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BERLIN, GERMANY
OCTOBER 7-10

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ABSTRACTS

AMMONIUM REMOVAL BY ION EXCHANGER - EFFECTS ON WATER PARAMETERS, MICROBIAL COMMUNITY AND SEA BASS (*Dicentrarchus labrax*) IN A MARINE RECIRCULATING AQUACULTURE SYSTEM

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Introduction

Water treatment plays a central role in the successful operation of recirculating aquaculture systems (RAS), because high stocking densities and feeding rates rapidly impair the quality of the limited water body. In RAS, nitrogen load is typically removed by multistep biological filtration whereby the first step is ammonium oxidization to nitrite. This biological degradation is vulnerable to disturbances e.g. changing water conditions and medications of the cultivated species what can lead to an accumulation of toxic nitrogen components in the system water. Ammonium can alternatively be removed from water by using zeolite. In emergencies zeolite can decrease fish mortality by reducing dangerous ammonium concentrations. In the present study a marine RAS, stocked with Sea bass (*Dicentrarchus labrax*), was operated with the bioreactor replaced by zeolite in the RAS water. Water parameters, microbial community and reared animals were determined to evaluate the impact of an alternative ammonium removal method on RAS performance.

Material and methods

Two identical 5m^3 RAS each equipped with 3 rearing tanks, drum filte , ozone- injected protein skimmer and moving bed bioreactor were operated at constant water parameters (temperature: 17.0°C, conductivity: 50.4mS cm^{-1}, pH: 7.9, O2: 97.8%). RAS were stocked in each experiment with 9kg m^{3-1} juvenile Sea bass (102.7 ± 25.3g) and fishes were fed 8 times a day (1.02% body weight per day) during a period of 21 days. These two RAS were controlled in 3 different scenarios: 1) RAS 1 and 2 with bioreactor and ozone, 2) RAS 1 and 2 with bioreactor without ozone and 3) with zeolite and ozone (RAS 1) or without ozone (RAS 2). Nitrogen components and abiotic water parameters in the water were measured daily. At the beginning and the end of each phase bacterial count and the composition of the bacterial community were determined. At the end of each phase the blood of 12 fishes per RAS was collected and analysed for relevant parameters (cortisol, glucose, lactate, ammonium, lysozyme, haematocrit).

Results

During phase 1 and 2 ammonium and nitrite concentration in the tank waters were similar in both RAS (Figure 1). Zeolite treatment (phase 3) led to a large increase in ammonium concentration and a decrease in nitrite concentration when ozone was applied (RAS 1), while without ozone ammonium increase was much lower but nitrite was strongly elevated (RAS 2). Nitrate level in the water increased during phase 3 in both RAS but with a higher slope in the system with ozone. During phase 1 and 2 ozone treatment had minimal effect on the bacterial count in both systems. Numbers of bacterial units increased strongly during zeolite treatment, especially when ozone was not applied (Table I). Zeolith treatment had no effect on stress related blood plasma parameters of the fishes.

Discussion

Zeolite had strong effects on water parameters in both RAS. Ammonium content in the water were elevated without bio- filtration, and probably caused bacterial growth in the RAS leading to high nitrite level in RAS 2 without ozone. An additional ozone treatment could prevent the accumulation of toxic nitrite, because of the spread of the bacterial mass was reduced. Blood parameter data indicate that the zeolite treatment could be suitable to continue the normal operation of a RAS when biofiltration is affected allowing emergency situations to be managed without the need for performance-reducing emergency measures such as stopping feeding or reducing stock biomass.