Low-dose hydrogen peroxide application in closed recirculating aquaculture systems

The aim of the present work was to simulate water treatment practices with hydrogen peroxide (HP) in recirculating aquaculture systems (RAS). Six identical 1,700-L pilot-scale RAS were divided into two experimental groups based on daily feed allocation and operated under constant conditions for a period of 3 months. The organic and nitrogenous loadings of the systems differed fourfold between the two groups and were achieved by predefined constant daily feed loads and constant additions of water. The fixed cumulative feed burden was 1.6 × 10^3 mg feed/L in the low-intensity RAS and 6.3 × 10^3 mg/L in the high-intensity RAS. The decay of HP in rearing tanks and disconnected biofilter units was investigated by means of HP spiking experiments. The decay in high-intensity RAS rearing units and biofilters was orders of magnitude faster than that in low-intensity units. The application of HP impaired biofilter nitrite oxidation in low-intensity RAS but not in high-intensity RAS. The impact of HP exposure time on biofilter nitrification capacity was then assessed in biofilter bench-scale experiments with nitrite spiking. Exposure time was found to significantly affect nitrite oxidation. Compared with unexposed biofilter elements, nitrite oxidation was reduced more than 90% following 3 h of exposure to 15 mg HP/L, whereas 30 min of exposure had only minor negative effects on nitrite oxidation. The findings of this study demonstrate the potential for developing HP water treatment practices for RAS and contradict prevailing notions that HP cannot be used safely in RAS that employ biofiltration. The development of effective new HP treatment protocols for recirculating aquaculture could reduce the current dependence on formalin to improve water quality and control parasitic loads.