treatment tanks X inflow-outflow) showed significantly different values ($p<0.05$) in terms of NH3+NH4-N concentrations. The NO2-N was also significantly different ($p<0.05$) in terms of inflow-outflow factor. This proved that the treat- ment tank efficiently removed the NH3+NH4-N and NO2- N. The highest removal of NH3+NH4-N and NO2-N was recorded in the CR+Swd treatment tank. No significant difference ($p<0.05$) of specific growth rate and yield of E. spinosum in the four treatment tanks was recorded. The average growth rate and yield of E. spinosum were 0.42 ± 0.12 % day-1 and 1.13 ± 0.30 g day-1 m-2, respectively in the Swd tank, 0.42 ± 0.13 % day-1 and 1.13 ± 0.32 g day-1 m-2, respectively in the Swd+S tank, 0.40 ± 0.13 % day-1 and 1.08 ± 0.31 g day-1 m-2 respectively in the Swd+CR tank, and 0.36 ± 0.11 % day-1 and 0.95 ± 0.27 g day-1 m-2 respectively in the Swd+S+CR tank. Besides, the new thal- lus of E. spinosum was slightly small and

thin. Other algae such as Melosira sp. and Vaucheria sp, were noted to grow on the surface of four treatment tanks. This study sug- gested that a combination of coral rubbles and E. spinosum 26 are suitable for use in a hatchery seawater remediation of dissolved inorganic nitrogen.