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Water quality remediation using aquaponics sub-systems as biological and mechanical filters in aquaculture

ABSTRACT

This paper presents data obtained through trials on small-scale aquaponics sub-system which performs the roles of biological and mechanical filters for aquaculture water quality remediation. Aquaponics is a bio-integrated food production system, consisting of closed recirculating aquaculture combined with hydroponics. The trials were conducted on Nile tilapia (Oreochromis niloticus), and green beans (Phaseolus vulgaris) and the Chinese cabbage (Brassica rapa chinensis) over a period of 70 days. The results revealed that the system is more efficient in terms of plant growth and does not adversely affect the growth of captive stock of fish. Mean (± S.D.) values of water temperature, DO, pH, NH3-N, NO2-N, NO3-N and PO4-P during the trial were 25.2 ± 0.25 °C, 6.6 ± 0.13 mg/L, 7.14 ± 0.06, 0.23 ± 0.02 mg/L, 0.39 ± 0.22 mg/L, 0.89 ± 0.37 mg/L and 0.45 ± 0.04 mg/L, respectively. The average total weight gain by O. niloticus was 637.2 ± 8.49 g, and feed conversion ratio (FCR) was 1.47 ± 0.01 which indicated the efficiency of Nile tilapia in converting feed mass – a universally standard measure of efficiency of feed assimilation into weight gain, especially when there is no additional source of nourishment. High survival rate (95 ± 2.8%) was noticed during the trials. The average (±SD) values of biomass gain by P. vulgaris and B. rapa were 951.6 ± 1.6 g and 85.3 ± 13.4 g, respectively. The system was cost-effective and efficient in purging the toxic waste from water, resulting in remediation of water quality for the recirculating aquaculture system. This reflected the effectiveness of biofiltration which is currently assessed by its ability to completely remove the ammonia and minimize the generation of nitrite.