Nitrate removal from aquaculture effluents using woodchip bioreactors improved by adding sulfur granules and crushed seashells

This study examined the effects on nitrate removal when adding sulfur granules and crushed seashells to a woodchip bioreactor treating aquaculture effluents. Using a central composite design, the two components were added at three levels (0.000, 0.125 and 0.250 m3/m3 bioreactor volume) to 13 laboratory-scale woodchip bioreactors, and a response surface method was applied to find and model the optimal mixture ratios with respect to reactor performance. Adding 0.125 m3/m3 sulfur granules improved the total N removal rate from 3.27±0.38 to 8.12±0.49 g N/m3/d compared to pure woodchips. Furthermore, the inclusion of crushed seashells together with sulfur granules helped to maintain the pH above 7.4 and prevent a production (i.e., release) of nitrite. According to the modeled response surfaces, a sulfur granule:crushed seashell:woodchip mixture ratio containing about 0.2 m3 sulfur granules and 0.1 m3 crushed seashells per m3 reactor volume would give the best results with respect to high N removal and minimal nitrite release. In conclusion, the study showed that N removal in woodchip bioreactors may be improved by adding sulfur granules and seashells, contributing to the optimization of woodchip performance in treating aquaculture effluents.

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