

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 *Eucheuma spinosum* (also known as *E. denticulatum*) effectiveness in reducing $\text{NH}_3+\text{NH}_4^+$, NO_2^- and NO_3^- 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) cuttings, 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 °C, 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 $\text{NH}_3+\text{NH}_4\text{-N}$ concentrations. The $\text{NO}_2\text{-N}$ was also significantly different ($p < 0.05$) in terms of inflow-outflow factor. This proved that the treatment tank efficiently removed the $\text{NH}_3+\text{NH}_4\text{-N}$ and $\text{NO}_2\text{-N}$. The highest removal of $\text{NH}_3+\text{NH}_4\text{-N}$ and $\text{NO}_2\text{-N}$ 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 thallus 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 suggested that a combination of coral rubbles and *E. spinosum* 26 are suitable for use in a hatchery seawater remediation of dissolved inorganic nitrogen.