

End-of-pipe removal of nitrogen using woodchip beds

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Abstract

Nitrogen (N) removal from aquaculture effluents is currently facilitated mainly by denitrification reactors. These reactors require constant input of readily available carbon (C) sources to fuel the denitrification process, which can restrict their application in aquaculture systems due to practical and/or economic reasons.

An alternative technology for removing N, which has been used for more than two decades to treat surface and drainage water, is based on using wood by-products as solid C sources for denitrification. In these denitrifying beds, wood-based substrates are implemented into the ground or filled into containers to intercept the waste stream or treat point source discharges, respectively. The technologically simple systems are characterized by low-maintenance and high longevity rendering them potentially relevant for end-of-pipe treatment in aquaculture.

Based on pre-assessments in the laboratory, the current study set out to investigate the interactive effects of two operating variables; hydraulic retention time and bicarbonate addition (inlet concentration), on N-removal rates. Experimental, horizontal-flow woodchip filters treating the effluent from a freshwater recirculating aquaculture system were used in the study.

Results demonstrate that the woodchip beds were able to remove nitrate-N sustaining that denitrification occurred within the woodchip filters. In addition, nitrate removal could be enhanced by addition of bicarbonate. The study thus indicates that nitrogen removal through denitrifying woodchip filters may present an alternative end-of-pipe treatment method for N-removal in some aquaculture facilities.

Acknowledgements: This research was funded by The Ministry of Food, Agriculture and Fisheries of Denmark and by the European Union through The European Fisheries Fund (EFF).

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